SACRED HEART COLLEGE (AUTONOMOUS), THEVARA

KOCHI, KERALA, 682013

Curriculum and Syllabi

MSc Computer Science
(Artificial Intelligence)

Introduced from 2024 Admission Onwards

Board of Studies in Computer Science
Sacred Heart College (Autonomous), Thevara, Kochi, Kerala

Board of Studies, Department of Computer Science

Sl. No	Name & Address	Designation/Category
1	Ms. Achamma Cherian Asst. Professor & HoD Dept. of Computer Science Sacred Heart College, Thevara	Chairman
2	Rev. Dr. Jaison Paul Mulerikkal Vice Principal Rajagiri School of Engineering and Technology, Kakkanad	Expert in the subject from outside the college, nominated by the academic council.
3	Dr. Judy M V Professor Dept. of Computer Applications CUSAT	Expert in the subject from outside the college, nominated by the academic council.
4	Dr. Swaraj K.P. Associate Professor, Department of Computer Science & Engineering, Govt.College of Engineering, Thrissur	Expert nominated by the Vice Chancellor
5	Mr. Maxon C J Infrastructure Associative UST Global, Kochi	Post Graduate meritorious alumnus nominated by the Principal
6	Mr. Mathew James Azure Cloud Solution Architect UST Global, Kochi	Representative from industry, corporate – sector or allied area.
7	Ms. Tressa Shybe Asst. Professor, Dept. of Computer Science	Faculty member
8	Ms. Jisha Soman Asst. Professor, Dept. of Computer Science	Faculty member
9	Ms. Rensi K Ranjith Asst. Professor, Dept. of Computer Science	Faculty member
10	Rev. Fr. Nijo Antony Asst. Professor, Dept. of Computer Science	Faculty member
11	Ms. Christy Jacqueline Asst. Professor, Dept. of Computer Science	Faculty member
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1. Introduction

With the digital revolution, Data science and Artificial Intelligence (AI) has become an important part of our lives and in society as a whole. Artificial Intelligence enables student to get into Machine Learning and automation and for better decision making. Students will get an overall understanding of key machine learning algorithms, and popular methods. AI is the science and combination of engineering of making computer machines learning which able to perform tasks which requires human intelligence, such as perception, speech recognition, decision making process and interpretation between languages. It is a branch of the Computer Science that goal to develop intelligent.

1.1 Scope

The effort is to make computer intelligence programs that can solve real time problems and to achieve goals of the organisations and day to day life as well as humans. There is a scope in developing the machines games, speech recognition machine, language detection, computer vision, expert systems, robotics etc. Career options in AI where student can get jobs at public and private sectors. Job will be offered like: Game Programmer, Robotic, Scientist, Computer Scientist and data scientist. Skilled AI engineers are in high demand everywhere.

1.2 Eligibility

A candidate who has passed an Undergraduate degree in Science with 50% marks in any one of the following subjects as core or complementary from any recognised University is eligible to apply

- Computer Science
- Mathematics
- Statistics

1.3 Learning Outcomes

Students who have completed the MSc Computer Science (Artificial Intelligence) will be able to:

- Apply statistical modelling and data analysis techniques to the solution of real-world business problems, effectively present results using data visualization techniques.
- Test and train various machine learning algorithms for real world data and applications.
- Create data warehouse and mine the data for analysis.
- Analysis big data using various languages and tools.
- Apply machine learning algorithms to real-world problems.
- Create the applications for analysis using natural language processing concepts.
- Recognize and analyze ethical issues in data security, integrity and privacy.

Regulations

2.1 Title

These regulations shall be called 'SACRED HEART COLLEGE REGULATIONS FOR POST GRADUATE PROGRAMMES UNDER CREDIT SEMESTER SYSTEM (CSS) – 2024

2.2 Scope

Applicable to all Post Graduate (PG) programmes of the college with effect from 2024-25 admissions. The provisions herein supersede all the existing regulations for the post graduate programmes of the college.

2.3 Definitions

2.3.1 **'Programme'** means the entire course of study and examinations.

2.3.2 **'Duration of Programme'** means the period of time required for the conduct of the programme. The duration of post graduate programme shall be of four semesters spread over two academic years.

2.3.3 **'Semester'** means a term consisting of a minimum of ninety working days, inclusive of examination, distributed over a minimum of eighteen weeks each having five working days, each with five contact hours of one hour duration.

2.3.4 **'Course'** means a segment of subject matter to be covered in a semester. Each course is to be designed variously under lectures/ tutorials / laboratory or fieldwork/ study tour /seminar / project / practical training / assignments / evaluation etc., to meet effective teaching and learning requirements.

2.3.5 **'Credit' (Cr)** of a course is the numerical value assigned to a course according to the relative importance of the content of the syllabus of the programme.

2.3.6 '**Extra credits**' are additional credits awarded to a student over and above the minimum credits required for a programme.

2.3.7 '**Programme Credit'** means the total credits of the PG Programmes. For PG programmes the total credits shall be eighty.

2.3.8 **'Programme Elective Course'** means a course, which can be chosen from a list of electives and a minimum number of courses is required to complete the programme.

2.3.9 **'Elective Group'** means a group consisting of elective courses for the programme.

2.3.10 '**Programme Project'** means a regular project work with stated credits on which the student undergoes a project under the supervision of a teacher in the parent department / any appropriate institute in order to submit a dissertation on the project work as specified.

2.3.11 '**Internship**' is on-the-job training for professional careers.

2.3.12 '**Plagiarism**' is the unreferenced use of other authors' material in dissertations and is a serious academic offence.

2.3.13 '**Seminar'** means a lecture by a student, expected to train the student in self-study, collection of relevant matter from the books and internet resources, editing, document writing, typing and presentation.

2.3.14 'Evaluation' is the process by which the knowledge acquired by the students is quantified as per the criteria detailed in the regulations.

2.3.15 'Repeat Course' is a course that is repeated by a student for having failed in that course in an earlier registration.

2.3.16 'Audit Course' is a course for which no credits are awarded.

2.3.17 'Department' means any teaching department offering a programme of study approved by the college / institute as per the Act or Statute of the University.

2.3.18 'Department Council' means the body of all teachers of a department in a college.

2.3.19 'Faculty Advisor' is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities undertaken in the department.

2.3.20 'College Coordinator' means a teacher from the college nominated by the College Council to look into the matters relating to CSS-PG system.

2.3.21 'Letter Grade' or simply **'Grade'** in a course is a letter symbol (A^+, A, B^+, B etc.) which indicates the broad level of performance of a student in a course.

2.3.22 'Grade Point' (GP), is an integer indicating the numerical equivalent of the broad level of performance of a student in a course.

2.3.23 'Grade Point Average' (GPA) is an index of the performance of a student in a course. It is obtained by dividing the sum of the weighted grade points obtained in the course by the sum of the weights of the course ($GPA = \sum WGP/\sum W$).

2.3.24 'Weighted Grade Point' (WGP) is obtained by multiplying the grade point by its weight (WGP = GP x weight).

2.3.25 'Credit Point' (CP) of a course is the value obtained by multiplying the grade point (GPA) by the credit (Cr) of the course (CP = GPA x Cr).

2.3.26 'Semester Grade Point Average' (SGPA) is the value obtained by dividing the sum of credit points (CP) obtained by a student in the various courses taken in a semester by the total number of credits of the courses taken by him/her in that semester. The SGPA shall be rounded off to two decimal places and it determines the overall performance of a student at the end of a semester.

2.3.27 'Cumulative Grade Point Average' (CGPA) is the value obtained by dividing the sum of credit points in all the courses taken by the student for the entire programme by the total number of credits and shall be rounded off to two decimal places.

2.3.28 '**Grace Grade Points'** means grade points awarded to a student for course(s), in recognition of meritorious achievements in NSS/Sports/Arts and cultural activities, as per the orders issued by the college from time to time.

2.4 Attendance

Being a regular college, physical presence in the regular activities, especially, classes and exams, is mandatory for the students. However, if a student secures 75% of attendance he/she is eligible to appear for the exams, provided there are no other impediments like disciplinary proceedings, malpractice record etc.

2.4.1 Absence: A student found absent for one hour in the forenoon or afternoon session is deprived of the attendance for the entire session as far as eligibility for final exam is concerned.

2.4.2 Leave: A student has to formally report his/her absence with reasons either in advance, or immediately after the absence for obtaining an approved leave. This applies to all sorts of leave – medical, on duty or similar cases.

2.4.3 The student has to retain a copy/section of the approved leave form and produce the same as proof, in case there is any confusion regarding the leave sanctioning. In the absence of such proof, the claims will not be entertained.

2.4.4 Duty Leave: A student representing the college in sports, arts, social service or academic matters, has to get sanction from the class teacher concerned and submit the leave application form duly endorsed by the class teacher and the Head of the Department, and submit it to the Vice Principal. The same will be forwarded by the Vice Principal for attendance entry. The approval of the Department of Physical Education and the class teacher is required for granting attendance related to sports. The time limit for submission mentioned above is applicable in the case of duty leave as well.

2.4.5 Condonation: A student may have the privilege of condonation of attendance shortage (up

to a maximum of ten days) on the basis of genuineness of the grounds of absence (medical reasons or college duty), duly recommended by the department. This is not a matter of right. It is a matter of privilege based on Principal's discretion and the good conduct of the student on the campus. A student of PG programme may have only one such opportunity.

2.4.6 Re-admission: A student whose attendance is inadequate will have to discontinue the studies. Such students, whose conduct is good, may be re-admitted with the approval of Governing Body, on the basis of recommendation from the department, and assurance from the student and the guardian regarding good conduct and compliance in academic and discipline matters. For this the prescribed re-admission fee has to be paid.

2.4.7 Unauthorised absence & removal from rolls: A student, absent from the classes continuously for ten consecutive working days without due intimation or permission, shall be removed from the rolls, and the matter shall be intimated to the student concerned. On the basis of recommendation of the department concerned, re-admission process may be permitted by the Principal.

2.5 Programme Registration

2.5.1 A student shall be permitted to register for the programme at the time of admission.

2.5.2 A PG student who registered for the programme shall complete the same within a period of eight continuous semesters from the date of commencement of the programme.

2.6 Promotion

A student who registers for the end semester examination shall be promoted to the next semester. However, in extreme circumstances, a student having sufficient attendance who could not register for the end semester examination may be allowed to register notionally by the Principal with the recommendation of the Head of the Department concerned and by paying the prescribed fee.

2.7 Examinations

All the end semester examinations of the college will be conducted by the Controller of Examinations. The Principal will be the Chief Controller of Examinations. An Examination Committee consisting of the Chief Controller of Examinations, Controller of Examinations, Additional Chief Superintendent, Deans, IQAC Coordinator and other faculty members nominated by the Principal will act as an advisory body on the matters relating to the conduct of examinations.

2.8 Evaluation and Grading

2.8.1 Evaluation

The evaluation scheme for each course shall contain two parts:

a. Continuous Internal Assessment (CIA)

b. End Semester Examination (ESE)

25% weightage shall be given to internal evaluation and the remaining 75% to external evaluation and the ratio and weightage between internal and external is **1:3**, for the courses with or without practicals (except the courses offered by the School of Communications). In the case of courses offered by the School of Communications, the internal-external assessment ratio shall be **1:1**. In their case, the components for evaluation and their respective weightage shall be determined by their Board of Studies. Both internal and external evaluation shall be carried out in the grading system and the GPAs are to be rounded to two places of decimals.

2.8.2 Direct Grading: The direct grading for the components of CIA shall be based on six letter grades (A+, A, B, C, D and E) with numerical values of 5, 4, 3, 2, 1 and 0 respectively as per the following scale of accuracy/level of quality. The questions for internal test papers and the end semester examination shall be prepared in such a way that the answers can be awarded A+, A, B, C, D and E grades.

Grade	Grade Points	Scale of accuracy/Level of quality
A+	5	Greater than or equal to 90%
A	4	80% to less than 90%
B	3	60% to less than 80%
C	2	40% to less than 60%
D	1	20% to less than 40%
E	0	Less than 20%

2.8.3 Grade Point Average (GPA): Internal and external components are separately graded and the combined GPA shall be calculated for each course with weightage **1** for internal and **3** for external.

2.8.4 Components of Continuous Internal Assessment (CIA): Grades shall be given to the evaluation of theory/practical/project/comprehensive viva-voce and all internal evaluations are based on the Direct Grading System.

The Board of studies of the respective subject is permitted to make changes, if necessary, with regard to the weightages for the components of CIA without changing the total weightage of 5.

a. **Components of Internal Evaluation (for theory)**

No	Components	Weightage
i.	Assignments	1
ii.	Seminar	1
iii.	Quiz/Field study/Industrial Visit/Viva Voce/Study Tour	1
iv.	Test paper-1	1

v.	Test paper-2	1
	Total	5

b. **Components of Internal Evaluation (for practical)**

Components	Weightage
Laboratory Involvement	1
Written/ Lab Test	2
Record	1
Viva Voce	1
Total	5

c. **Components of Internal Evaluation (for project)**

Components	Weightage
Relevance of the topic and analysis	2
Project content and presentation	2
Project viva voce	1
Total	5

d. **Components of Internal Evaluation(for comprehensive viva voce)**

Components	Weightage
Comprehensive viva voce (all courses from first semester to fourth semester)	5
Total	5

2.8.5 Components of End Semester Examination (ESE):

a. **For Theory**

Evaluation shall be based on the following pattern of questions:

No.	Type of Questions	Weight	Number of questions to be answered
1	Short answer type questions	1	8 out of 10
2	Short essay/problem solving type questions	2	6 out of 8
3	Long essay/problem solving type questions	5	2 out of 4

*Board of studies of respective subjects can decide on the number questions in each type of questions.

b. **For Practical**

Components of External Evaluation (for practical)

Components	Weightage
Laboratory Involvement	3
Written/ Lab Test	6
Record	3
Viva Voce	3
Total	15

The Board of studies of the respective subject is permitted to make changes, if necessary, with regard to the weightages for the components of Practical Examinations (External) without changing the total weightage i.e. 15. The pattern of questions for external evaluation of practical examinations can also be prescribed by the respective Board of Studies.

c. **Components of External Evaluation (for project)**

Components	Weightage
Relevance of the topic and analysis	3
Project content and presentation	7
Project viva voce	5
Total	15

d. **Components of External Evaluation(for comprehensive viva voce)**

Components	Weightage
Comprehensive viva voce (all courses from first semester to fourth semester)	15
Total	15

2.8.6 Project:

Project work is a part of the syllabus of most of the programmes offered by the college. The guidelines for doing projects are as follows:

i. Project work shall be completed by working outside the regular teaching hours.

ii. Project work shall be carried out under the supervision of a teacher in the concerned department or an external supervisor.
iii. A candidate may, however, in certain cases be permitted to work on the project in an industrial / Research Organization/ Institute on the recommendation of the Supervisor.
iv. There should be an internal assessment and external assessment for the project work in the ratio 1:3
v. The external evaluation of the project work consists of valuation of the dissertation (project report) followed by presentation of the work and viva voce.

2.9 Performance Grading

Students are graded based on their performance (GPA/SGPA/CGPA) at the examination on a 7 point scale as detailed below

Range	Grade	Indicator
4.50 to 5.00	**A+**	**Outstanding**
4.00 to 4.49	**A**	**Excellent**
3.50 to 3.99	**B+**	**Very Good**
3.00 to 3.49	**B**	**Good (Average)**
2.50 to 2.99	**C+**	**Fair**
2.00 to 2.49	**C**	**Marginal (Pass)**
Up to 1.99	**D**	**Deficient (Fail)**

a. No **separate minimum** is required for internal evaluation for a pass, but a minimum a '**C**' grade is required for a pass in an external examination. However, a minimum '**C**' grade is required for pass in a course and the programme as well.

b. A student who fails to secure a minimum grade '**C**' for a pass in a course shall be permitted to write the examination along with the next batch.

c. **Improvement of GPA:** The candidates who wish to improve the GPA of the external examinations of a course/courses can do the same by appearing in the external examination of the semester concerned along with the immediate junior batch. The facility is restricted to first and second semesters of the programme.

d. **Computation of SGPA and CGPA:** For the successful completion of a semester, a student should pass all the courses and score at least the minimum SGPA grade **'C'**. After the successful completion of a semester, Semester Grade Point Average (**SGPA**) of a student in that semester is calculated as the ratio of the sum of the credit points of all courses taken by a student in the semester to the total credits of that semester.

Thus, **SGPA = TCP/TCr**, where **TCP** is **Total Credit Point of that semester (** $\sum_{i=1}^{n} CP_i$ **)** and **TCr is Total Credit of that semester (** $\sum_{i=1}^{n} Cr_i$ **)** where '**n**' is the number of courses in that semester.

Cumulative Grade Point Average (**CGPA**) of a programme is calculated as the ratio of the sum of the credit points of all the courses of the programme to the total credits of the programme.

$$CGPA = \frac{\sum (SGPA \times TCr)}{\sum TCr}$$

The SGPA/CGPA shall be rounded off to two decimal places.

For the successful completion of a programme, a student should pass all the courses and score at least the minimum CGPA grade **'C'**. However, a student is permitted to move to the next semester irrespective of her/his SGPA.

To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board/website at least one week before the commencement of external examination. There shall not be any chance for improvement for internal assessment grade.

The course teacher and the faculty advisor shall maintain the academic record of each student registered for the course which shall be forwarded to the controller of examinations through the Head of the Department and a copy should be kept in the department for at least two years for verification.

2.10 Registration for the Examination

a. All students admitted in a programme with remittance of prescribed fee are eligible for the forthcoming semester examinations.

b. Online application for registration to the various End Semester Examinations shall be forwarded to the CE along with prescribed fee for each course in prescribed format.

c. The eligible candidates who secure the prescribed minimum attendance of the total duration of the course and possess other minimum qualification prescribed in the regulations for each course shall be issued the hall tickets. The hall ticket shall be downloaded by the students from the college website.

The mode of fee remittance shall be through the prescribed bank.

2.11 Supplementary Examinations

Candidates who failed in an examination can write the supplementary examination conducted by the College along with regular examinations.

2.12 Promotion to the Next Higher Semester

A candidate shall be eligible for promotion from one semester to the next higher semester if,

a. He / she secures a minimum 75 % attendance and registered for the End Semester Examination of the programme for which he/she is studying.
b. His / her progress of study and conduct are satisfactory during the semester completed, as per the assessments recorded by the course teachers and the Head of the Department concerned.

2.13 Certificates

1. Diploma and Degree certificates are issued by the Mahatma Gandhi University, Kottayam as per the act and statues of the University on the submission of the consolidated mark / score cards of the students by the College.
2. A consolidated mark / scored card shall be issued to the candidates after the publication of the results of the final semester examination taken by the candidate.
3. A Course Completion Certificate with classification shall be issued to students till the provisional certificate is issued by the university.

2.14 Rank Certificate

Candidates shall be ranked in the order of merit based on the CGPA secured by them. Grace grade points awarded to the students shall not be counted for fixing the rank/positions. Rank certificates shall be issued to the candidates who secure positions from the first to the third in the order of merit. The position certificates shall be issued to the next seven candidates in the order of merit.

2.15 Award of Degree

The successful completion of all the courses with **'C'** grade shall be the minimum requirement for the award of the degree.

2.16 Monitoring

There shall be a Monitoring Committee constituted by the Principal consisting of faculty advisors, HoD, a member from Teaching Learning Evaluation Committee (TLE) and the Deans to monitor the internal evaluations conducted by college. The course teacher, class teacher and the deans should keep all the records of the internal evaluation, for at least a period of two years, for verification.

Every programme conducted under Credit Semester System shall be monitored by the College Council under the guidance of IQAC Coordinator, Controller of Exams, Academic Deans and HoDs. An academic committee consisting of the vice principal, deans and teachers nominated by the Principal shall look after the day-to-day affairs of these regulations.

2.17 Grievance Redressal Mechanism

In order to address the grievance of students regarding Continuous Internal Assessment (CIA) a three-level grievance redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: Level of the course teacher concerned

Level 2: Level of a department committee consisting of the Head of the Department, a

coordinator of internal assessment for each programme nominated by the HoD and the course teacher concerned.

Level 3: A committee with the Principal as Chairman, Dean of the Faculty concerned, HOD of the department concerned and one member of the Academic Council nominated by the Principal every year as members

2.18 Transitory Provision

Notwithstanding anything contained in these regulations, the Principal of the college has the power to make changes in these regulations, by due orders, that shall be applied to any programme with such modifications as may be necessary on the recommendations of the Board of Studies of the respective programme.

3. Distribution of Course and Credits

Semester I

Sem.	Course Code	Course Title	Core/ Elective/ Lab	Hours/ Week	Credits	Weightage	
						Internal	External
1	24P1CAIT01	Computer Organisation and Operating System	Core	4	4	25	75
	24P1CAIT02	Object Oriented Programming with Java	Core	4	4	25	75
	24P1CAIT03	Data Structures and Algorithms	Core	4	4	25	75
	24P1CAIT04	Mathematics for Computational Intelligence	Core	3	3	25	75
	24P1CAIT05	Foundations of Data Analytics	Core	4	4	25	75
	24P1CAIP01	Oops with Java	Lab	3	2	25	75
	24P1CAIP02	Data Structures Lab with C++	Lab	3	2	25	75

Semester II

Sem.	Course Code	Course Title	Core/ Elective/ Lab	Hours/ Week	Credits	Weightage	
						Internal	External
2	24P2CAIT06	Programming in Python	Core	4	4	25	75
	24P2CAIT07	AI and Knowledge Representation	Core	4	3	25	75
	24P2CAIT08	Database Design	Core	4	4	25	75
	24P2CAIT09	Machine Learning	Core	4	4	25	75
	24P2CAIT10EL	Elective 1	Elective	3	3	25	75
	24P2CAIP03	Machine Learning Lab	Lab	3	2	25	75
	24P2CAIP04	DBMS Lab and Micro Project	Lab	3	2	25	75

Elective I

1. Digital Image Processing and Computer Vision
2. Theory of Computation
3. Algorithm Analysis and Design
4. Graph Theory and Network Analysis

Semester III

Sem.	Course Code	Course Title	Core/ Elective/ Lab	Hours/ Week	Credits	Weightage	
						Internal	External
3	24P3CAIT11	Computer Networks	Core	4	3	25	75
	24P3CAIT12	Data Mining and Analytics	Core	4	3	25	75
	24P3CAIT13EL	Elective II	Elective	4	3	25	75
	24P3CAIT14EL	Elective III	Elective	4.	3	25	75
	24P3CAIP05	Data Analytics Lab Using R	Lab	4	2	25	75
	24P3CAIP06	Mini Project/Seminar	Lab	5	3	50	50

Elective II

1. Natural Language Processing and Information Retrieval
2. Big Data Analytics
3. Computational Modelling

Elective III

1. Soft Computing and Optimization Techniques
2. Pattern Recognition
3. Object Oriented Analysis and Design

Semester IV

Sem.	Course Code	Course Title	Core/ Elective/ Lab	Hours/ Week	Credits	Weightage	
						Internal	External
4	24P4CAIPJ	Project / Internship	Core	25	15	50	50
	24P4CAICV	Comprehensive Viva		-	3		100

4. Outcomes

4.1 Programme Outcomes

Programme Outcomes (POs)	PO Description
PO1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability.
PO2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.
PO3	Make choices based on the values upheld by the institution, and have the readiness and knowhow to preserve the environment and work towards sustainable growth and development.
PO4	Develop an ethical view of life and have a broader (global) perspective transcending the provincial outlook.
PO5	Explore new knowledge independently for the development of the nation and the world and are able to engage in a lifelong learning process.

4.2 Programme Specific Outcomes

Programme Specific Outcomes (PSOs)	PSO Description
PSO1	Identify and describe artificial intelligence techniques, knowledge representation, automated planning and agent systems, machine learning, and probabilistic reasoning
PSO2	Apply and evaluate models to devise solutions to data science tasks and transform the findings from data resources into actionable business strategies.
PSO3	Analyse and demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering in terms of real world problems to meet the challenges of the future.
PSO4	Apply Artificial Intelligence techniques for problem-solving and explain the limitations of current Artificial Intelligence techniques
PSO5	Apply tools and techniques used to design, analyse, implement and verify AI systems.

5. Syllabus

Semester I

24P1CAIT01 - Computer Organisation and Operating System

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:

On completion of the module the student should be able to:

CO1. Understand the theory and architecture of central processing unit.
CO2. Analyse some of the design issues in terms of speed, technology, cost, performance.
CO3. Analyse the concepts of parallel processing, pipelining and interprocessor communication.
CO4. Understand the better way the I/O and memory organization, CPU scheduling, scheduling algorithms and deadlocks.
CO5. Analyse the fundamental concepts and principles of operating system.
CO6. Understand the foundational concepts, process management, memory management, virtual memory, file systems and I/O management

Module 1 **(15 Hrs)**

Basic Structure of Computers: Hardware and Software, Von Neumann Architecture. Instruction Sets, RISC and CISC, Addressing Modes. Programming the computer: Machine Language, Assembler.

Processing Unit: General Register Organization, Bus Structure. Design of Arithmetic Logic Unit: Number representations and arithmetic, Floating-Point Operations. Design of Control Unit: Hardwired Control and Micro-programmed Control unit.

Module II **(16 Hrs)**

Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Operating Systems Structures Operating System Services and Systems Calls, Operating System Generation

Processes-Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; Threads- Overview, Multithreading Models Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors;

Module III **(13 Hrs)**

Input-Output Organization: Peripheral Devices, I/O Interfaces, I/O Hardware, Asynchronous Data Transfer, Modes of data transfer: Programmed I/O, Interrupts, Direct Memory Access

Disk Structure, Scheduling and Management; File System Structure, Directory Structure, Allocation Methods.

Module IV **(13 Hrs)**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Memory management- Segmentation, Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing

Module V **(15 Hrs)**

CPU Scheduling: Scheduling Criteria –Scheduling Algorithms. Deadlocks: Conditions, Modeling using graphs. Handling, Prevention, Avoidance, Detection- Recovery.

Pipelining: Pipeline concept, Throughput, data hazard, Instruction hazard: Branch prediction.

Text Books

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts. Sixth edition. Addison-Wesley (2003).
2. John L. Hennesy, David A. Patterson Computer Organization and Design: The Hardware / Software Interface (Third Edition), Morgan Kaufmann, 2004

References

1. William Stallings, Computer Organization and Architecture: Designing for Performance (Seventh Edition), Prentice-Hall India, 2006
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization (Fifth Edition), McGraw Hill, 2002
3. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
4. William Stallings, Operasting Systems, Prentice Hal

24P1CAIT02 - Object Oriented Programming with JAVA

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:
On completion of the module the student should be able to:

CO1. Understand the principles of object-oriented problem solving and programming.
CO2. Analyse the essential features and elements of the JAVA programming language.
CO3. Create the concepts of programming fundamentals, including statement and control flow and recursion.
CO4. Apply the concepts of class, method, constructor, data abstraction, function abstraction, inheritance, overloading, and polymorphism.
CO5. Understand the principle of multithreading.

Module I **(14 Hrs)**
Object Oriented Paradigm and JAVA overview: Object oriented Concepts: Introduction to OOPS, Abstraction, Encapsulation, Objects and Classes, Constructors Inheritance, Polymorphism, Abstract Classes, Interfaces, Introduction to Java, JVM, Primitive data types, Control Statements, Methods, Classes Introduction to Java Compilers and Lab

Module II **(16 Hrs)**
JAVA statements: Java's selection statements, iteration statements, jump statements, Introduction to classes: Class fundamentals, declaring object reference variable, Introducing methods, constructors, the key word, garbage collection, the finalize () method. Methods and Classes Overloading methods, using objects as parameters

Module III **(13 Hrs)**
Java Arrays, Utilities and Packages: Java Arrays, Wrapper Classes, Java IO, Inheritance, Super class, Polymorphism, java Packages, class libraries, Interfaces, Exception Handling, JAVA Strings

Module IV **(16 Hrs)**
Multithreading and JAVA Networking: The Java thread model, the main thread, creating thread, creating multiple thread, using is alive () and join (). Thread priorities, synchronization, Inter thread communications, suspending resuming and stopping thread using multithreading Networking: Networking basics, Java and the Internet Address, TCP/IP client Sockets, URL, URL connection, TCP/IP server Sockets The Applet Class

Module V **(13 Hrs)**
Applet and Swing: its architecture displays methods. The HTML applet. Passing parameters to Applet, Java GUI, AWT, Text Box, Menu, Event Handling, Frames, Java Swing.

Text Books:

1. Patrick Naughton, Helbert Schildt, "The Complete Reference JAVA 2", Tata McGraw-Hill, 1999
2. C. Thomas Wu, "Introduction to Java programming", Second Edition, John Wiley and Sons 2000

Reference Books:

1. Bruce Eckel, Chuck Allison, "Thinking in Java", Edition 2, Prentice Hall, 2000
2. Cay Horstmann, Computing Concepts With JAVA 2 Essentials, 2ND ED, Published by Wiley-India, 2006
3. Herbert Schildt, Java: a Beginner's Guide Essential Skills Made Easy, 4th Edn, McGrawHill Professional, 2007

24P1CAIT03 - Data Structures and Algorithms

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:

On completion of the module the student should be able to:

CO1. Understand a variety of techniques for designing algorithms.
CO2. Understand a wide variety of data structures and should be able to use them appropriately to solve problems
CO3. Understand some fundamental algorithms.

Module I **(14 Hrs)**

Introduction to ADT and Algorithms: Principles of DSA, ADT, computational problem, algorithm notion, time complexity, space complexity, asymptotic notations, analysis of algorithms, design of algorithms, data, abstract data type, procedural abstraction, worst case complexity, Big-Oh notation, incremental design.

Module II **(15 Hrs)**

Stack and Queues: Introduction to stack, basic operations, implementation using array and linked list, computational problems relating to stack, parenthesis matching, expression representation using Polish and reverse Polish notations, Evaluation of expression using stack, introduction to queues, basic operations, implementation

Module III **(15 Hrs)**

Lists and Linked List: Lists in ADT, Linked list, Insert, delete operations, doubly linked list, implementation, ADT and applications, Recursion and Heap: Closed form, recursive form, problem solving, Fibonacci series, Towers of Hanoi, celebrity problem (with and without recursion), Efficiency of Recursion Algorithm, Heap: Introduction, max heap, min heap, representation, complexity.

Module IV **(16 Hrs)**

Trees, Graphs and Hashing: Binary tree, traversal in a tree, balanced binary search tree, binary search tree, extended binary tree, insertion, deletion, height balanced trees, AVL trees, B-tree, red black tree. Graph: Weighted graph, spanning tree, greedy method, Kruskal's algorithm, Prim's algorithm, traversal, DFS and BFS, shortest path, Dijkstra's algorithm.

Module V **(12 Hrs)**

Sorting techniques, Searching algorithms: Linear and Binary search. Hashing: open address hashing, double hashing, chaining. Pattern matching and string/text algorithms- substring matching, regular expression matching, Knuth Morris Pratt algorithm.

Text Books

1. Bradley N. Miller, David L. Ranum Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, 2011.
2. T.H. Cormen Introduction to algorithms, MIT Press. 2009

References

1. A.D Aho, J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson education Asia, 1983.
2. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, Data Structures using C, Pearson Education Asia, 2004
3. Adam Drozdek, Data Structures and Algorithms in Java, Published by Brooks/Cole, 2nd edition 2002

24P1CAIT04 – Mathematics for Computational Intelligence

54 Hours (3 hrs/week) **Credits-3**

Course Outcomes:

On completion of the module the student should be able to:

CO1. Demonstrate linear equations, linear independence, basis, and rank, and apply linear mappings to practical problems in various fields.
CO2. Apply concepts of analytic geometry, including norms, inner products, lengths, distances, angles, orthogonality.
CO3. Utilize various matrix decomposition techniques, including computing determinants and traces, eigenvalues and eigenvectors, Cholesky decomposition, eigen decomposition and diagonalization, and singular value decomposition.
CO4. Perform differentiation of univariate and multivariate functions, compute gradients for scalar and vector-valued functions as well as matrices, utilize useful identities for gradient computation.
CO5. Apply continuous optimization techniques, including gradient descent, constrained optimization using Lagrange multipliers, and convex optimization on real-world optimization problems efficiently and effectively.

Module I **(10 Hrs)**

Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings.

Module II **(11 Hrs)**

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections.

Module III **(11 Hrs)**

Matrix Decompositions: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation.

Module IV **(11 Hrs)**

Vector Calculus: Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series.

Module V **(11 Hrs)**

Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization.

Text Books

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, published by Cambridge University Press, 2019
2. Strang Gilbert. Introduction to Linear Algebra. 4th ed., Wellesley-Cambridge Press, 2009.
3. Stark, Henry, Woods, John W Probability and Random Processes with Application to Signal Processing, 4th Ed., Pearson, 2013.
4. ShaiShalev-Shwartz, Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014

24P1CAIT05 - Foundations of Data Analytics

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:

On completion of the course the student should be able to:

CO1. Understand the methods of processing and transforming data.
CO2. Introduce and interpret probability concept in real life situation.
CO3. Illustrate the methods for estimation.
CO4. Apply the test procedures for decision making.
CO5. Evaluate various statistical techniques for modelling and exploring practical situations.

Module I **(10 Hrs)**

Fundamental concepts - Histogram – univariate and bivariate data, estimation of basic statistical parameters, viz., mean, standard deviation, variance, Covariance, correlation coefficient,

Module II **(20 Hrs)**

Introduction to Probability Theory- sample space – events –addition theorem, Conditional probability, Multiplication theorem, total probability, Baye's Theorem. Random variables, distribution function. Joint density function and distribution function, independence of random variables – moments –introduction to Markov chain. Binomial distribution and Normal distribution.

Module III **(15 Hrs)**

Sampling distributions- statistic, standard error, Chi-square, t, and F. Estimation theory: Properties , methods of finding estimators- Maximum Likelihood Estimation. Properties of point estimators, Sampling distribution of sample mean, Estimation of mean and variance and Estimation of confidence intervals.

Module IV **(15 Hrs)**

Testing of hypothesis– Test concerning mean and standard deviation of sampling from normal population, chi-square tests for standard deviation and independence and sequential test of hypotheses

Module V **(12 Hrs)**

Probabilistic Inference- Priors on continuous variable- Gaussian Prior – Bayesian reasoning MAP. Expectation Maximization – Mixture of Gaussians – Gibbs Sampling –Logistic Regression.

Text Books

1. K. Murphy, Machine Learning – A probabilistic perspective, MIT Press 2010
2. Lyman Ott, R. Lyman Ott, Micheal Longnecker, An introduction to statistical methods and data analysis, 6th Edn, Cengage Learning, 2008
3. . Stark, Henry, Woods, John W Probability and Random Processes with Application to Signal Processing, 4th Ed., Pearson, 2013.

24P1CAIP01 – OOPS with JAVA

54 Hours (3 hrs/week) **Credits – 2**

List of Experiments

1. Basics
    a) Command line
    b) Control Structures
    c) Class and Objects
    d) Constructors
    e) Constructor and Function Overloading
2. Inheritance
3. Interfaces
4. Exception handling
5. Multithreading
6. Synchronization
7. AWT/Swing
8. Event Handling
9. Applets
10. Socket Programming
11. JDBC – CURD Application
12. Graphics
13. Using External Libraries

24P1CAIP02 – Data Structures Lab with C++

54 Hours (3 hrs/week) **Credits – 2**

List of Experiments

Experiment 1

- Arrays
- Linked List
- Stacks
- Queues
- Binary Trees

Experiment 2

- Sorting
- Searching

Experiment 3

- Hashing
  - Linear probing
  - Quadratic probing
  - Random probing
  - Double hashing/rehashing
  - Chaining

Experiment 4

- Binary Trees
- Binary Search Trees
- AVL Trees
- B Trees
- B+ Trees

Experiment 5

- Graphs Implementation
- Searching
  - DFS
  - BFS
- Minimum Spanning Trees
  - Kruskal
  - Prims
- Shortest Path
  - Single Source
  - Dijikstra's
  - Floyd Warshalls

Experiment 6

- String matching using naive algorithm
- String matching using Knuth-Morris-Pratt algorithm.

Semester II

24P2CAIT06 – Programming in Python

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:

On completion of the module the student should be able to:

CO1. Install and run the Python interpreter.
CO2. Perform basic calculations, print text on the screen and create lists, and perform simple control flow operations.
CO3. Create programs with reuse of functions.
CO4. Create and execute Python programs
CO5. Understand the concepts of file I/O

Module I **(15 Hrs)**

Introduction to programming: Program Logic and Flowcharts- Introduction to Program Logic, Methodology of Problem Solving, Flowcharts and Flowcharts Symbols. Introduction to Python: Features of Python, How to Run Python, Identifiers, Reserved Keywords, Variables, Comments in Python, Indentation in Python, Multi-Line Statements, Multiple statement Group(Suite), Quotes in Python, Input, Output and Import Functions- Displaying and Output, Reading the Input and Import function, Operators - Arithmetic Operators, Comparison Operators, Assignment Operators, Bitwise Operators, Membership Operators, Identify Operators and Operator Precedence

Module II **(16 Hrs)**

Data Types and Operations: Numbers- Mathematical Functions, Trignometric Functions and Random Number Functions. Strings- Escape Characters, String Formatting Operator and String Formatting Functions. List- Built-in List Functions and Built-in List Methods. Tuple-Built-in Tuple Functions. Set- Built-in Set Functions, Built-in Set Methods and Frozenset. Dictionary: - Built-in Dictionary Functions and Built-in Dictionary Methods. Mutable and Immutable Objects, Data Type Conversion

Module III **(14 Hrs)**

Flow Control: Decision Making- if statement, if..else statement, if…elif…else statement, nested if statement. Loops- for loop, for loop with else, while loop, while loop with else statement, nested loops. Control Statements- break, continue and pass statement. Types of Loops- Infinite Loop, Loops with condition at the - top, middle & bottom.

Module IV **(14 Hrs)**

Functions and Modules: Function Definition, Function Calling, Function Arguments - Required arguments, Keyword arguments, Default Arguments, Variable-Length Arguments, Anonymous Functions (Lambda functions) – Uses of lambda function, Recursive Functions. Functions with more than one return value. Modules- Built-in Modules, Creating Modules, import statement – import with renaming, from…import statement and import all names, Locating Modules –

PYTHONPATH variable, Namespaces and Scope, The dir() function, The reload() function, Date and Time Modules- The time Module, The calendar Module and The datetime Module.

Module V (13 Hrs)

Packages And Files: Packages- Importing modules from a Package. Files-Opening a file – Modes for opening a file and Attributes of file object, Closing a file, Writing to a file, Reading from a file, Renaming a file, Deleting a file, Directories in Python – mkdir() method, chdir() method, getcwd() method and rmdir() method.

Text Books

1. Dr. Jeeva Jose and Dr. Sojan P. Lal.-( )-Introduction to Computating & Problem Solving with Python kindle edition-Khanna book publishing
2. John M. Zelle-2003- Python Programming: An Introduction to Computer Science 2nd Edition-originally Published
3. David Ascher and Mark Lutz-2004-Learning Python Kindle Edition-O'REILLY

References

- John M. Zelle Python Programming: An Introduction to Computer Science

David Ascher and Mark Lutz Learning Python

24P2CAIT07 - AI and Knowledge Representation

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
CO2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
CO5. Demonstrate proficiency in applying scientific method to models of machine learning.
CO6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Module I **(13 Hrs)**
Introduction to AI, Intelligent Agents and Environment, Structure of Agents, Nature of Environments, Implication of Bigdata in AI

Module II **(14 Hrs)**
Solving Problem by Searching, Searching Agents, Seeking Agents - go beyond Search, Uninformed Search Strategies, Searching with Partial Information, Blind Search, Informed Search and Exploration, Heuristic Search, Local Search, Constraint Satisfaction, Online Search, Adversial Search, Game theory

Module III **(14 Hrs)**
Knowledge and reasoning, Knowledge based Agents and Logical Agents, First Order Logic, Inference in First Order Logic, Uncertain Knowledge and Reasoning, Probabilistic Reasoning.

Module IV **(15 Hrs)**
Planning and Decision making, Planning with state space search, Planning Graph, Planning and acting in the real world, Multi-Agent Planning, Making Simple & complex Decisions.

Module V **(16 Hrs)**
Ontology in Knowledge Representation, Folksonomy and Web 2.0 / Web 3.0 technologies Various Graph Databases for KR: Allegrograph, Hypergraph, Pregel, Trinity, Tao, FlockDB, Storage and Retrieval of Knowledge , Distributed Storage for Sparse Dataset, In – Memory Cache for Knowledge Representation and Trinity, Indexing Mechanism for Query Retrieval, Authorization and Authentication for Knowledge Access and Manipulation.

Text Books

1. Ronald J. Brachman, Hector J. Levesque, Knowledge, Representation and Reasoning, The Morgan Kaufmann Series in Artificial Intelligence, 2004
2. T.J.M. Bench-Capon, Knowledge Representation: An Approach to Artificial Intelligence, Elsevier, 2014

Reference

1. Stuart Jonathan Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 2010
2. Peter Norvig, Paradigms of Artificial Intelligence Programming: Case Studies in Common LISP, Morgan Kaufmann, 1992

24P2CAIT08 – Database Design

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Identify and define the information that is needed to design a database management system

CO2. Build a database management system that satisfies relational theory with queries, forms, and reports.

CO3. Understand the core terms, concepts and tools of relational database management systems.

CO4. Design entity-relationship diagrams to represent simple database application scenarios

Module I **(13 Hrs)**
Introduction to Database Management Systems: Data, Information, Database, Transaction and its desired properties, File Server Model, Client Server Model DBMS Features, Components of DBMS, Data Abstraction, Data Independence.

Module II **(14 Hrs)**
Data Modeling: Logical and Physical Data Models, E-R Modeling A detailed study, Record Based Models, Relational Model An overview, Relational Concepts, Tables, Keys, Constraints, Data Integrity and Constraints, Integrity Rules, Database Objects Schema and Non-schema, Normalisation, Codds Rules.

Module III **(16 Hrs)**
Introduction to SQL: Introduction to SQL, SQL Features, SQL Operators, SQL Datatypes, SQL Parsing, Types of SQL Commands, Advanced Study of Structured Query Language, Querying Data from the database, Correlated Sub-queries, Joins, Hierarchical Queries, Bind Variables, Cursors, Functions, Stored Procedures.

Module IV **(15 Hrs)**
Distributed Databases: Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases.

Module V **(14 Hrs)**
Emerging trends Object Oriented databases: Object oriented queries Active databases Deductive databases concepts of next generation databases, NoSQL database, design for performance / quality parameters, documents and information retrieval.

Text Books

1. Abraham Silberschatz; Henry F Korth, Database System Concepts, McGraw Hill Publication, 2002

2. Hellerstein, Joseph, and Michael Stonebraker. Readings in Database Systems (The Red Book). 4th ed. MIT Press, 2005.

3. Raghu, and Johannes Gehrke. Database Management Systems. 3rd ed. McGraw-Hill, 2002.

References

1. Stefano Ceri; Giuseppe Pelagatti, Distributed Databases: Principles and Systems, Universities Press, 2000

2. Jan L Harrington, Object Oriented Database Design Clearly Explained, Harcourt, 2000

3. Elmasri, Ramez, Navathe, Shamkant B, Fundamentals of Database Systems, Pearson, 2000

24P2CAIT09 – Machine Learning

72 Hours (4 hrs/week) **Credits – 4**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand complexity of Machine Learning algorithms and their limitations;
CO2. Understand modern notions in data analysis oriented computing;
CO3. Apply common Machine Learning algorithms in practice and implementing their own.
CO4. Apply and analyze experiments in Machine Learning using real-world data.

Module I **(13 Hrs)**
Machine learning paradigms – supervised, unsupervised, reinforcement learning. Density Estimation – Parzen Windows, Maximum Likelihood estimation

Module II **(15 Hrs)**
Dimensionality reduction – Principal-Component Analysis, Singular-Value Decomposition. Classification: Neural networks – Perceptron, Feed Forward Network – Back propagation algorithm, Support Vector Machines.

Module III **(14 Hrs)**
Data Clustering – Partitioning based algorithms, subspace clustering, support vector clustering, self-organizing maps. Regression – Linear, support vector regression.

Module IV **(16 Hrs)**
Bayesian Networks, Hidden Markov Models –Viterbi Algorithm, Conditional Random Fields.Introduction to TensorFlow - TensorFlow Basic Syntax - TensorFlow Graphs - Variables and Placeholders

Module V **(16 Hrs)**
Deep Neural Network Components – Convolutional Neural Network – Deep Belief Networks – Recurrent Neural Network – Long short-term memory – Data Streams & Active Learning

Text Books
1. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 24 Aug2012 - 2 books
2. Alex Smola and S.V.N. Vishwanathan, Introduction to Machine Learning, Cambridge University Press, 2008. - NA

References
1. Richard O. Duda , Peter E. Hart, David G. Stork, Pattern Classification, WileyInterscience, 2009. – 2 books
2. Machine Learning, Tom M. Mitchell, McGraw Hill, 1997. – 1 book

24P2CAIT10EL (1) – Digital Image Processing and Computer Vision

54 Hours (3 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand and master basic knowledge, theories and methods in image processing and computer vision.
CO2. Solve problems in image processing and computer vision.
CO3. Analyze, evaluate and examine existing practical computer vision systems.
CO4. Assess scientific literature in the field and apply theoretical knowledge to identify the novelty and practicality of proposed methods.
CO5. Design and develop practical and innovative image processing and computer vision applications or systems.
CO6. Conduct themselves professionally and responsibly in the areas of computer vision image processing and deep learning.

Module I **(10 Hrs)**

Image formation – Gray scale and color Images, image sampling and quantization – singular value decomposition – Harr, Walsh and Hadamard transforms – Discrete Fourier Transform - Photometric image formation – Statistical description of images.

Module II **(11 Hrs)**

Feature detection and matching – Digital morphology - Segmentation – Mean shift and mode finding – K-means-and mixture of Gaussians – Graph cuts and energy-based methods – feature based alignment

Module III **(12 Hrs)**

Image restoration – Inverse filtering – Classification – Minimum distance classifiers – Cross validation – SVM – Ensembles – Bagging and boosting

Module IV **(10 Hrs)**

Recognition – Object classification and detection – Face recognition – Instance recognition – Category recognition– Context and scene understanding – Human motion recognition

Module V **(11 Hrs)**

State-of-the-art and the future - Content based Search – Computation Photography -Application Domains - Image & video annotation – Medical Image Processing

References

1. Computer vision: Algorithms and Applications (1st Ed): Richard Szeliski , Springer (2010)

2. Algorithms for Image Processing and Computer Vision (2nd Ed): J. R. Parker, Wiley (2010)

3. Learning OpenCV: Computer Vision with the OpenCV Library (1st Ed): Gary Bradski, O'Reilly (2008)

4. Image Processing: The Fundamentals (2 edition): Maria Petrou and Costas Petrou, Wiley (2010)

5. Mathematical Elements of Computer Graphics (1st Ed): David F. Rogers and J. Alan Adams, McGraw Hill (1989)

24P2CAIT10EL (2) - Theory of Computation

54 Hours (3 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand the conversion between finite automata, regular grammars, and regular expression representation of regular languages*
CO2. Apply the pumping lemma for regular languages to determine if a language is regular
CO3. Convert between grammars and push-down automata for context-free languages
CO4. Translate a context-free grammar from one form to another
CO5. Produce simple programs for a Turing Machine
CO6. Explain the concept of undecidability and examples of undecidable problems

Module I **(11 Hrs)**
Finite Automata (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

Module II **(12 Hrs)**
Regular Expressions (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

Module III **(10 Hrs)**
Context Free Grammar (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted).

Module IV **(10 Hrs)**
Pushdown Automata: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters

Module V **(11 Hrs)**

Recursive and Recursively Enumerable Languages (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages andComputation, 3rdedition, Pearson Education, India.

Reference Books:

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India

24P2CAIT10EL (3) - Algorithm Analysis and Design

54 Hours (3 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Analyze the performance of algorithms.
CO2. Compare appropriate algorithm design techniques for solving problems.
CO3. Understand how the choice of data structures and the algorithm design methods impact the performance of programs.
CO4. Understand set of rules design methods including the grasping approach, divide and overcome, dynamic programming, backtracking and department and certain.
CO5. Distinguish the variations among tractable and intractable problems.
CO6. Recognize p and np classes.

Module I **(10 Hrs)**

What is an algorithm – Properties of an Algorithm, Difference between Algorithm, Computational Procedure and Program, Study of Algorithms; Pseudo-code Conventions; Recursive Algorithms – Space and Time Complexity –Asymptotic Notations – 'Oh', 'Omega', 'Theta', Common Complexity Functions; Recurrence Relations and Recurrence Trees for Complexity Calculations; Profiling. –Deterministic and non – deterministic algorithms.

Module II **(11 Hrs)**

Control Abstraction, Finding Maximum and Minimum, Binary Search, Divide and Conquer Matrix Multiplication, Stressen's Matrix Multiplication, Merge Sort, Quick Sort.
Control Abstraction, General Knapsack Problem, Optimal Storage on Tapes, Minimum Cost Spanning Trees – Prim's Algorithm, Kruskal's Algorithm – Job sequencing with deadlines.

Module III **(11 Hrs)**

Principle of Optimality, Multi-stage Graph, All-Pairs Shortest Paths, Travelling Salesman Problem.
Lower Bound Theory – Comparison Trees for Searching and Sorting, Oracles and Adversary Arguments – Merging, Insertion & Selection Sort; Selection of 'k'th Smallest Element.

Module IV **(12 Hrs)**

Control Abstraction – Bounding Functions, Control Abstraction, N-Queens Problem, Sum of Subsets, Knapsack problem.
Branch and Bound Techniques – FIFO, LIFO, and LC Control Abstractions, 15-puzzle, Travelling Salesman Problem.

Module V **(10 Hrs)**

Introduction to Complexity Theory:-Tractable and Intractable Problems- The P and NP Classes- Polynomial Time Reductions - The NP- Hard and NP-Complete Classes

Text Books:

1. Fundamentals of Computer Algorithms – Horowitz and Sahni, Galgotia References
2. Computer Algorithms – Introduction to Design and Analysis – Sara Baase & Allen Van Gelder.

Reference Books:

1. Data Structures algorithms and applications – Sahni, Tata McGrHill
2. Foundations of Algorithms – Richard Neapolitan, Kumarss N., DC Hearth & Company
3. Introduction to algorithm- Thomas Coremen, Charles, Ronald Rivest -PHI

24P2CAIT10EL (4) - Graph Theory and Network Analysis

54 Hours (3 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand and apply the fundamental concepts in graph theory
CO2. Apply graph theory based tools in solving practical problems
CO3. Create problems using basic graph theory
CO4. Identify induced subgraphs, cliques, matchings, and covers in graphs
CO5. Determine whether graphs are Hamiltonian and/or Eulerian
CO6. Create problems involving vertex and edge coloring, vertex and edge connectivity, planarity and crossing numbers
CO7. Design a model real world problems using graph theory

Module I **(11 Hrs)**

GRAPHS AND SUBGRAPH - Graphs and Simple Graphs, Graph Isomorphism, The Incidence and Adjacency Matrices, Subgraphs, Vertex Degrees, Paths and Connection, Cycles, Applications – The Shortest Path Problem, Sperner's Lemma; TREES - Cut Edges and Bonds, Cut Vertices, Cayley's Formula, Applications - The Connector Problem

Module II **(11 Hrs)**

CONNECTIVITY - Blocks, Applications-Construction of Reliable Communication Networks Euler Tours, Hamilton Cycles, Applications-The Chinese Postman Problem, The Travelling Salesman Problem; MATCHINGS - Matchings and Coverings in Bipartite Graphs Perfect Matchings, Applications - The Personnel Assignment Problem, The Optimal Assignment Problem.

Module III **(12 Hrs)**

INDEPENDENT SETS AND CLIQUES - Independent Sets, Ramsey's Theorem, TurAn's Theorem, Applications - Schur's Theorem, A Geometry Problem; VERTEX COLOURINGS - Chromatic Number, Brooks' Theorem, Hajos' Conjecture, Chromatic Polynomials, Girth and Chromatic Number, Applications - A Storage Problem.

Module IV **(10 Hrs)**

Planar Graphs - Plane and Planar Graphs, Dual Graphs, Euler's Formula, Bridges, Muratowski's Theorem, The Five-Colour Theorem and the Four-Colour Conjecture, Nonharniltonian Planar Graphs, Applications - A Planarity Algorithm.

Module V **(10 Hrs)**

Directed Graphs - Directed Paths, Directed Cycles, Applications - A Job Sequencing Problem, Designing an Efficient Computer Drum, Making a Road System One-way, Ranking the Participants in a Tournament; NETWORKS - Flows , Cuts, The Max-Flow Min-Cut Theorem, Applications - Menger's Theorems, Feasible Flows

Text Books:

1. Bondy,J. A. and Murty,U.S.R., ‘Graph Theory with Applications’, Springer, 2008.
2. Diestel, R. Graph Theory (Graduate Texts in Mathematics). New York, NY: Springer-Verlag, 1997. ISBN: 3540261834

Reference Books:

1. N. Alon and J. Spenser, "Probabilistic Methods", John Wiley and Sons, 2nd edition, 2000.
2. Bollobás, B. Modern Graph Theory (Graduate Texts in Mathematics). New York, NY: SpringerVerlag, 1998. ISBN: 0387984917.

24P2CAIP03 – Machine Learning Lab

54-hours (3 hrs/week) **Credits – 2**

LIST OF EXPERIMENTS

1. Classification
    a. Estimate the accuracy of Naive Bayes algorithm
    b. Estimate the accuracy of decision classifier
    c. SVM
    d. KNN
    e. Random Forest
2. Regression
    a. Linear Regression
    b. Logistic Regression
3. Data Clustering
    a. K- Means
    b. K – Medoid
    c. Hierarchical Clustering
4. Neural Networks
    a. Perceptron
    b. MLP
    c. DNN
    d. CNN
    e. RNN
5. Others
    a. Hidden Markov Model
    b. Conditional Random Fields
    c. Association Rule mining

Text Books

1. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 24-Aug-2012
2. Alex Smola and S.V.N. Vishwanathan, Introduction to Machine Learning, Cambridge University Press, 2008.

References

1. Richard O. Duda , Peter E. Hart, David G. Stork, Pattern Classification, WileyInterscience, 2009.
2. Machine Learning, Tom M. Mitchell, McGraw Hill, 199

24P2CAIP04 – DBMS Lab and Micro Project

54-hours (3 hrs/week) **Credits – 2**

LIST OF EXPERIMENTS

1 Introduction SQL-SQL*Plus
2 Road way travels E-R Diagrams
3 Various Data Types
4 Tables
5 My SQL Installation
6 DDL and DML Commands with Examples
7 Key Constrains-Normalization
8 Aggregate functions
9 Joins
10 Views
11 Index
12 PL/ SQL
13 Exception handling
14 Triggers
15 Cursors
16 Subprograms-procedure PL/ SQL
17 Functions of PL/ SQL
18 Micro Project
    - Any Information Management System (Either Web/Desktop/Mobile Application)
    - Back end must be MySQL

Semester III

24P3CAIT11 – COMPUTER NETWORKS

72 Hours (4 hrs/week) **Credits – 3**

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to

CO1. Build an understanding of the fundamental concepts of computer networking.
CO2. Understand the concepts of IPV4 and IPV6.
CO3. Distinguish the different methods of error detection and correction.
CO4. Understand the audio and video compression, streaming stored audio and video
CO5. Understand the concepts of cryptography and its different methods.

MODULE I **(13 Hrs)**

Computer networks and Internet: The network edge: Client and server programmes, Access networks, Physical Media. The network core, network access, delay and loss, protocol layers and services, Application layer protocols, socket programming, content distribution.

MODULE II **(16 Hrs)**

Transport layer services, Connection less transport - UDP and Connection oriented transport - TCP, congestion control, Network layer services, Network service models, Internet Protocol - IP, router, IPv4 and IPv6, multicast routing, mobility.

MODULE III **(15 Hrs)**

Link layer services, Error detection and correction Techniques, Multiple access protocols, Address Resolution protocols - ARP, Ethernet, hubs, bridges, switches, wireless links, PPP, ATM.

MODULE IV **(14 Hrs)**

Multimedia networking Applications, Audio and Video compression, Streaming stored audio and video, Protocols for real-time Interactive applications: RTP and RTP Control Protocol (RTCP), providing multiple classes of services.

MODULE V **(14 Hrs)**

Network security, Cryptography, Message Integrity - Message authentication code, key distribution, Network management – Internet standard Management Network, Structure of management information, Management Information Base

Text books

1. J. F. Kurose and K . W. Ross, Computer Networking: A Top-Down Approach Featuring Internet, 3/e, Perason Education, 2005.

2. Peterson L.L. & Davie B.S., Computer Networks, A systems approach, 3/E, Harcourt Asia, 2003.

References:

1. Keshav S., An Engineering Approach to Computer Networking, Pearson Education, 2000.

2. Andrew S. Tanenbaum, Computer Networks, 3/E, PHI, 1996.

3. Shinde S.S., Computer Network, New Age International, 2009

24P3CAIT12 - Data Mining and Analytics

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Distinguish the major data mining problems as different types of computational tasks (prediction, classification, clustering, etc.) and the algorithms appropriate for addressing these tasks

CO2. Analyze data through statistical and graphical summarization, supervised and unsupervised learning algorithms

CO3. Evaluate data mining algorithms and understand how to choose algorithms for different analysis tasks

CO4. Analyse the methods and results from a data mining practice

CO5. Design and implement data mining applications using real-world datasets, and evaluate and select proper data mining algorithms to apply to practical scenarios

Module I **(13 Hrs)**
Data analytics: An introduction, Data Preparation: Data Cleaning, Data summarization, Data Warehousing: OLTP and OLAP.

Module II **(16 Hrs)**
Data Classification: Nearest Neighbour, Naïve Bayes, Decision Trees: axis parallel and oblique. Performance evaluation – confusion matrix, precision, recall, F-Measure. Text Processing – Representation, Boolean and Vector Space Retrieval, TFIDF, Cosine Similarity, Relevance and Ranking,

Module III **(15 Hrs)**
Data Clustering: Hierarchical, Partitioning based: K-Means, K-Medoids, Incremental Clustering – BIRCH, Density Based Clustering – DBSCAN, Frequent item set mining – Apriori Algorithm, FP Trees, Association Rule Mining.

Module IV **(14 Hrs)**
Locality Sensitive Hashing, Topic Modeling – Latent Semantic Indexing, Probabilistic Latent Semantic Indexing, Text Summarization – single and multi-document summarization.

Module V **(14 Hrs)**
Web Mining, Search Engines: Web Crawl, Link Analysis: Page Rank, Semantic Web: Ontology, Agent Technologies. Recommendation Systems – collaborative filtering.

Text Books

1. P.-N. Tang, M. Steinback, and V. Kumar: Introduction to Data Mining,Addison Wesley, 2006,
2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers, Third Edition, 2011.

References:

1. Souman Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kauffama, 2002.

24P3CAIT13EL (1) - Natural Language Processing and Information Retrieval

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand the theoretical basis behind the standard models of IR (Boolean, Vector-space, Probabilistic and Logical models),
CO2. Understand the difficulty of representing and retrieving documents, images, speech, etc.
CO3. Implement, run and test a standard IR system,
CO4. Understand the standard methods for Web indexing and retrieval,
CO5. Understand how techniques from natural language processing, artificial intelligence, human-computer interaction and visualization integrate with IR, and be familiar with various algorithms and systems.

Module I **(12 Hrs)**
Introduction to NLP, Knowledge Acquisition, Regular expression (RE) and Text Processing, Word Tokenization, Word Normalization and Word Stemming, Sentence Segmentation, Edit Distance, Word Alignment Problem and Statistical Machine Translation (MT), Word Alignment Problem, Parallel Corpora, Decoding, Evaluation, Statistical MT, Modern MT Systems

Module II **(14 Hrs)**
Language Modelling, Introduction to N-grams, Estimating N-gram Probabilities, Evaluation and Perplexity, Generalization and Zeros, Interpolation, Good-Turing Smoothing, Kneser-Ney Smoothing, Spelling Correction, Noisy-Channel Model for Spelling

Module III **(18 Hrs)**
Text Classification and Sentiment Analysis, Naïve Bayes Classifier, Precision, Recall and the F measure, Text Classification, Evaluation, Sentiment Analysis - Baseline Algorithm , Learning Sentiment Lexicons and Discriminative Classifier - Maximum Entropy Classifier, Generative vs. Discriminative Model Making features from text, Feature-based Linear Classifier, Problem of Over counting evidence, Named Entity Recognition (NER) and Maximum Entropy Sequence Model

Module IV **(16 Hrs)**
Introduction to Information Extraction, NER and Evaluation of NER, Sequence Models for NER, Maximum Entropy Sequence Model, Relation extraction by using patterns, Supervised, Semi-supervised and Unsupervised Relation Extraction, Advanced Maximum Entropy Models, Parts of Speech (POS) Tagging , Sequence Models for POS Tagging, Parsing, Syntactic Parsing - Constituency vs. Dependency, Context Free Grammar (CFG) and PCFG, Grammar Transforms, CKY Parsing, Lexicalized Parsing, Lexicalization and PCFGs, Charniak' Model, Unlexicalized PCFGs, Latent Variable PCFGs, Context Sensitive Grammar (CSG)

Module V **(12 Hrs)**

Information Retrieval and Ranked Information retrieval, Introduction, Term-Document Incidence Matrices, Inverted Index and Query Processing with Inverted Index, Ranked Information Extraction, Termed Frequency (TF) Weighting, Inverse Document Frequency Weighting, Semantics, Word Senses and Word Relations, Word Similarity , WSD (Word Sense Disambiguation) and Context, Influence of WSD in Conversation, Coreference Resolution

Text Books

1. Speech and Language Processing, Jurafsky, D. and J. H. Prentice-Hall. 2000.
2. Foundations of Statistical Language Processing, Martin Manning, C. D. and H. Schütze, The MIT Press. 1999.
3. Foundations of Statistical Natural Language Processing - Christopher Manning

References

1. Natural Language Understanding, Allen J, The Benajmins/Cummings Publishing Company Inc. 1994.
2. Natural Language Processing A Paninian Perspective, Akshar Bharati, Chaitanya Vineet, Sangal Rajeev, Prentice Hall India. 1999.
3. Martin Rajman and Vincenzo Pallota, Speech and Language Engineering, Efpl Press, 2007

24P3CAIT13EL (2) - Big Data Analytics

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand what Big Data is and why classical data analysis techniques are no longer adequate
CO2. Understand the benefits that Big Data can offer to businesses and organisations
CO3. Understand conceptually how Big Data is stored
CO4. Understand how Big Data can be analysed to extract knowledge

Module I **(12 Hrs)**
Data Science – technology and business perspectives, Information platform and rise of data scientist, computational framework for big data - review of Map- Reduce computation framework.

Module II **(15 Hrs)**
Massive data computing with clusters of commodity hardware, Map Reduce algorithm design - Text Processing with Map-reduce, Statistical computations at scale on Map Reduce.

Module III **(13 Hrs)**
NoSQL Data stores, distributed storage systems for massive data – Google file system, HBase and Cassandra.

Module IV **(16 Hrs)**
Data finds data paradigm, Similarity Search on large data sets – locality sensitive hashing, Mining Data Streams – sampling data in a stream, filtering streams, counting distinct elements in a stream.

Module V **(16 Hrs)**
Link Analysis – computing webpage relevance- page rank, Link Spam, Hub and Authorities, Leveraging the likelihood of customer interest - Recommendation Engines, Advertising over the web- search advertising, adwords.

Text Books
1. Tom White, Hadoop: The Definitive Guide, 3rd edition, O'Reilly Media , 2012.
2. Toby Segaran, Jeff Hammerbacher, Beautiful Data, O'Reilly Media, 2009.

References
1. Anand Rajaraman, Jeffrey D Ullman. Mining of Massive Datasets, Cambridge University Press 2010.

24P3CAIT13EL (3) – Computational Modelling

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand fundamental concepts of computer simulation and its role in engineering problem solving.
CO2. Create and model engineering problems and apply procedures for modelling systems using ARENA framework.
CO3. Discuss the advantages of using simulation and modelling for taking decision in engineering problems.
CO4. Understand the need to incorporate simulation and modelling considerations throughout the design and execution of a project aiming at understanding its limitations and ways of improvement.

Module I **(13 Hrs)**
Describing Reality through Models. Deduction, induction, abduction. Reality and model, Quantitative reasoning and mathematical modeling, Mathematical modeling and the scientific method: falsifiability

Module II **(15 Hrs)**
The Life Cycle of a Model. Formulation of a model: abstraction, qualitative vs. quantitative, stochastic vs. deterministic, etc. Deciphering the behavior of the model: analytical reasoning and mathematical analysis, approximation, numerical computation, simulation: computational and non-computational.

Module III **(14 Hrs)**
Computing Guidelines. Coding style recommendations for efficient large-scale numerics:code organization, modularity and reusability; readability and self-explanatory documentation; Visualization in 2D and 3D: contours, surfaces, isosurfaces; visualization tools.

Module IV **(16 Hrs)**
Optimization Techniques; A survey of optimization problems and their modeling, a minimizer, local and global minima, constrained and unconstrained minimization, Golden section search, two-point bracketing and bisection, Brent's method. Numerical methods that use derivative information: Newton-Raphson, Davidon's method, Brent with bracketing.

Module V **(14 Hrs)**
Constrained Minimization. Linear programming and the simplex method. Equality and bound constraints: general theory. A survey of constrained minimization methods for nonlinear problems. Deterministic Global Minimization. Survey of global minimization problems and deterministic global minimization methods

Text Books

1. Clive L. Dym, Principles of Mathematical Modeling. Elsevier, 2004
2. Edward A. Bender, An Introduction to Mathematical Modeling. Dover Publications, 2000

References

1. Walter J. Meyer, Concepts of Mathematical Modeling. Dover Publications, 2004.
2. Rutherform Aris, Mathematical Modeling Techniques. Dover Publications (1994).
3. Reinhard Illner, C. Sean Bohun, Samantha McCollum, Thea van Roode, Mathematical Modelling: A Case Studies Approach. American Mathematical Society, 2005

24P3CAIT14EL (1) - Soft Computing and Optimization Techniques

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand the human intelligence and AI Explain how intelligent system works.
CO2. Apply basics of Fuzzy logic and neural networks.
CO3. Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
CO4. Develop some familiarity with current research problems and research methods in Soft Computing Techniques.
CO5. Apply basic concepts of mathematics to formulate an optimization problem
CO6. Analyse and appreciate variety of performance measures for various optimization problems

Module I **(12 Hrs)**
Introduction: Introduction to soft computing, introduction to biological and artificial neural networks, introduction to fuzzy sets and fuzzy logic systems

Module II **(14 Hrs)**
Artificial Neural Networks and Applications: Different artificial neural network models, learning in artificial neural networks, neural network applications in control systems

Module III **(14 Hrs)**
Fuzzy Systems and Applications: Fuzzy sets, fuzzy reasoning, fuzzy inference systems, fuzzy control, fuzzy clustering, applications of fuzzy systems

Module IV **(16 Hrs)**
Neuro-fuzzy systems: Neuro-fuzzy modeling, neuro-fuzzy control Genetic algorithms: Simple GA, crossover and mutation, genetic algorithms in search and optimization, Introduction to Ant Colony Optimization method and Swarm Intelligence

Module V **(16 Hrs)**
Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

Text Books
1. M. Friedman and A. Kandal, Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches, (Series in Machine Perception and Artificial Intelligence) World Scientific Pub Co Inc (December 1999).
2. Neural and Fuzzy Logic Approaches, World Scientific, 2005

References

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, McGraw Hill, 1997.
2. J.S.R. Jang, C.T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing: A Computational
3. Approach to Learning and Machine Intelligence, Prentice Hall, 1996.
4. Melanie Mitchell, An Introduction to Genetic Algorithms, Prentice Hall of India, 2004.
5. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley Professional, 1989.

24P3CAIT14EL (2) - Pattern Recognition

72 Hours (4 hrs/week) **Credits –3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CO3. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
CO4. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Module I **(15 Hrs)**

Supervised Pattern Recognition: Introduction to Pattern recognition systems, the design cycle, learning and adaptation, feature extraction and feature selection, Bayesian decision theory, minimum error rate classification, discriminant function and decision surfaces, the normal density based discriminant functions; Maximum likelihood, Gaussian case, curse of dimensionality and principle component analysis.

Module II **(16 Hrs)**

Non parametric techniques**:** density estimation, parzen windows, nearest neighborhood estimation, linear discriminant functions and decision surfaces, generalized linear discriminant functions, two-category linearity separable case, Perception Algorithm. Nonmetric methods: Decision trees, Cart methods; Algorithm-independent machine learning: lack of inherent superiority of any classifier, Bias and Variance for regression and classification, resampling for estimating statistics, estimating and comparing classifiers.

Module III **(14 Hrs)**

Unsupervised learning and clustering: Criterion functions for clustering, Proximity Measures, hierarchical and non-hierarchical (partitional) clustering, low-dimensional representations and multidimensional scaling.

Module IV **(13 Hrs)**

Fuzzy Logic systems: Basics of fuzzy logic theory, crisp and fuzzy sets, fuzzy relations fuzzy inference, fuzzy pattern recognition and fuzzy c-Mean clustering.

Module V **(14 Hrs)**

Paradigms for intrusion detection systems: Misuse detection and anomaly detection, the formulation of intrusion detection task as a pattern recognition problem, data collection, and Feature extraction, various approaches-Neural networks, statistical, structural and syntactic.

Text Books

1. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, Second Edition, John Wiley & Sons Inc., 2003.

2. Sergios Theodorides and Konstantinos Koutroumbas, Pattern Recognition, Third Edition, Academic Press, 2006.

References

1. Sing-Tze Bow, Pattern Recognition: Application to Large Data-Set Problems, Marcel Dekker Inc. New York and Basel, 2005. 45

2. Etham Alpaydin, *Introduction to Machine Learning*, Prentice Hall of India Private Limited, New Delhi, 2004.

3. Margret H. Dunham, Data Mining: Introductory and Advance Topics, Prentice Hall; 1 edition, 2002

4. Earl Gose, Richard Johnsonbaugh and Steve Jost, Pattern Recognition and Image Analysis, Prentice Hall of India, 2002.

24P3CAIT14EL (3) – Object Oriented Analysis and Design

72 Hours (4 hrs/week) **Credits – 3**

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1. Understand the use an object-oriented method for analysis and design
CO2. Analyse information systems in real-world settings and to conduct methods such as interviews and observations
CO3. Understanding of a variety of approaches and perspectives of systems development, and to evaluate other IS development methods and techniques
CO4. Understand the techniques aimed to achieve the objective and expected results of a systems development process
CO5. Understand the different types of prototyping and use of UML for notation

Module I **(14 Hrs)**
Best Practices of Software Engineering and Introduction to OMT: Develop iteratively, models and visualizations, UML, best practices in software engineering. Object modeling Technology, basic principles of object orientation, UML modeling mechanisms, Relationships, Class diagrams, Instances, Object diagrams, Packages, Interfaces.

Module II **(13 Hrs)**
UML Behavioral Modeling: Use cases, Use case diagrams, Activity diagrams, Analysis- Use case behavior, finding classes and relationships Identify Design Elements, Design Mechanism

Module III **(15 Hrs)**
Interaction Diagrams: Sequence diagram, Collaboration Diagram, activity diagram, activity states, transitions, state chart diagram, Events Signals State machines Processes Threads State chart diagrams

Module IV **(16 Hrs)**
Architectural Analysis and Component Diagram: 4+1 view architecture, analysis mechanism, use case realization, Components Collaborations Patterns Frameworks, Process and Threads, Concurrency, Synchronization, Collaborations, Component diagrams

Module V **(14 Hrs)**
Deployment Diagram: Distribution diagrams, runtime architecture, concurrency, configurations, process, nodes, networks, Deployment diagrams

Text Books

1. Grady Booch, James Rambaugh, Ivar Jacobson, The United Modeling Language User Guide- Published by Addison-Wesley, 2005
2. James Rambaugh et. al., Object Modeling and Design Prentice Hall,1991

References

1. Meilier Page Jones, Fundamentals of Object Oriented Design in UML, Pearson Education, Asia, 2002

24P3CAIP05 –DATA ANALYTICS LAB USING R

72-hours (4 hrs/week) **Credits – 2**

LIST OF EXPERIMENTS

1. R Programming Language Basics
2. Controlling functions (procedures or commands) using arguments (options or parameters) or an object's class; how to change class
3. Data Transformations – modifying existing variables and creating new ones
4. Writing functions (macros)
5. Graphics
6. Traditional graphics
7. Lattice graphics
8. ggplot2 package
9. Implement the following Data structures in Java
10. a)Linked Lists b) Stacks c) Queues d) Set e) Map
11. Perform setting up and Installing Hadoop in its three operating modes:
    a. Standalone,
    b. Pseudo distributed,
    c. Fully distributed
12. Use web based tools to monitor your Hadoop setup.
13. Implement the following file management tasks in Hadoop:
    a. Adding files and directories
    b. Retrieving files
    c. Deleting files
14. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
15. Write a Map Reduce program that mines weather data.
16. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.
17. Implement Matrix Multiplication with Hadoop Map Reduce
18. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
19. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions and indexes

Text Books

1. Lyman Ott, R. Lyman Ott, Micheal Longnecker, An introduction to statistical methods and data analysis, 6th Edn, Cengage Learning, 2008

References

1. G. W. Snedecor, and W.G.Cochran, Statistical Methods. Iowa State University Press, 1989.

24P3CAIP06 –Mini Project/Seminar

90-hours (5 hrs/week) **Credits – 3**

1. Mini project shall be done in the college itself, under the guidance of a faculty in the department. The project can be done individually, or as a team of two members.
2. The volume of work shall be limited to be completed in not more than 72 hrs.

CE Mark for Minor Project & Seminar (out of 50)

However, the faculty in charge shall assign the marks as follows:

1. Mini Project :
   a. Report : 5
   b. Design and development : 10
   c. Implementation/Findings : 5
   d. Presentation and Defence : 5

2. Seminar:
   a. Presentation & Defence : 12
   b. Report : 8
   c. Topic & content organization of presentation : 5

24P4CAIPJ –Project / Internship

450-hours (25 hrs/week) **Credits – 15**

Major Project:

1. Major project work shall be done individually by each student under the guidance of a faculty member from the department.
2. An internal evaluation team consisting of at least three members, chaired by the Head of Department or a senior faculty member shall be constituted at the college every year by the end of third semester.
3. The project guide of the candidate can be one of the members in the team.
4. If the student chooses to do his project in an organization other than the college as an internship, the department shall ensure the following:
5. The project is supervised by a qualified person.
6. The External Supervisor shall be a post graduate in either Science/Applied Science/Engineering branches.
7. He/She shall have at least 3 years' experience in running /managing /implementing/ supervising such projects.
8. A declaration shall be obtained in this regard from that person, and shall be kept with the Department.
9. An attendance statement and a performance feedback shall be obtained from the External supervisor.
10. The student has to present periodic reports and attend for evaluation process before the internal evaluation team at the College as per the schedule.

CE Marks for Major Project (out of 50)

1. Study Phase activities & Report/Literature survey: 10 marks
2. Design: 10 Marks
3. Methodology: 10 marks
4. Findings/Implementation: 10 marks
5. Presentation & Defense : 10 marks