MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI-12
PG COURSES – AFFILIATED COLLEGES
MASTER OF SCIENCE in COMPUTER SCIENCE
with
ARTIFICIAL INTELLIGENCE
REGULATIONS – 2022

(Choice Based Credit System)
(with effect from the academic year 2022-2023)

Vision of the University

To provide quality education to reach the un-reached

Mission of the University

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of Information Technology to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality/ inclusive education, especially for the rural and un-reached segments of economically downtrodden students including socially oppressed and differently abled

PREAMBLE

The Learning Outcome-based Curriculum Framework (LOCF) approach which is student-centric, interactive and outcome oriented with well-defined aims, objectives and goals to achieve has been adopted in M.Sc Computer Science with Artificial Intelligence Programme to create and disseminate knowledge to the students on the latest

technologies by imparting the technical skills to meet industrial needs and inculcate the skills for employability.

Vision

Empowering students with knowledge and technical skill set in the domain of Artificial Intelligence

Mission

To enable the students excel in the field of Artificial Intelligence

PROGRAM EDUCATIONAL OBJECTIVES

1. To understand the core concepts in Artificial Intelligence and acquire expertise.
2. To facilitate students to develop problem solving and programming skills in the field of Artificial Intelligence.
3. To empower students to involve in active research
4. To contribute to the developmental needs of India and the world.
5. To make the students employable by imparting knowledge in the Artificial Intelligence domain

PROGRAM OUTCOME:

PO1 Evaluate the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems

PO2 Analyze, synthesize, model and integrate technologies to develop expert systems

PO3 Communicate effectively, as a member or team leader, in AI related projects involving multidisciplinary environments.

PO4 Adapt to new developments and foster technological growth.

PO5 Develop strong moral and ethical values to contribute as a responsible member of the society

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 Understand and analyze the fundamental knowledge in the Artificial Intelligence domain.

PSO2 Enhance the logical and analytical thinking to understand the computational systems.

PSO3 Ability to comprehend the development methodologies of software systems and to design the software solutions.

PSO4 Explore the developing areas in the Information Technology sector and to enrich themselves to be skillful to meet the diverse expectations of the industry.

PSO5 Equipped to be competent in providing optimal and ethical solutions to the technological challenges laid by the professional societies.

REGULATIONS/ PROGRAMME SPECIFIC REQUIREMENTS

Duration of the Course:
M.Sc. Computer Science with Artificial Intelligence is a full time 2 years programme spread over four semesters.

Eligibility for Admission to the Programme
Candidates with three year Bachelor's degree in Computer Science / Computer Applications / Information Technology / Computer Technology / Software Engineering or equivalent degree as recognized by Manonmaniam Sundaranar University are eligible for this programme

Credit Requirement: The general Regulations of the Choice Based Credit System programme of Manonmaniam Sundaranar University are applicable to this programme. The University requirement for the M.Sc. programme is completion of 90 credits of course work, out of which 6 credits should be through the mini project, 16 credits should be through the 4th semester main project work, remaining 64 credits should be through Core and Elective papers. A Core course has 4 credits, elective has 3 credits and Practical papers weigh 2 credits each. No candidate will be eligible for the Degree of M.Sc. (Master of Science) in Computer Science with Artificial Intelligence unless the candidate has undergone the prescribed course of study for a period not less than 4 semesters and has acquired 90 credits.

A candidate will be permitted to appear for the semester examination only if the candidate keeps not less than 75 percent attendance. The University condonation rules are applicable for those who lack minimum of 75% attendance. The candidates with less than 60% attendance will have to repeat the concerned entire semester. The assessment will comprise Continuous Internal Assessment (CIA) carrying a maximum of 25% marks and end-semester Examination carrying a maximum of 75% marks in each theory subject (Core/Elective/Supportive Course). For practical subjects, Mini Project and Major Project, the CIA is carried out for 50% marks and the External Assessment (Final Practical Examination, Record, Viva-Voce for Practical Presentation, Project Report, Viva-Voce for Mini Project and Major Project) is for 50% marks. Semester Examination will be conducted for all subjects of study, at the end of each Semester. If a Student wants to carry out the final Major project work in 4th semester in a software company/firm, the student can get permission from the concerned Project Supervisor and Head of the Department after submitting the Acceptance Letter from the software company/firm.

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

PG COURSES – AFFILIATED COLLEGES

M.Sc COMUTER SCIENCE WITH ARTIFICIAL INTELLIGENCE

(Choice Based Credit System)

(with effect from the academic year 2022-2023 onwards)

SEMESTER WISE COURSE LIST

Sem	Sub No	Subject status	Subject Title	Contact Hrs	Credits
I	1	Core 1	Artificial Intelligence	5	4
	2	Core 2	Design & Analysis of Algorithms	4	4
	3	Core 3	Python for Data Science	4	4
	4	Core 4	Data Science & Big Data Analytics	5	4
	5	Core 5	Mathematical Foundation for Data Analytics	4	4
	6	Core 6 Practical 1	Algorithm Lab	4	2
	7	Core 7 Practical 2	Python Programming Lab	4	2
			Sub Total	30	24
II	8	Core 8	Machine Learning	5	4
	9	Core 9	Soft Computing	4	4
	10	Core 10	Pattern Recognition & Image Analysis	5	4
	11	Core 11	Compiler Design	4	4
	12	Elective 1	Android Programming/ Optimization Techniques / Augmented Reality/ Database Management Systems	4	3
	13	Core 12 Practical 3	Machine Learning Lab with R & Hadoop	4	2
	14	Core 13 Practical 4	Image Processing Lab	4	2
			Sub Total	30	23
III	15	Core 14	Natural Language Processing	4	4
	16	Core 15	Internet of Things	4	4
	17	Core 16	Network Security & Cryptography	4	4
	18	Core 17	Research Methodology	4	4
	19	Elective 2	Deep Learning/Robotics / Mobile Computing/ Distributed Operating Systems	4	3
	20	Core 18 Practical 5	Natural Language Processing Lab	4	2
	21	Core 19	Mini Project	6	6
			Sub Total	30	27
IV	22	Core 20	Major Project	30	16
			Sub Total	30	16
			Total	120	90

Scheme of Examination - Theory Subjects:

(Total Marks: 100 (Internal: 25 Marks, External: 75 Marks)

CIA[1] - Internal Marks There is no Passing Minimum for the CIA component.	**End Semester Examination** **External Marks**
i. Average of best two tests from three: 15 Marks ii. Assignment: 05 Marks iii. Seminar: 05 Marks	Total : 75 Marks
Total : **25 Marks**	Passing minimum 50% i.e. **38 marks**

Passing Minimum for Practical Exam:

There is no Passing Minimum for the CIA component. But overall (CIA+ External), the student should get 50% or more to get a pass.

Assessment Components (External: Internal – 50: 50)

PRACTICAL

Practical examinations will be conducted at the end of each semester. The scheme of valuation is to be decided by the respective board of Question setters.

Passing Minimum for Mini/Major Project:

The CIA component is given by the Project Supervisor based on the reviews for 50 marks. There is no Passing Minimum for the CIA component. But overall (CIA+ External), the student should score 50% or more to get a pass.

PROJECT AND VIVA-VOCE

The break-up for the external project work is as follows:

Components	**Marks**
Project Report	20
Project Presentation	20
Viva-Voce	10
Total	50

[1] Continuous Internal Assessment

External (End Semester) Examination Question pattern:

Time: 3 hours Max. Marks: 75

Part – A

(10*1=10)

Answer all the questions

Ten Questions - two objective type questions from each unit.

Part – B

(5*5=25)

Answer all the questions

Five Questions -two short answer type questions from each unit with internal choice(Either ...Or... type)

Part – C

(5*8=40)

Answer all the questions

Five Questions - two descriptive/Analytical type questions from each unit with internal choice(Either .. Or type)

Core 1	ARTIFICIAL INTELLIGENCE	L	T	P	C
		4	1	0	4

Course Objectives:

1. To understand the basic concepts and principles of Artificial Intelligence
2. To learn various applications domains of AI
3. To study the concepts of Expert Systems

Unit-I Fundamentals of Artificial Intelligence (15L)

Introduction: What is AI? AI Techniques, Representation of Knowledge, Knowledge Based Systems, State Space Search. Production Systems: Problem Characteristics, Types of production systems. Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, Knowledge based agents

Unit-II Search Strategies (15L)

Informed Search: Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means-Ends Analysis. Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence

Unit-III Knowledge Representation (15L)

Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.

Unit-IV Expert systems (15L)

Architecture of expert systems, Steps to build Expert Systems - Role of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, PROSPECTOR

Unit-V Prolog Programming (15L)

Introduction to Prolog: Syntax and Numeric Function, Basic List Manipulation Functions in Prolog, Functions, Predicates and Conditional, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays

Course Outcome:

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

1. Delineate Artificial intelligence.
2. Build knowledge based systems.
3. Understand the basics of knowledge representations
4. Develop Expert Systems
5. Reformulate a problem from AI perspective

CO - PO - PSO Mapping

ARTIFICIAL INTELLIGENCE											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 4
CO 3	H	H	M	H	H	H	H	H	H	H	K – 2
CO 4	H	H	M	H	H	H	H	H	H	H	K – 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence." Tata McGraw Hill, 3rd Edition
2. Stuart Russell & Peter Norvig, "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.
3. Donald A. Waterman, “A Guide to Expert Systems”, Addison Wesley Publishing Company
4. Carl Townsend, “Introduction to Prolog Programming”
5. Ivan Bratko, “PROLOG Programming for Artificial Intelligence”, Addison-Wesley, 2nd Edition.
6. Klocksin and Mellish, “Programming with PROLOG”

Reference Books:

1. Eugene, Charniak, Drew McDermott, "Introduction to Artificial Intelligence", Addison Wesley
2. Patterson, “Introduction to AI and Expert Systems”, PHI
3. Nilsson, “Principles of Artificial Intelligence”, Morgan Kaufmann.
4. Carl Townsend, “Introduction to Turbo Prolog”, Paperback

https://nptel.ac.in/courses/106/105/106105077/

https://lecturenotes.in/materials/29314-note-for-artificial-intelligence-ai-by-jaswanth-chowdary

https://www.tutorialspoint.com/artificial_intelligence/index.htm

Core 2		L	T	P	C
	DESIGN AND ANALYSIS OF ALGORITHMS	4	0	0	4

Course Objective:

To learn effective problem solving in computing applications and analyze the algorithmic procedure to determine the computational complexity

Unit I: Introduction: Algorithm Definition – Algorithm Specification – Performance Analysis-Asymptotic Notations. Elementary Data Structures: Stacks and Queues – Trees – Dictionaries – Priority Queues – Sets and Disjoint Set Union – Graphs (12L)

Unit II: Divide and Conquer: The General Method – Defective Chessboard – Binary Search – Finding the Maximum and Minimum – Merge Sort – Quick Sort – Selection - Strassen's Matrix Multiplication. (12L)

Unit III: The Greedy Method: General - Container Loading - Knapsack Problem - Tree Vertex Splitting – Job Sequencing With Deadlines - Minimum Cost Spanning Trees - Optimal Storage On Tapes – Optimal Merge Patterns - Single Source Shortest Path. (12L)

Unit IV: Dynamic Programming: The General Method – Multistage Graphs – All-Pairs Shortest Paths – Single-Source Shortest Paths - Optimal Binary Search Trees - String Editing - 0/1 Knapsack - Reliability Design - The Traveling Salesperson Problem - Flow Shop Scheduling. Basic Traversal and Search Techniques: Techniques for Binary Trees – Techniques for Graphs – Connected Components and Spanning Trees – Bi-connected Components and DFS. (12L)

Unit V: Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem Branch and Bound: Least Cost search - 0/1 Knapsack Problem. (12L)

Course Outcome:

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

1. Understand and solve complex problems
2. Select an appropriate algorithm for the problem
3. Evolve as a competent programmer capable of designing and analyzing algorithms and data structures for different kinds of problems
4. Classify problems into complexity classes like P and NP.
5. Analyze graphs and determine shortest path

CO – PO – PSO Mapping

DESIGN AND ANALYSIS OF ALGORITHMS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	M	H	H	M	H	H	H	M	H	H	K - 2
CO 2	H	M	M	H	H	H	H	H	H	H	K - 1
CO 3	H	H	M	H	H	H	H	H	H	H	K - 3
CO 4	H	H	M	H	H	H	H	H	M	H	K - 4
CO 5	H	H	M	H	M	H	H	H	H	M	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.

References

1. Data Structures Using C - Langsam, Augenstien, Tenenbaum, PHI
2. Data structures and Algorithms, V.Aho, Hopcropft, Ullman , LPE
3. Introduction to design and Analysis of Algorithms - S.E. Goodman, ST. Hedetniem-TMH.
4. Carlos A.Coello Coello, Gary B.Lamont, David A.Van Veldhuizen, “Evolutionary Algorithms for Solving Multi-Objective Problems”, Springer 2nd Edition, 2007.

Core 3

PYTHON FOR DATA SCIENCE

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand different datatypes in Python
2. To learn the different concepts in Python
3. To analyze Database Connectivity and Data Visualization

UNIT I INTRODUCTION

Introduction to Python: Features of Python – Writing the First Python Program – Executing a Python Program – Datatypes in Python – Literals – Operators – Input and Output – Control Statements. (10L)

UNIT II NUMPY & PANDAS PACKAGES

NumPy and array - Vectorization Operation - Array Indexing and Slicing - Transposing Array and Swapping Axes - Saving and Loading Array - Universal Functions - Mathematical and Statistical Functions in Numpy . Series and DataFrame data structures in pandas - Creation of Data Frames – Accessing the columns in a DataFrame - Accessing the rows in a DataFrame - Panda's Index Objects - Reindexing Series and DataFrames - Dropping entries from Series and Data Frames - Indexing, Selection and Filtering in Series and Data Frames - Arithmetic Operations between Data Frames and Series - Function Application and Mapping. (14L)

UNIT III DICTIONARIES AND INTRODUCTION TO OOPS

Operations on Dictionaries – Dictionary Methods – Creating a Class – Types of Variables – Types of Methods – Constructors in Inheritance – Types of Inheritance – Operator Overloading – Method Overloading and Overriding – Interfaces in Python – Regular Expressions in Python. (12L)

UNIT IV GRAPHICAL USER INTERFACE AND DATA WRANGLING

The Root Window – Working with Containers – Canvas – Frame – Widgets - Creating Tables. Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String manipulations – Regular Expressions. (12L)

UNIT V: DATA AGGREGATION, DATABASE CONNECTIVITY AND VISUALIZATION

Data Aggregation and Group Operations Group by Mechanics – Data Aggregation – GroupWise Operations – Transformations – Pivot Tables – Cross Tabulations – Date and Time data types.

Database Connectivity: Types of Databases used with Python – Using MySQL from Python – Inserting, Deleting and Updating rows in a Table – Creating Database Tables using Python - Data Frame and Data Visualization. (12L)

Course Outcome:

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

1. Create Arrays, Strings, Lists and Tuples
2. Examine Dictionaries and Object Oriented Programming concepts in Python.
3. Understand Database Connectivity and Data Visualization
4. Access Database with Python

5. Use MySQL from Python

CO - PO - PSO Mapping

PYTHON FOR DATA SCIENCE											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

TEXT BOOK

1. Dr. R. Nageswara Rao, “Core Python Programming”, Second Edition, Dreamtech Press, 2019.
2. Gowrishanker and Veena, “Introduction to Python Programming”, CRC Press, 2019.

REFERENCE BOOKS

1. Martin C. Brown, “The Complete Reference Python”, Indian Edition, Mc Graw Hill Education, 2018.
2. Yashavant Kanetkar, Aditya Kanetkar, “Let us Python”, Second Edition, BPB Publications, 2019.

Core 4 | **L** | **T** | **P** | **C**
DATA SCIENCE AND BIG DATA ANALYTICS | **4** | **1** | **0** | **4**

Course Objective:
The course provides knowledge of basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Unit I: Introduction to Big Data Analytics : Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize. **(15L)**

Unit II: Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interface – Data Import and Export – Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation: Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA. **(15L)**

Unit III: Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics – Reasons to choose and cautions – Additional Algorithms - Association Rules : A Priori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Validation and Testing – Diagnostics. Linear Regression and Logistic Regression :– Use cases – Model Description – Diagnostics - Additional Regression Models. **(15L)**

Unit IV: Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Na'ive Bayes – Bayes Theorem – Naïve Bayes Clasifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis: Overview – Box – Jenkins Methodology – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model - Text Analysis : Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights. **(15L)**

Unit V: Advanced Analytics-Technology and Tools: MapReduce and Hadoop : Analytics for Unstructured Data .- UseCase - MapReduce - Apache Hadoop – The Hadoop Ecosystem – Pig – Hive – Hbase – Mahout – NoSQL - Tools in Database Analytics: SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MADlib - Analytics
Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables: Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization **(15L)**

Course Outcome:

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

1. Acquire the knowledge on the basics of Big Data
2. Work with Big Data tools
3. Design efficient algorithms for mining the data from large volumes
4. Explore the cutting-edge tools and technologies to analyze Big Data
5. Appreciate Big Data Processing concepts and Data visualization techniques

CO - PO - PSO Mapping

DATA SCIENCE AND BIG DATA ANALYTICS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons, Inc. 2015

Reference Books

1. Noreen Burlingame , "The little book on Big Data", New Street publishers, 2012.
2. Anil Maheshwari, " Data Analytics", McGraw Hill Education, 2017.
3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", Starch Press;
First edition , 2011.
4. Sandip Rakshit, "R for Beginners", McGraw Hill Education, 2017
5. http://www.johndcook.com/R_language_for_programmers.html.
6. http://bigdatauniversity.com/.
7. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#introduction.

Core 5

MATHEMATICAL FOUNDATION FOR DATA ANALYTICS	L	T	P	C
	4	0	0	4

Course Objective:

To impart mathematical knowledge required for Data Analytics

UNIT I: Introduction: Machine Learning-Definition, Examples, Supervised Learning-Unsupervised Learning-Definition and Examples, Model Representation, Cost Function, Intuitions. (12L)

UNIT II: Gradient Descent and Regularization: Gradient Descent, Intuitions, Gradient Descent for a Regression algorithm. Multiple Features, Gradient Descent on Multiple Features, Practice on Gradient Descent. Gradient Descent for Polynomial Regression, Normal Equation, Invertibility, Problem of Over fitting, Regularization, Cost function, Regularized Linear Regression (10L)

UNIT III: Linear Algebra: Matrix, Representation, Examples of matrix Data, Vectors, examples, Representation, Matrix Addition, Scalar Multiplication, Matrix Multiplication properties, Matrix Vector Multiplication, Matrix Multiplication, Inverse and Transpose, Applications of Matrix operations on Real Time Data, Parallel Matrix Multiplication, Dimensionality Reduction by Principal Component Analysis and Eigen Values, Eigen Vectors. (11L)

UNIT IV: Basic operations of Octave: Installation of Octave, Logical & Arithmetic Operations, Assignment of Different Variables, Assigning Matrices, Vector Representation, Histogram of matrices, Diagonal Matrices. (13L)

UNIT V: Data Visualization and Processing using Octave: Finding the size of a Matrix, Loading Data into Octave, Viewing the Workspace of Octave, Accessing the elements of Matrix, Arithmetic operations on matrices- Addition, Multiplication, log, exponentiation, Transpose, Maximum and Minimum Value of a Matrix, Control Statements in Octave, Visualizing Data in Octave-Plotting Data, giving labels, axes and titles, Victimization, Vector implementation, Advantages. (14L)

Course Outcome:

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

1. Acquire knowledge of processing using octave
2. Statistically analyse data
3. Comprehend Machine Learning
4. Compute solutions of linear equations and system of equations
5. Understand the basic concepts of Data Visualization

CO - PO - PSO Mapping

MATHEMATICAL FOUNDATION FOR DATA ANALYTICS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Books:

1. Lectures of Professor Dr. Andrew Ng, Stanford University, Coursera.
2. Gene H.Golub, Charles F.Van Loan, “Matrix Computations”, John Hopkins University Press.
3. https://skymind.ai/wiki/eigenvector
4. Randolf H. Reiss, B.S, “Eigen Values and Eigen Vectors in Data dimension Reduction for Regression”, San Marcos, Texas.
5. Gilbert Strang, “Linear Algebra and its Applications”, Thomson Learning Inc., 4th Edition.
6. https://www.cs.utah.edu/~jeffp/M4D/M4D-v0.4.pdf

Core 6 Practical 1 **ALGORITHM LAB**

L	T	P	C
0	0	4	2

Prolog:

1. Write Prolog program to implement A* algorithm.
2. Write Prolog program to implement MinMax search
3. Write Prolog program to solve water jug problem
4. Write Prolog program to implement TicTacToe
5. Write Prolog program to implement alpha-beta pruning
6. Write Prolog program to solve 4 Queen problem

C++

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n.
2. Write a program to obtain the topological ordering of vertices in a given digraph.
3. Implement travelling salesman problem.
4. Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Solve N queen problem

Course Outcome:

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

1. Understand and solve complex problems
2. Select an appropriate algorithm for the problem
3. Evolve as a competent programmer capable of designing algorithms
4. Analyze algorithms
5. Analyze and find shortest path in a graph

CO - PO - PSO Mapping

ALGORITHM LAB											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Core 7 Practical 2

PYTHON PROGRAMMING LAB

L	T	P	C
0	0	4	2

1. Program using Strings - Program to Sort Words in Alphabetic Order
2. Program to perform various list operations, such as:
   - Append an element
   - Insert an element
   - Append a list to the given list
   - Modify an existing element
   - Delete an existing element from its position
   - Delete an existing element with a given value
   - Sort the list
   - Display the list.
3. Program using Tuples - swap two numbers without using a temporary variable.
4. Program using Dictionaries - count the number of times a character appears in a given string
5. Write a function to convert number into corresponding number in words
   For eg, if the input is 876 then the output should be 'Eight Seven Six'.
6. Program using Inheritance.
7. Program using Interfaces.
8. Program involving Overloading
9. Program using Regular Expressions.
10. Working with Widgets.
11. Program to Insert, Delete and Update in Database.
12. Program to create and perform operations using Data Frames.
13. Program to implement Data Visualization.
14. Reading and Writing Text Files and Binary Files
15. Combining and Merging Data Sets
16. Data Aggregation and GroupWise Operations

Course Outcome:

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

1. Appreciate programming concepts in Python
2. Work with Widgets.

3. Insert, Delete and Update in Database.
4. Create and perform operations using Data Frames.
5. Implement Data Visualization

CO - PO - PSO Mapping

PYTHON PROGRAMMING LAB											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 2
CO 2	H	H	M	H	H	H	H	H	H	H	K - 3
CO 3	H	H	M	H	H	H	H	H	H	H	K - 2
CO 4	H	H	M	H	H	H	H	H	H	H	K - 6
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Core 8

MACHINE LEARNING

L	T	P	C
4	1	0	4

Course Objectives:

- To Learn about Machine Intelligence and Machine Learning applications
- To implement and apply machine learning algorithms to real-world applications.
- To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
- To understand how to perform evaluation of learning algorithms and model selection.

UNIT I : INTRODUCTION : Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **(15L)**

UNIT II: NEURAL NETWORKS AND GENETIC ALGORITHMS :Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning. **(15L)**

UNIT III: BAYESIAN AND COMPUTATIONAL LEARNING : Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **(15L)**

UNIT IV: INSTANT BASED LEARNING: K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. **(15L)**

UNIT V: ADVANCED LEARNING: Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **(15L)**

Course Outcome

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

1. Have a good understanding of the fundamental issues and challenges of machine learning
2. Appreciate the underlying mathematical relationships within and across Machine Learningalgorithms
3. Understand the paradigms of supervised and un-supervised learning.
4. Design and implement various machine learning applications

5. Analyze different machine learning models

CO - PO - PSO Mapping

MACHINE LEARNING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

TEXT BOOK

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

REFERENCES

1. EthemAlpaydin, “Introduction to Machine Learning” (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.
3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham, “Genetic Algorithms and Genetic Programming”, CRC Press, Taylor and Francis Group.

Core 9

SOFT COMPUTING

L	T	P	C
4	0	0	4

Course Objectives

1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
2. Introduce artificial neural networks and fuzzy theory from an engineering perspective.

UNIT I: Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability. (12L)

UNIT II: Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM - Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network. (12L)

UNIT III: Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification – Methods. (12L)

UNIT IV: Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems. (12L)

UNIT V: Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA. (12L)

Course Outcome:

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

1. Gain sound knowledge of Fuzzy Logic and Neural Networks
2. Apply fuzzy logic and reasoning to handle uncertainty
3. Apply Neural Network based algorithms to real world problems
4. Analyze Neuro-fuzzy system
5. Understand Genetic algorithm

CO - PO - PSO Mapping

SOFT COMPUTING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 4
CO 3	H	H	M	H	H	H	H	H	H	H	K – 5
CO 4	H	H	M	H	H	H	H	H	H	H	K – 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book

1. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007.

Reference Book

1. S. Rajasekaran, G.A.V. Pai, “Neural Networks, Fuzzy Logic, Genetic Algorithms”, Prentice Hall India, 2004.

Core 10

PATTERN RECOGNITION AND IMAGE ANALYSIS	L	T	P	C
	4	1	0	4

Course Objective:

To be familiar with processing of images, recognition of the pattern and their applications

Unit I: Introduction to Image Processing: Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing. **(15L)**

Unit II: Image Restoration: Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone image compression, block coding, run length coding, and contour coding. **(15L)**

Unit III: Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough transform, topological and texture analysis, shape matching. **(15L)**

Unit IV: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi square test. **(15L)**

Unit V: Statistical Pattern Recognition -Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods – Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM),Gaussian mixture models. **(15L)**

Course Outcome:

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

1. Get acquainted with image processing
2. Apply basic algorithms in image processing
3. Grasp basics of knowledge representation
4. Analyze the texture of images
5. Recognize patterns

CO – PO – PSO MAPPING

PATTERN RECOGNITION AND IMAGE ANALYSIS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 2
CO 3	H	H	M	H	H	H	H	H	H	H	K – 3
CO 4	H	H	M	H	H	H	H	H	H	H	K – 4
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

TEXT BOOKS

1. Digital Image Processing – Gonzalez and Wood, Addison Wesley, 1993.
2. Fundamental of Image Processing – Anil K. Jain, Prentice Hall of India.
3. Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006

REFERENCE BOOKS

1. Digital Picture Processing – Rosenfeld and Kak, vol.I & vol.II, Academic,1982
2. Computer Vision – Ballard and Brown, Prentice Hall, 1982
3. An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986
4. Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.
5. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

Core 11	COMPILER DESIGN	L	T	P	C
		4	0	0	4

Objectives

1. Discover principles, algorithms and techniques that can be used to construct various phases of compiler.
2. Acquire knowledge about finite automata and regular expressions
3. Learn context free grammars, compiler parsing techniques.
4. Explore knowledge about Syntax Directed definitions and translation scheme
5. Understand intermediate machine representations and actual code generation

Unit – I: Lexical analysis - Language Processors, The Structure of a Compiler, Parameter passing mechanism – Symbol table - The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens – Finite automata - Regular expression to automata. (12L)

Unit – II: Syntax Analysis - The role of the parser - Context-free grammars - Writing a grammar - Top down Parsing - Bottom-up Parsing - LR parsers- LALR parsers. (12L)

Unit – III: Semantic Analysis - Inherited and Synthesized attributes – Dependency graphs – Ordering the evaluation of attributes – S-attributed definitions – L-attributed definitions – Applications of Syntax Directed translation – Syntax Directed translations schemes - Storage organization – Stack allocation of space. (12L)

Unit – IV: Intermediate Code Generation - Variants of Syntax trees – Three Address code – Types and Declarations - Translation of Expressions – Type checking - Control flow - Back patching - Switch Statements - Procedure calls. (12L)

Unit – V: Code Generation and Code Optimization - Issues in design of code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization. (12L)

Course Outcome:

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

1. Understand various phases of a compiler
2. Appreciate the working of a parser
3. Explore the features of code generation and optimization techniques
4. Use Optimization Techniques
5. Design a compiler

CO - PO - PSO Mapping

COMPILER DESIGN											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers-Principles, Techniques and Tools”, Second Edition, Pearson Education Asia, 2009.

References

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers - Principles, Techniques and Tools, Addison- Wesley, 2003.
2. Fischer Leblanc, Crafting Compiler, Benjamin Cummings, Menlo Park, 1988.
3. Kennath C.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
4. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2001.
5. S.Godfrey Winster, S.Aruna Devi, R.Sujatha, “Compiler Design”, yesdee Publishers, Third Reprint 2019.

Elective 1 a

ANDROID PROGRAMMING	L	T	P	C
	4	0	0	3

Course Objective:

To learn the fundamentals of Android Programming using the Android SDK.

UNIT I: Getting Started with Android Programming: What is Android – Android versions – Features of Android –Android Architecture –Android devices in the market –The Android Market. Obtaining the required tools – Android Studio – Android SDK – Creating Android Virtual Devices – The Android Developer Community – Launching the first Android Application. Using Android Studio for Android Development - Exploring the IDE – Using Code completion – Debugging your application – Publishing your application. (12L)

UNIT II: Activities, Fragments and Intents : Understanding Activities - Applying Styles and Themes to an activity – Hiding the Activity title – Displaying a Dialog Window – Displaying a Progress Dialog. Linking Activities using Intents – Returning results from an intent – Passing data using an Intent Object. Fragments – Adding Fragments dynamically - Life cycle of a fragment – Interactions between fragments – Understanding the Intent object – Using intent filters. Displaying notifications. (12L)

UNIT III: Android User Interface: Understanding the components of a screen – View and view groups – Frame Layout – Linear Layout (Horizontal and Vertical) – Table layout – Relative layout –Frame layout – Scroll view. Adapting to Display Orientation – Anchoring views – Managing changes to screen orientation – Persisting State information during changes in configuration – Detecting orientation changes – Controlling the orientation of the Activity. Utilizing the Action Bar – Adding Action items to the Action Bar–Creating the user interface programmatically–Listening for user Notifications. (12L)

UNIT IV: Designing your User Interface with Views: Using Basic views –Textview view – Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views –ProgressBar View, AutoCompleteTextView View. Using Picker Views – TimePicker view – DatePicker View. Using List views to display long lists – ListView View – Using the Spinner view. Understanding Specified fragments – Using a list fragment – Using a Dialog fragment – Using a preference fragment. (12L)

UNIT V: Displaying Pictures and Menus with views: Using ImageViews to Display pictures –ImageView view – ImageSwitcher – GridView. Using Menus with Views – Creating the Helper Methods – Options Menu – Context Menu – Using WebView. Data Persistence: Saving and Loading User Preferences – Accessing preferences using an activity – Programmatically Retrieving and Modifying the Preferences Values. Persisting Data to Files – Saving to Internal Storage – Saving to External Storage – Choosing the best storage option. Creating and using Databases – Creating the DBAdapter Helper Class – Using the database programmatically. (12L)

Course Outcome:

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

1. Obtain hands-on experience in developing basic and advanced Android apps.
2. Develop multiple activities and indent in mobile applications
3. Understand Fragments of mobile application development
4. Develop mobile application with user interface
5. Display pictures and menus

CO - PO - PSO Mapping

ANDROID PROGRAMMING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book:

J.F. DiMarzio, “Beginning Android Programming with Android Studio”, Wrox Publications

Reference Books:

1. Beginning Android Programming with Android Studio, Roger Deutsch

2. Android Programming: Mastering Course for Beginners - Quick Start to Develop Your Own App (Android studio, Android Development, App Development . Updated to Android 6 Platform, Mitchell Schuler)

Elective 1 b

OPTIMIZATION TECHNIQUES

L	T	P	C
4	0	0	3

Objective

1. To understand the concept of optimization
2. To develop mathematical model of real life cases
3. To study Optimization algorithms

Unit – I: Linear Programming Problem (LPP): Formulations and graphical solution of two variables- canonical and standard terms of linear programming problem. Simplex method, Two phase simplex (12L)

Unit – II: Duality in LPP- dual problem to primal- primal to dual problem-dual simplex method-Revised simplex method-Integer programming problem (12L)

Unit – III: Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. Determining Net evaluation-Degeneracy in TP
Assignment Model: Hungarian assignment model – Travelling salesman problem. (12L)

Unit – IV: Replacement Problem: Replacement policy for equipment that deteriorate gradually, Replacement of item that fail suddenly-Individual and group replacement, Problems in mortality and staffing. (12L)

Unit – V: Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity – PERT Computation – CPM Computation – Resource Scheduling. (12L)

Course Outcome:

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

1. Formulate and solve Linear Programming Problems.
2. Examine the Two Phase method
3. Analyze the usage of Integer Programming Problem.
4. Evaluate the Sequencing Problems and Queueing Models.
5. Apply PERT and CPM techniques to find the optimal solution.

CO - PO - PSO Mapping

OPTIMIZATION TECHNIQUES											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Textbooks

1. KantiSwarup, P.K. Gupta & Manmohan, “Operations Research”, Sultan Chand & Sons. 1996.
2. S.Kalavathy, “Operations Research”, Second Edition – Vikas Publishing House Pvt.Ltd.,

References

1. P. K. Gupta & Manmohan. Problems in Operations Research: Methods and Solutions Sultan Chand & Sons

Elective 1 c **AUGMENTED REALITY**

L	T	P	C
4	0	0	3

Unit I: Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR ,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

VR Systems: VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays. (14L)

Unit II: Stereoscopic Vision & Haptic rendering: Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images. (10L)

Unit III: VR software development: Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available SDK to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR). (12L)

Unit IV: 3D interaction techniques: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation. (12L)

Unit V: AR software development: AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit. Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR. (12L)

Course Outcome:

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

1. Design, create, and integrate audio, visual, and interactive elements into a comprehensive experience.
2. Develop content for successful delivery across multiple platforms.
3. Discuss the benefits, challenges and misconceptions involved with working in AR and VR.
4. Evaluate various interaction schemes common to AR/VR experiences.
5. Use immersive effects of visual and audio assets to AR/VR experiences.

CO - PO - PSO Mapping

AUGMENTED REALITY											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Books:

1.George Mather, Foundations of Sensation and Perception:Psychology Press; 2nd edition 2009.

2. The VR Book: Human-Centered Design for Virtual Reality, by Jason Jerald

3. Learning Virtual Reality by Tony Parisi, O' Reilly

4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-EEE Press, 2003/2006.

5.Alan B. Craig, "Understanding Augmented Reality, Concepts & Applications", Morgan Kaufmann, 2013

e-Resources: • http://msl.cs.uiuc.edu/vr/

REFERENCE BOOKS:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

Elective 1 d

DATABASE MANAGEMENT SYSTEMS	L	T	P	C
	4	0	0	3

Objective

Acquire Knowledge of Database Models, Applications of Database Models and Emerging Trends

Unit-I: Relational and parallel Database Design: Basics, Entity Types, Relationship Types, ER Model, ER-to-Relational Mapping algorithm. Normalization: Functional Dependency, 1NF, 2NF, 3NF, BCNF,4NF and 5NF. Architecture, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism. (12L)

Unit-II: Distributed & Object based Databases: Architecture, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control, Query Processing. Complex Data Types, Structured Types and Inheritance, Table Inheritance, array & Multiset, Object Identity & Reference Types, Object Oriented Vs Object Relational. (12L)

Unit-III: Spatial Database: Spatial Database Characteristics, Spatial Data Model, Spatial Database Queries, Techniques of Spatial Database Query, Logic based Databases: Introduction, Overview, Propositional Calculus, Predicate Calculus, Deductive Database Systems, Recursive Query Processing. (12L)

Unit-IV: XML Databases: XML Hierarchical data model, XML Documents, DTD, XML Schema, XML Querying, XHTML, Illustrative Experiments. (12L)

Unit-V: Temporal Databases: Introduction, Intervals, Packing and Unpacking Relations, Generalizing the relational Operators, Database Design, Integrity Constraints, Multimedia Databases: Multimedia Sources, Multimedia Database Queries, Multimedia Database Applications. (12L)

Course Outcome:

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

1. Acquire Knowledge of Database Models and Emerging Trends
2. Understand the concepts behind the relational database management system
3. Know about the Various Data models and Work on Database Architecture
4. Analyze Knowledge patterns and Object Oriented Databases
5. Understand the database activities such as recovery, administration, backup

CO - PO - PSO Mapping

DATABASE MANAGEMENT SYSTEM											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Book

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Comcepts”, 6th edition , McGraw-Hill International Edition , 2011

2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education Reprint 2016.

Reference Books

1. Ramez Elmasri, Shamkant B Navathe, “Fundamental of Database Systems”, Pearson, 7th edition 2016.

2. Thomas Connolly, Carolyn Begg., “Database Systems a practical approach to Design , Implementation and Management “, Pearson Education, 2014.

Core 12 Practical 3

MACHINE LEARNING LAB WITH R & HADOOP

L	T	P	C
0	0	4	2

Course Objectives:

1. To apply the concepts of Machine Learning to solve real-world problems
2. To implement basic algorithms in clustering & classification applied to text & numericdata
3. To implement algorithms emphasizing the importance of bagging & boosting classification & regression
4. To implement algorithms related to dimensionality reduction
5. To apply machine learning algorithms for Natural Language Processing applications

LIST OF EXERCISES

1. Solving Regression using Decision Trees
2. Solving Classification using Decision Trees
3. Root Node Attribute Selection for Decision Trees using Information Gain
4. Bayesian Inference in Gene Expression Analysis
5. Pattern Recognition Application using Bayesian Inference
6. Bagging in Classification
7. Bagging, Boosting applications using Regression Trees
8. Data & Text Classification using Neural Networks
9. Use Weka tool for SVM classification for chosen domain application
10. Data & Text Clustering using K-means algorithm
11. Data & Text Clustering using Gaussian Mixture Models
12. Dimensionality Reduction Algorithms in Image Processing applications

Course Outcome:

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

1. Implement machine learning algorithms related to numeric data
2. Apply machine learning algorithms for text data
3. Use dimensionality reduction algorithms for image processing applications
4. Distinguish Clustering and Classification
5. Apply CRFs in Natural Language Processing

CO – PO – PSO MAPPING

MACHINE LEARNING LAB WITH PYTHON/ R & HADOOP											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 2
CO 2	H	H	M	H	H	H	H	H	H	H	K - 1
CO 3	H	H	M	H	H	H	H	H	H	H	K - 4
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Core 13 Practical 4 **IMAGE PROCESSING LAB**

L	T	P	C
0	0	4	2

LIST OF EXERCISES

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
3. Display FFT (1-D & 2-D) of an image.
4. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
5. Implementation of image sharpening filters
6. Edge Detection and segmentation using Gradient operators.
7. Image Compression by DCT, HUFFMAN coding
8. Image morphology – Dilation and Erosion
9. Implement SVM classifier
10. Implement Expectation Maximization Algorithm

Course Outcome:

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

1. Acquire complete knowledge on Image Processing & Pattern Recognition.
2. Review the fundamental concepts of a digital image processing system
3. Analyze images in the frequency domain using various transforms.
4. Evaluate the techniques for image enhancement and image restoration.
5. Interpret image segmentation and representation techniques.

CO - PO - PSO Mapping

IMAGE PROCESSING LAB											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	M	H	K - 4
CO 3	H	H	M	H	H	H	M	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	M	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	M	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Core 14

NATURAL LANGUAGE PROCESSING

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the algorithms available for the processing of linguistic information
2. To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.

UNIT-I: Introduction to NLP: NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English. (12L)

UNIT-II: Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model Case study: application of neural language model in NLP system development. (12L)

UNIT-III: Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tag set; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model. (12L)

UNIT-IV: Parsing Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs. (12L)

UNIT-V: Semantics Vector Semantics; Words & Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embedding from prediction: Skip-gram and CBOW; Concept of Word Sense; WordNet (12L)

Course Outcome:

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

1. Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
2. Discover various linguistics relevant to NLP tasks
3. Identify statistical features relevant to NLP tasks
4. Analyze parsing in NLP
5. Develop systems for various NLP problems with moderate complexity.

CO - PO - PSO Mapping

NATURAL LANGUAGE PROCESSING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 3
CO 3	H	H	M	H	H	H	H	H	H	H	K – 5
CO 4	H	H	M	H	H	H	H	H	H	H	K – 2
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text book:

Jurafsky Dan and Martin James H. “Speech and Language Processing”, 3rd Edition, 2018.

Reference books:

1. Jurafsky D. and Martin J. H., “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.

2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.

Core 15		L	T	P	C
	INTERNET OF THINGS	**4**	**0**	**0**	**4**

Course Objective:

1. To gain knowledge on the basics of Internet of Things (IoT), IoT Architecture, and the Protocols of IoT;
2. To understand the concept of the Web of Things and the relationship between the IoT and WoT.

UNIT I: INTRODUCTION to IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels and Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology. (12L)

UNIT II: IoT ARCHITECTURE: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture (12L)

UNIT III: IoT PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security (12L)

UNIT IV: WEB OF THINGS: Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOAP and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The C o T Architecture. (12L)

UNIT V: APPLICATIONS: The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging (12L)

Course Outcome:

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

1. Gain the basic knowledge about IoT
2. Understand the Protocols of IoT
3. Use IoT related products in real life.
4. Rely less on physical resources
5. Do their work smarter.

CO - PO - PSO Mapping

INTERNET OF THINGS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Books

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Core 16

NETWORK SECURITY & CRYPTOGRAPHY

L	T	P	C
4	0	0	4

Objectives

1. To understand Cryptography Theories, Algorithms and Systems.
2. To build protection mechanisms in order to secure computer networks.
3. To know about the malicious software & firewalls.

Unit I: Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis. (12L)

Unit II: Symmetric Encryption and Message Confidentiality - Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management. (12L)

Unit III: Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME. (12L)

Unit IV: IP Security - IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3. (12L)

Unit V: Intruders - Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation. (12L)

Course Outcome:

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

1. Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
2. Apply the different cryptographic operations of symmetric cryptographic algorithms
3. Apply the different cryptographic operations of public key cryptography
4. Apply the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards

CO - PO - PSO Mapping

NETWORK SECURITY & CRYPTOGRAPHY											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text books
1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007, Reprint 2015.
2. Stallings William, “Cryptography and Network Security - Principles and Practice”, 2017.
3. William Stallings, “Network Security Essentials Applications and Standards”, Third Edition, Pearson Education, 2008.

References
1. Man Young Rhee, “Internet Security: Cryptographic Principles, Algorithms and Protocols”, Wiley Publications, 2003.
2. Charles Pfleeger, “Security In Computing”, 4th Edition, Prentice Hall of India, 2006.
3. Uyless Black, “Internet Security Protocols”, Pearson Education Asia, 2000.
4. Charlie Kaufman, Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication In Public World”, PHI 2002.
5. Bruce Schneier and Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson “Cryptography – Theory and Practice”, First Edition, CRC Press, 1995.

Core 17	RESEARCH METHODOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES
- To enable the students to know about the information needs of the research domain
- To introduce the concept of scientific research and the methods of conducting scientific enquiry

UNIT – I INTRODUCTION TO RESEARCH (13L)

Research Methodology : Introduction -– Objectives of Research – Types of Research – Research approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific method – Research process – Criteria of good Research – Problems encountered by Researchers in India. Defining the Research problem : What is a Research problem - Selecting the Problem – Techniques involved in defining a problem.

UNIT – II RESEARCH AND SAMPLE DESIGN (11L)
Research design: Meaning of research design – Need for Research Design - Features of Good Design – Important concepts relating to Research design – Different Research designs – Basic Principles of Experimental Designs – Important Experimental designs – Informal Experimental designs – Formal Experimental designs. Design of sample surveys: Sample design - Types of sampling designs – Non probability sampling – Probability sampling.

UNIT – III SCALING, DATA COLLECTION (13L)
Measurements and scaling: Quantitative and qualitative data – Classifications of measurement scales – Goodness of measurement scales –Sources of error in measurement – Scaling – Scale classification bases – Scaling techniques – Comparative Scaling Techniques – Non- Comparative Scaling Techniques.
Data Collection : Collection of Primary Data –– Observation Method – Interview method – Collection of data through Questionnaires – Collection of data through Schedules – Difference between Questionnaire and schedule – Guidelines for constructing Questionnaire/schedule – Some other methods of data collection – Collection of secondary data – Selection of Appropriate method for data collection

UNIT – IV ANOVA (12L)
Data Preparation : Data preparation process – Questionnaire checking – Editing – coding – classification – tabulation – Graphical representation – Data cleaning – Data adjusting – Some problems in preparation process – Types of analysis – Statistics in research. Analysis of variance: The ANOVA technique – One way ANOVA – Two way ANOVA

UNIT – V REPORT WRITING, ALGORITHMIC RESEARCH (11 L)
Interpretation and Report Writing: Meaning of interpretation –Technique of interpretation – Precaution in Interpretation – Significance of Report Writing – Different Steps in Writing Report – Layout of the Research Report – Types of Reports – Mechanics of Writing a Research Report.
Algorithmic Research : Algorithmic Research Problems – Types of Solution Procedure/ Algorithm – Steps of Development of Algorithm – Comparison– Computer and Researchers.

Course Outcome:

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

1. Get a view of how to choose research problem
2. Able to design the research and samples
3. Explore the features of data collection and data preparation
4. Analyze data
5. Generate report

CO - PO - PSO Mapping

RESEARCH METHODOLOGY											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 4
CO 3	H	M	M	H	H	H	M	H	H	H	K – 5
CO 4	H	H	M	H	H	H	H	M	H	H	K – 3
CO 5	H	H	M	H	H	H	H	H	M	M	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

REFERENCES

1. C.R.Kothari, “Research Methodology, Methods and Techniques”, Third edition, New Age
International Publishers, 2010.
2. R.Panneerselvam, “Research Methodology”, PHI, 2009.
3. D.K.Bhattacharya, “Research Methodology”, First Edition, EBP, 2003.

Elective 2 a **DEEP LEARNING**

L	T	P	C
4	0	0	3

Course Objective

1. To introduce the fundamental techniques and principles of Neural Networks

2. To familiarize fundamental concepts in Deep Learning

Unit I: Introduction to Neural Networks – Introduction – Basic Architecture of Neural Networks – Training and Neural Network with Backpropagation – Practical Issues in Neural Network Training – The Secrets to the Power of Function Composition – Common Neural Architectures – Advanced Topics. (12L)

Unit II: Machine Learning with Shallow Neural Networks: Introduction – Neural Architectures for Binary Classification Models – Neural Architectures for Multiclass models – Back propagated saliency for Feature Selection – Matrix Factorization with Auto encoders – Simple Neural Architectures for Graph Embedding. (12L)

Unit III: Training Deep Neural Networks: Introduction – Backpropagation – Setup and Initialization issues – The vanishing and exploding gradient problems – Gradient Descent Strategies' – Batch Normalization – Teaching Deep Learners to Generalize: Introduction – The Bias-Variance trade-off – Generalization issues in model tuning and evaluation – Penalty based regularization – Ensemble methods – Early Stopping – Unsupervised pre-training – Continuation and Curriculum learning – Parameter sharing – Regularization in Unsupervised Applications. (12L)

Unit IV: Recurrent Neural Networks: Introduction – Architecture of Recurrent Neural Networks – The challenges of training recurrent Networks – Echo-State Networks – Long Short-Term memory – Gated Recurrent Units – Applications of Recurrent Neural Networks.

Convolutional Neural Networks: Introduction – The Basic Structure of a Convolutional Network – Training a convolutional network – Case studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Convolutional networks. (14L)

Unit V: Deep Reinforcement Learning: Introduction – Stateless Algorithms – The basic framework of Reinforcement Learning – Bootstrapping for value function learning – Policy Gradient Methods – Monte Carlo Tree Search – Case Studies – Practical Challenges associated with safety. (10L)

Advanced Topics associated with Deep Learning: Generative Adversarial Networks (GAN) – Competitive Learning – Limitations of Neural Networks.

Course Outcome:

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

1. Become familiar with the fundamental concepts in Deep Learning

2. Explore the use of Deep Learning technology
3. Apply Deep Learning technology in computer vision, speech analysis, healthcare, agriculture, and understanding climate change
4. Analyze Deep Reinforcement Learning
5. Evaluate the Practical Challenges in Deep Learning

CO – PO – PSO MAPPING

DEEP LEARNING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 2
CO 2	H	H	M	H	H	H	H	H	H	H	K – 1
CO 3	H	H	M	H	H	H	H	H	H	H	K – 3
CO 4	H	H	M	H	H	H	H	H	H	H	K – 5
CO 5	H	H	M	H	H	H	H	H	H	H	K – 4

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Textbook

Charu C. Aggarwal, Neural Netwoks and Deep Learning, Springer 2018

Reference books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, The MIT Press, 2016
2. Francois Chollet, Deep Learning with Python, Manning Publications Co, 2018
3. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach 1st Edition, O'Reilly' 2017.

Elective 2 b

L	T	P	C
4	0	0	3

ROBOTICS

Course Objectives:

1. To understand the functions of the basic components of a Robot
2. To study the use of various types of End Effectors and Sensors
3. To impart knowledge in Robot Kinematics and Programming

UNIT I: Fundamentals of Robot: Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications- Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load Robot Parts and their Functions-Need for Robots-Different Applications. (12L)

UNIT II: Robot Drive Systems And End Effectors**:** Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives- D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers- Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations. (12L)

UNIT III: Sensors And Machine Vision: Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation. (12L)

UNIT IV: Robot Kinematics And Robot Programming: Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs. (12L)

UNIT V: Implementation and Robot Economics: RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots. (12L)

Course Outcome:

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

1. Understand the functions of the basic components of a Robot
2. Analyze the use of various types of End Effectors and Sensors
3. Gain knowledge in Robot Kinematics and Programming
4. Ascertain Safety Considerations for Robot Operations
5. Determine the feasibility of implementing a Robot

CO – PO – PSO MAPPING

ROBOTICS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 2
CO 3	H	H	M	H	H	H	H	H	H	H	K - 4
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2019.
2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGrawHill, 2018.

REFERENCE BOOKS:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2017.
2. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 2019.
3. Fu.K.S., Gonzalez R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., .2017
4. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 2015.

Elective 2 c

MOBILE COMPUTING

Objectives

L	T	P	C
4	0	0	3

1. Understand the basic concepts of mobile
2. Be familiar with GPRS Technology
3. Be exposed to Ad-Hoc networks
4. Gain knowledge about different mobile platforms and application development

Unit 1
Basics of mobile - Mobile device profiles - Middleware and gateways - Wireless Internet - Smart clients - Three-tier Architecture- Design considerations for mobile computing-– Mobility and Location based services. (12L)

Unit -2
Mobile computing through Internet - Mobile-enabled Applications - Developing Mobile GUIs – VUIs and Mobile Applications – Characteristics and benefits -Multichannel and Multi modal user interfaces – Synchronization and replication of Mobile Data - SMS architecture – GPRS – Mobile Computing through Telephony. (12L)

Unit -3
Mobile Application Development - Android- wi-fi –GPS – Camera – Movement – orientation - event based programming – iOS/ windows CE - Blackberry – windows phone – MCommerce- structure – pros & cons Mobile payment system - J2ME (12L)

Unit -4
ADHOC Wireless Network - Ad Hoc Wireless Network –MAC protocol – Routing protocols - Transport Layer Protocol - QoS – Energy Management – application design – work flow – composing applications – Dynamic linking – Intents and Services – Communication via the web. (12L)

Unit -5
Security and Hacking - Password security – Network security – web security – Database security - Wireless Sensor Network - Architecture and Design – Medium Access Control – Routing – Transport Layer – Energy model. (12L)

Course Outcome:
On successful completion of the course, the learners will be able to

1. Able to explain the basics of mobile system
2. Able to develop mobile application
3. Understand the Mobile Adhoc networks
4. Analyze routing of Mobile Adhoc networks
5. Understand the different types of security features

CO - PO - PSO Mapping

MOBILE COMPUTING											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 4
CO 3	H	H	M	H	H	H	H	H	H	H	K – 5
CO 4	H	H	M	H	H	H	H	H	H	H	K – 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Books

1. Jochen Schiller, Mobile Communications, Second Edition, 2012.
2. William Stallings,"Wireless Communications & Networks", Pearson Education, 2009.

References

1. C.Siva Ram Murthy, B.S. Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", 2nd Edition, Pearson Education. 2004
2. Ashok K Talukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill, 2005.
3. Jochen Burkhardt Dr.Horst Henn, Klaus Rintdoff,Thomas Schack, "Pervasive Computing", Pearson, 2009.
4. Fei Hu , Xiaojun Cao, " Wireless Sensor Networks Principles and Practice " CRC Press, 2010.

Elective 2 d

DISTRIBUTED OPERATING SYSTEM

L	T	P	C
4	0	0	3

Objectives

1. To study Distributed operating system concepts
2. To understand hardware, software and communication in distributed OS
3. To learn the distributed resource management components.
4. Practices to learn concepts of OS and Program the principles of Operating Systems

UNIT I

Introduction – Operating System Definition – Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem – Process Deadlock – Models of Deadlock – Conditions for Deadlock – System with single-unit requests, Consumable Resources, Reusable Resources. (12L)

UNIT II

Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Lamport's Logical Clock , Vector Clock, Global State , Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement Protocols (12L)

UNIT III

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols –Issues – Distributed Scheduling – Issues – Components – Algorithms. (12L)

UNIT IV

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – Two-Phase and Non-blocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols. (12L)

UNIT V

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems – concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems. (12L)

Course Outcome:

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

1. Gain clear understanding on several resource management techniques
2. Understand distributed shared memory
3. Gain knowledge on mutual exclusion and Deadlock detection of Distributed operating system.
4. Design and implement algorithms of distributed shared memory and commit protocols

5. Implement fault tolerant distributed systems.

CO - PO - PSO Mapping

DISTIBUTED OPERATING SYSTEM											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 4
CO 3	H	H	M	H	H	H	H	H	H	H	K - 5
CO 4	H	H	M	H	H	H	H	H	H	H	K - 3
CO 5	H	H	M	H	H	H	H	H	H	H	K – 5

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

Text Books

1. Mukesh Singhal, N.G .Shivaratri, “Advanced Concepts in Operating Systems”, McGraw Hill 2000.
2. Distributed Operating System – Andrew S. Tanenbaum, PHI.

Reference Books

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, “Operating Concepts”, 6th Edition Addison Wesley publications 2003.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, 2nd Edition Addison Wesley 2001

Core 18 Practical 5 **NATURAL LANGUAGE PROCESSING LAB**

Course Objective:

To familiarize the students with practical aspects of natural language processing.

1. Tokenizing Text and WordNet basics: Tokenizing text into sentences, Tokenizing sentences into words, Tokenizing sentences using regular expressions, Filtering stop words in a tokenized sentence, Looking up SynSets for a word in WordNet, Looking up lemmas and synonyms in WordNet, Calculating WordNet SynSet similarity, Discovering word collocations.

2. Replacing and correcting words: Stemming words, Lemmatizing words with WordNet, Translating text with Babelfish, Replacing words matching regular expressions, Removing repeating characters, Spelling correction with Enchant, Replacing synonyms, Replacing negations with antonyms.

3. Creating Custom Corpora : Setting up a custom corpus, Creating a word list corpus, Creating a part of speech tagged word corpus, Creating a chunked phrase corpus, Creating a categorized text corpus, Creating a categorized chunk corpus reader, Lazy corpus loading, Creating a custom corpus view, Creating a MongoDB backed corpus reader, Corpus editing with file locking.

4. Parts-of -Speech Tagging: Training a unigram part-of-speech tagger, Combining taggers with Backoff tagging, Training and combining Ngram taggers, Creating a model of likely word tags, Tagging with regular expressions, Affix tagging, Training a Brill tagger, Training the TnT tagger Using WordNet for tagging, Tagging proper names, Classifier based tagging.

5. Extracting Chunks : Chunking and chinking with regular expressions, Merging and splitting chunks with regular expressions, Expanding and removing chunks with regular expressions, Partial parsing with regular expressions, Training a tagger-based chunker, Classification-based chunking, extracting named entities, Extracting proper noun chunks, Extracting location chunks, Training a named entity chunker.

6. Transforming Chunks and Trees: Filtering insignificant words, Correcting verb forms, Swapping verb phrases, Swapping noun cardinals, Swapping infinitive phrases, Singularizing plural nouns, Chaining chunk transformations, Converting a chunk tree to text, Flattening a deep tree, Creating a shallow tree, Converting tree nodes.

7. Parsing Specific Data: Parsing dates and times with Dateutil, Time zone lookup and conversion, Tagging temporal expressions with Timex, Extracting URLs from HTML with lxml, Cleaning and stripping HTML, Converting HTML entities with Beautiful Soup.

Course Outcome:

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

1. Implement common NLP tasks using Python and Natural Language Toolkit, NLTK
2. Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
3. Discover various linguistics relevant to NLP tasks
4. Analyze parsing in NLP
5. Develop systems for various NLP problems with moderate complexity.

CO – PO - PSO MAPPING

NATURAL LANGUAGE PROCESSING LAB											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 1
CO 2	H	H	M	H	H	H	H	H	H	H	K – 3
CO 3	H	H	M	H	H	H	H	H	H	H	K – 5
CO 4	H	H	M	H	H	H	H	H	H	H	K – 4
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

References

1. Python Text processing with NLTK 2.0 Cookbook , Jacob Perkins, PACKT Publishing

2. Natural Language Processing with Python, Steven Bird, Ewan Klein, and Edward Loper, O' Reilly

Core 19	MINI PROJECT	L	T	P	C
		0	0	6	6

1. Each student has to undergo an individual project in the Institution
2. Project Supervisor shall be allocated for each student.

Course Outcome:

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

1. Develop a model to achieve the project's goal
2. Demonstrate sound technical knowledge of the selected project topic.
3. Undertake problem identification, formulation and solution.
4. Design solutions to complex problems utilising a systematic approach
5. Appreciate the steps involved in Software development process

CO – PO - PSO MAPPING

MINI PROJECT											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 2
CO 3	H	H	M	H	H	H	H	H	H	H	K - 3
CO 4	H	H	M	H	H	H	H	H	H	H	K - 5
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L

SEMESTER VI

Core 20

L	T	P	C
0	0	30	16

MAJOR PROJECT

1. Each student has to undergo an individual project either in the Institution or in a reputed industry
2. Internal Project Supervisor shall be allocated for each student in the Institution.

Course Outcome:

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

1. Develop a model to achieve the project's goal
2. Demonstrate sound technical knowledge of the selected project topic.
3. Undertake problem identification, formulation and solution.
4. Design solutions to complex problems utilising a systematic approach
5. Appreciate the steps involved in Software development process

CO – PO - PSO MAPPING

MAJOR PROJECT											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K – 4
CO 2	H	H	M	H	H	H	H	H	H	H	K – 5
CO 3	H	H	M	H	H	H	H	H	H	H	K – 6
CO 4	H	H	M	H	H	H	H	H	H	H	K – 1
CO 5	H	H	M	H	H	H	H	H	H	H	K – 6

Strongly Correlated – H, Moderately Correlated – M, Weekly Correlated - L