LALAGAPPA UNIVERSITY

(A State University Accredited with A+ Grade By NAAC(CGPA:3.64) in the Third Cycle and Graded as Category-I University By MHRD-UGC)

Karaikudi – 630003.

Tamil Nadu.

DIRECTORATE OF DISTANCE EDUCATION

PROGRAMME PROJECT REPORT

for

DIPLOMA IN

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(from Calendar Year 2021)

DECEMBER 2020

Table of contents

Diploma in Artificial Intelligence and Machine Learning
Credit Based Curriculum and Evaluation System

ALAGAPPA UNIVERSITY, KARAIKUDI

DIRECTORATE OF DISTANCE EDUCATION

DIPLOMA IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Credit Based Curriculum Evaluation System (CBCS)
(With effect from Calendar Year 2021 Onwards)

(a) Programme's Mission and Objectives

Mission

Mission is to impart excellent career opportunities in various industries including software development companies in the areas of Decision making, Data analysis, design AI models, implement ML algorithms in real-world applications,supports, game programmingetc.

Programme Objectives:

- ✓ Discover, investigate the requirements of aAI/ML problem and find the solution to them using computing principles.
- ✓ Create and evaluate a computer-basedAI/ML model, components and process to meet the specific needs of applications.
- ✓ Utilize current techniques and tools necessary for AI/ML practices.
- ✓ Develop and integrate effectively AI/ML based components into user environment.
- ✓ Identify the need and develop the skill to employ in learning as a data analyst, big data analyst professional.
- ✓ Execute effectively in a team environment to achieve a common goal.
- ✓ Classify opportunities and use innovative ideas to create value and wealth for the betterment of the individual and society.
- ✓ Proficiency in developing application with required domain knowledge.

Programme Outcome:

- ✓ To support learner's capability to set up their own enterprise in Artificial Intelligence and Machine Learning.
- ✓ Create AI/ML solutions for various business problems.
- ✓ Build and deploy production grade AI/ML applications.
- ✓ Apply AI/ML methods, techniques and tools immediately.
- ✓ To improve the knowledge of the learners in finding solutions and developing Machine learning models for real time problems in various domains involving technical, managerial, economical & social constraints
- ✓ To develop in problem solving and programming skills in the various fields of data analysis.
- ✓ To prepare the learners to pursue higher studies in computing or related disciplines and to work in the fields of business, teaching and research.
- ✓ To gain experience of doing independent study and research.

(b) Relevance of the program with HEI's and Alagappa University Mission and Goals

This programme is aligned with HEI's and Alagappa University mission and goals to be offered through distance mode to reach quality higher education to the unreachable and/or rural learners. Higher education in Computer Science offered through distance mode meets the mission of HEI's like digital India and e-cash transaction will enrich the Human resources for the uplift of the nation.

(c) Nature of prospective target group of learners

The nature of prospective target group of learners is graduates from various disciplines like Commerce, Mathematics, Physics, Chemistry, Biology, Electronics, and Engineering etc. It also includes the learners who want to become entrepreneurs like Data Analyst, Data Science professionals, Software Developers, Big Data Analyst, BPO's, KPO's etc.,

(d) Appropriateness of programme to be conducted in Open and Distance Learning mode to acquire specific skills and competence;

Diploma Programme in Artificial Intelligence and Machine Learning Programme through Distance Learning mode is developed in order to give subject-specific skills including i) Knowledge about various kinds of programming languages like R programming and Python Programming ii) Artificial intelligence fundamentals, Relational Database Management System(RDBMS), Machine learning Algorithms iii) Soft computing techniques include fuzzy logic, Neural Networks and Genetic algorithms iv) Data analysis Software tools like Matlab, Weka, Tangara, keyras and Tensorflow.

(e) Instructional Design

e.1 Revisions of Regulation and Curriculum Design

1. The University reserves the right to amend or change the regulations, schemes of examinations and syllabi from time to time based on recent market dynamics, industrial developments, research and feedback from stakeholders and learners.
2. Each student should secure 16 credits to complete Diploma in AI&ML programme.
3. Each theory and practical course carries 2 credits with 75 marks in the University End Semester Examination (ESE) and 25 marks in the Continuous Internal Assessment (CIA).

Programme code

Diploma in Artificial Intelligence and Machine Learning	---

Diploma in Artificial Intelligence and Machine Learning
Credit Based Curriculum and Evaluation System

Course of Study and Scheme of Examinations

S.No	Course code	Name of the Course	CIA Marks Max.	ESE Marks Max.	Total Marks Max.	C Max.	Hrs
1	51811	Fundamentals of Artificial Intelligence	25	75	100	2	6
2	51812	Relational Database Management System (RDBMS)	25	75	100	2	6
3	51813	R Programming	25	75	100	2	6
4	51814	RProgramming Lab	25	75	100	2	60
		TOTAL	**100**	**300**	**400**	**8**	**78**
		Semester II					
5	51821	Fundamentals of Machine Learning	25	75	100	2	6
6	51822	Principles of Soft Computing	25	75	100	2	6
7	51823	Python Programming	25	75	100	2	6
8	51824	Machine Learning using Python Lab	25	75	100	2	60
		TOTAL	**100**	**300**	**400**	**8**	**78**
GRAND TOTAL			**200**	**600**	**800**	**16**	**156**

CIA : Continuous Internal Assessment **ESE :** End semester Examination **Max**. Maximum Marks; **C :** Credits**Hrs**: Hours

Course Code Legend:

X	Y	Z	S	C

XYZ – Programme code for DAI&ML
S -- Semester Number; C – Course Number in the Semester

No,of Credits perCourse(Theory& Practical):2

Total No.of creditsperSemester:8

Total No.of credits oftheprogramme: 8 * 2 =16

e.2 Detailed Syllabi

The detailed Syllabi of study and shall be as shown in Appendix.

e.3 Duration of the Programme:

The Diploma in Artificial Intelligence and Machine Learning programme shall consist of a period of one year (Two Semesters).

e.3.1 Medium of Instruction

The medium of instruction is only in **English**.
The course material is also in **English.**

e.4 Faculty and Support Staff Requirements:

The following faculty and support staff is required for this programme.

Staff Category	Required
Core Faculty	4
Laboratory Assistant	1
Clerical Assistant	1

*Faculty at least in Assistant Professor level

e.5 Instructional Delivery mechanisms

The instructional delivery mechanisms of the programme includes SLM- Study materials, Lab instruction manual, Personal contact session for both theory and practical courses of the programme, e-version of the course materials in the form of Video Lectures, e-book, e-tutorials, Webinars, Massive Open Online Courses (MOOC) Courses, Open Educational Resources(OER) and Virtual lab.

e.6 Identification of media

The printed version of SLM – study material shall be given to the learners in addition to MOOC, e-tutorial and Virtual lab.

e.7 Student Support Services

The student support services will be facilitated by the Directorate of Distance Education, Alagappa University, Karaikudi and its approved learning centres located in various parts of Tamilnadu.

The pre-admission student support services like counseling about the programme including curriculum design, mode of delivery, fee structure and evaluation methods will be explained by the staff at Directorate of Distance Education or Learning centres. The post-admission student support services like issuing Identity card, study materials will be provided thru Directorate or Learning centres. The face to face contact sessions of the programme for both theory and practical's will be held at the Directorate or Learning centres. The student support regarding the conduct of examinations, evaluations, publication of results and certificates done by the Office of the Controller of Examinations, Alagappa University, Karaikudi.

(f) Procedure for Admissions, curriculum transaction and evaluation

f.1 Minimum qualification for admission

Candidates for admission to the Diploma in Artificial Intelligence and Machine Learningprogramme shall be required to have passed the following examinations.

Candidates seeking admission to the certificate programme shall be required to have passed H.Sc or (10+2/10+3) of any Recognized institution or authority accepted by the Syndicate of the Alagappa University as equivalent thereto shall be eligible.

f.2 Curriculum transaction

- The face to face contact sessions in class room teaching with the support of SLM, Power Point Presentations, web based tools, audio and animated videos.
- The practical classes are based on the respective subject study materials containing requirement for the laboratory experiments.
- Face to face contact sessions will be conducted for both theory and practical courses in the following manner.

Course Type	**Face to facecontact session per semester(in Hours)**
Theory courses (3 Courses – 6 Hrs/course)	18
Practical course(1 Course – 60 Hrs/course	60
Total	**78**

f.3 Evaluation

There shall be two types of evaluation systems; Continuous internal assessment and end semester examination will be conducted by the University according to the following scheme. The internal assessment for both theory and practical's is maximum of 25 marks for each course. The end semester examination for theory and practicalis maximum of 75 marks for each course. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination.

Internal assessment

- Internal assessment of theory courses is through class test, home assignment with workbook, case studies, review questions, quiz, multiple choice questions for 25 marks.
- The internal assessment for the practical courses shall be through home assignment which includes model practical test with workbook designing algorithm, preparing source code, PL/SQL coding for 25 marks.
- Student should submit assignment for theory and practicalcourses of everycourse and semester.

Division of Internal Marks (Assignment)

Theory		Practical	
Assignment	**Marks**	**Assignment**	**Marks**
Class Test, Long and short answer questions, Workbook, case studies,quiz, Multiple Choice Questions(MCQ)	25	Model Practical Test : Algorithm Design,System design diagrams,Workbook for preparing source code, PL/SQL coding , results	25
TOTAL	**25**	**TOTAL**	**25**

End Semester Examination (ESE)

The university end Semester Examinations shall be of three hours duration with maximum of 75 Marks for both theory and practical courses.

f.3.1 Minimum for a pass:

To pass in each course, a candidate is required to secure 40% marks in the End Semester examination and 40% marks in the aggregate (marks in End Semester Examination + marks in Internal Assessment).

The students who does not secure required minimum marks for pass in a course(s) shall be required to reappear and pass the same in the subsequent examination,

f.3.2 Question Paper Pattern - Theory

The end semester examination will be conducted in the duration of 3 Hours and maximum of 75 Marks.

All the units Should be covered in each Part

Part – A (10 x 2 Marks: 20 Marks) Answer all questions
Part – B (5 x 5 Marks: 25 Marks) Answer all questions choosing either (a) or (b)
Part – C (3 x 10 Marks: 30 Marks) (Answer any 3 out of 5 questions)

End Semester Examination (ESE) - Practical

Students are required to prepare a separate lab record for each lab course. The practical counsellor should duly sign this lab record after each session.

Students shall prepare practical record note book which includes aim, algorithm, source code, input, expected output and result of the experiment and submit during end semester practical examination.

Division of marksin ESE – Practical (Maximum 75 marks)

The end semester practical examination will be conducted in the duration of 3 Hours and maximum of 75 Marks.

Practical details	Max. Marks
Algorithm / Flowchart	10
Source Code	20
Debugging	10
Execution	10
Results	10
Viva-Voce	5
Record	10
Total	**75**

f.3.3 Procedure for Completing the Course:

A student shall be permitted to continue the programme from I to II semester irrespective of failure(s) in the courses of the earlier semesters. The candidate will qualify for the Diploma in Artificial Intelligence and Machine Learning Programme only if he/she passes all the (including arrears) courses with in a period of Two years from the date of admission.

f.3.4 Results and Classification:

Results will be declared at the end of each semester of the University examination and the marks/grade obtained by the candidate will be forwarded to them by the Controller of Examinations, Alagappa University.

f.3.4.1 Marks and grades

The following table gives the marks, grade points, letter, grades and classification to indicate the performance of the candidate.

Range of Marks	Grade Points	Letter Grade	Description
96-100	10.00	S+	First class – Exemplary
91-95	9.5	S	
86-90	9.0	D++	First class – Distinction
81-85	8.5	D+	
76-80	8.0	D	
71-75	7.5	A++	First Class
66-70	7.0	A+	
61-65	6.5	A	

56-60	6.0	B	Second Class
50-55	5.5	C	
Below 50	0.00	F	Fail
ABSENT	0.00	AAA	Absent

For a semester

Grade Point Average[GPA] = $\sum C_i G_i / \sum C_i$

GPA = Sum of the multiplication of Grade points by the credit of the courses
Sum of the credit of the courses in the semester
= Sum of [Credit earned x Grade Points]
Sum of the credits earned in the semester

For the entire programme

Cumulative Grade Point Average [CGPA] = $\sum_n \sum_i C_{ni} G_{ni} / \sum_n \sum_i C_{ni}$

= sum of the multiplication of grade points by the credits of the entire programme
Sum of the credits of the courses for the entire programme

Where

C_i - Credits earned for the course i in any semester
G_i – Grade Point earned for course i in any semester
n - is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters (programme) in the case of CGPA.

CGPA	Grade	Classification of Final Result
9.6 – 10.00	S+	First class – Exemplary*
9.1–9.5	S	
8.6–9.0	D++	First class with Distinction*
8.1–8.5	D+	
7.6–8.0	D	
7.1–7.5	A++	First Class
6.6–7.0	A+	
6.1–6.5	A	
5.6–6.0	B+	Second Class
5.0– 5.5	C	
Below 5.0	U	Reappear

* The candidates who have passed in the first appearance and within the prescribed semester

f.4 Fees Structure

Fee Particulars	Rs.
Admission Processing Fees	300
Course Fees	5,000
ICT fees	150
Total Fees	**5,450**

The above mentioned fees structure is exclusive of examination fees.

(g)Requirement of the laboratory support and library resources

g.1 Laboratory Support

A well- equipment Computer Laboratory was established in the Alagappa University, Karaikudi with necessary software's as per the practical's syllabi for conducting face to face contact sessions for practical courses of this programme.

g.2 Library Resources

The Directorate of Distance Education, Alagappa University provides library facility with number of books and Self Learning materials for Computer Science Programmes. The Central library of Alagappa University provides the collection of volumes of Self Learning Materials, Printed books, Subscriptions to printed periodicals and Non-book materials in print form for the learner's references. All these library resources are meant for learner's reference purpose only.

(h)Cost estimate of the programme and the provisions:

Expense details	Amount in (Rs.) Approx.
Programme development (Single time Investment)	10,00,000/-
Programme delivery (per year)	24,00,000/-
Programme maintenance (per year)	5,00,000/-

(i)Quality assurance mechanism and expected programme outcomes:

i.1 University's Moto:' Excellence in Action'
i.2 University's Vision and Mission

Vision

Achieving Excellence in all spheres of Education, with particular emphasis on ' PEARL' - Pedagogy, Extension, Administration, Research and Learning.

Mission

Affording a High Quality Higher Education to the learners so that they are transformed into intellectually competent human resources that will help in the uplift of the nation to Educational, Social, Technological, Environmental and Economic Magnificence (ESTEEM).

i.3 University Objectives

1. Providing for instructions and training in such branches of Learning at the university may determine.
2. Fostering Research for the Advancement and Dissemination of Knowledge and Application.

i.4 Quality Policy

Attaining Benchmark Quality in every domain of 'PEARL' to assure Stakeholder Delight through Professionalism exhibited in terms of strong purpose, sincere efforts, steadfast direction and skillful execution.

i.5 Quality Quote : Quality Unleashes Opportunities Towards Excellence (QUOTE).

i.6. Course benchmarks

The benchmark qualities of the programme may be reviewed based on the performance of students in their end semester examinations and number of enrolments of students. Feedback from the alumni, students, parents, stakeholders and employers will be received to analyze the benchmark qualities for the further improvement of the programme.

****

Appendix
Detailed Syllabi
SEMESTER I

Semester	Course Code	Title of the Course	Credits	Hours
I	11	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	2	6

Course objectives

- The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches.
- Develop a basic understanding of the building blocks of AI as presented in terms problem, problem space: Search, Knowledge representation, inference, logic, and learning.

Course outcome

By the end of this course, you should be able to:

- Create AI solutions for various business problems.
- Build and deploy production grade AI applications.
- Apply methods, techniques and tools immediately.
- To gain experience of doing independent study and research.

Unit 1:

AI - Problems and Search: Introduction: The Artificial Intelligence (AI) Problem – What is an AI technique - Criteria for success. Problems, Problem Spaces, Search: Defining Problems, Problem Spaces, Search State space search - Production Systems – Problem characteristics - Production system characteristics – Application areas.

Unit 2 :

Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First search – Problem reduction – constraint satisfaction - Means-end analysis.

Unit 3:

AI - Knowledge Representation: Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

Unit 4 :

Using Predicate logic: Representing simple facts in logic – Representing Instance and ISA relationships - Computable functions and predicates -Resolution. Representing knowledge using rules: Procedural Vs Declarative knowledge –Logic programming - Forward Vs Backward reasoning - Matching – Control knowledge.

Unit 5 :

AI –Learning : What is learning – Rote learning - Learning by taking advice – learning in problem solving.

Unit 6 :

Learning from examples: Induction - Explanation-based learning – discovery – analogy – formal learning theory – Neural Net Learning and Genetic Learning.

Reference and text books:

1. Dan W. Patterson, "*Introduction to AI and ES*", Pearson Education.
2. Dheeraj Mehrotra(2019), *Basics of Artificial Intelligence & Machine Learning*, Notion Press.
3. Elaine Rich and Kevin Knight(1991)," *Artificial Intelligence*", Second Edition,Tata McGraw Hill, Publishers company Pvt Ltd.
4. Kevin Night, Elaine Rich, Nair B.(2008), "*Artificial Intelligence (SIE)",*McGraw Hill.
5. Stuart Russel, Peter Norvig (2007), "*AI – A Modern Approach*", 2nd Edition, Pearson Education.
6. Venugopal C.K(2019), *Artificial Intelligence and Machine Learning*, Pacific Books International.

*****

Semester	Course Code	Title of the Course	Credits	Hours
I	**12**	**RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS)**	**2**	**6**

Course Objectives:

- To understand the fundamentals of data models
- To make a study of SQL and relational database design.
- To know about data storage techniques an query processing.
- To impart knowledge in transaction processing, concurrency control techniques and External storage

Course Requirements:

- Knowledge about the basic concepts of the database.

Course Outcome:

By the end of this course, you should be able to:

- Design a database using ER diagrams and map ER into Relations and normalize the relations
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database application using normalization.

Unit 1 :

Data base System Applications, data base System VS file System – View of Data – Data Abstraction –Instances and Schemas – data Models – the ER Model - Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor.

\Unit 2

History of Data base Systems - Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

Unit 3 :

Relational Model: Introduction– Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying / altering Tables and Views.

Unit 4 :

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews - Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

Unit 5 :

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – joins- Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases. Schema refinement.

Unit 6 :

Normal forms:Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF.

Reference and text Books:

1. Colin Ritchie (2004), *Relational Database Principles*,3rdEdition, Cengage Learning Business Press.
2. ElmasriNavrate ,*Fundamentals of Database Systems*, Pearson Education.
3. Peter Rob & Carlos Coronel, *Data base Systems design, Implementation, and Management*, 7th Edition.
4. Raghurama Krishnan, Johannes Gehrke(2003), Data base Management Systems, 3rd Edition, TATA McGrawHill.
5. Silberschatz, Korth(2011), Data Base System Concepts, 6th Edition, Tata McGraw Hill.
6. Sharad Maheswari and RuchinJain(2006), *Database management systems Complete Practical Approach*, Firewall media.

****

Semester	Course Code	Title of the Course	Credits	Hours
I	**13**	**R PROGRAMMING**	**2**	**6**

Course objectives

- This course aims to provide a knowledge about R programming language.
- Student will learn how to use R for effective data analysis.
- By the end of the day-long course, the user will be comfortable operating in the R environment, including importing external data, manipulating data for specific needs, and running summary statistics, machine learning algorithms and visualizations.
- This course helps participants to have a good understanding of the methods, methodologies and techniques from the basics of statistics to obtain supporting evidence through data

Course outcome

By the end of this course, you should be able to:

- Download and install R
- Navigate and optimise the R integrated development environment (IDE) R Studio
- Install and load add-in packages
- Import external data into R for data processing and statistical analysis
- Learn the main R data structures
- Compute basic summary statistics
- produce data visualizations

Unit 1

Introduction to R – History of R - Features of R - Essentials of the R language – R-Environment setup – Basic syntax: command prompt, script file, comments. Data types - Variables – assigning, finding, deleting variables- operators: operator types – arithmetic operator – logical operators -assignment operators – logical operators -expressions.

Unit 2

Control statements – Decision making- if – if-else – nested if - switch– loops – repeat- while – for – loop control statements - break – next statement. Functions: function definition - function components –built-in functions – user defined function - calling function - Recursion - Strings: Rules of strings - string manipulation

.

Unit 3

Objects in R: Vectors – Vector creation – Vector Manipulation – Lists: Creating a list, naming, accessing, manipulating list elements- merge list -converting list to Vector – Arrays-Names columns and rows – Accessing array elements, manipulating array elements – operations of array elements.

Unit 4

Matrices – Accessing elements of Matrix – operations on matrix– Factors – Frames – Create data frames - getting the structure of data frame- Extract data from data frame. Packages – available R packages - install a new package – load package to library - Data reshaping – joining columns and rows in a data frame- merging dt frames – melting and casting

.

Unit 5

Working with files: CSV file – input CSV, read CSV, analyzing CSV, writing into CSV, Excel file: install, load, input, read excel files - Binary files: reading and writing – XML files: input and read XML files. mySQL package – connection R with mySQL – querying the table – table manipulation: create, insert, drop and update.

Unit 6

Visualizing: R charts and Graphs: R Pie charts: Pie chart title, color- slice percentages and chart legend – 3D Pie chart - Bar charts – Histograms – Line graphs – Scatter plots – creating scatterplot – scatterplot matrices.

Reference and text books:

1. Andrie de Vries, Joris Meys(2016), *R Programming for Dummies*, 2nd edition, Wiley.

2. Brett Lantz(2013), *Machine Learning with R*, Packt Publishing Ltd.
3. Mark Gardener(2013), *Beginning R The Statistical Programming Language*, Kindle edition.
4. Rajendra B. Patil,HirenDand& Rupali Dahake(2017), *A practical Approach to R*, Shroff/X-Team; First edition.
5. Scott Burger(2018), *Introduction to Machine Learning with R: Rigorous Mathematical Analysis*, Shroff/O'Reilly.
6. *UCI Machine Learning Repository* :http://archive.ics.uci.edu/ml/index.php

*****

Semester	Course Code	Title of the Course	Credits	Hours
I	14	R Programming LAB	2	60

Course objectives

- This course aims to provide a knowledge about practical R programming language.
- Student will learn how to use R for effective data analysis.
- By the end of the day-long course, the user will be comfortable operating in the R environment, including importing external data, manipulating data for specific needs, and running summary statistics, machine learning algorithms and visualizations.

Course outcome

By the end of this course, you should be able to:

- Download and install R
- Navigate and optimize the R integrated development environment (IDE) R Studio
- Install and load add-in packages
- Import external data into R for data processing and statistical analysis
- Learn the main R data structures
- Compute basic summary statistics and machine learning
- produce data visualizations

Experiments based on R Programming

- Simple R Programs
- Programs using conditional control statements
- Programs using functions and recursion.
- Problems based on Vectors, List, Arrays, Matrices, Factors and Frames.
- Experiments using packages.
- Problems using files and database.
- Experiments using charts and graphs.

- Experiments to perform statistics(mean, mode, median, normal distribution, binomial distribution) in R.
- Experiments for forecasting numeric data: Regression Methods.
- Experiments for data Visualizations.

Reference books:

7. Andrie de Vries, Joris Meys(2016), *R Programming for Dummies*, 2nd edition, Wiley.
8. Brett Lantz(2013), *Machine Learning with R*, Packt Publishing Ltd.
9. Mark Gardener(2013), *Beginning R The Statistical Programming Language*, Kindle edition.
10. Rajendra B. Patil,HirenDand& Rupali Dahake(2017), *A practical Approach to R*, Shroff/X-Team; First edition.
11. Scott Burger(2018), *Introduction to Machine Learning with R: Rigorous Mathematical Analysis*, Shroff/O'Reilly.
12. *UCI Machine Learning Repository* :http://archive.ics.uci.edu/ml/index.php

*****

SEMESTER II

Semester	Course Code	Title of the Course	Credits	Hours
II	21	FUNDAMENTALS OF MACHINE LEARNING	2	6

Course Objectives:

- To discover patterns in your data and then make predictions based on often complex patterns to answer business questions, detect and analyze trends and help solve problems**.**
- To introduce students to the state-of-the-art concepts and techniques of Machine Learning.

Course Outcome:

By the end of this course, you should be able to:

- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc. ...
- Be able to design and implement various machine learning algorithms in a range of real-world applications.
- be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
- be capable of performing experiments in Machine Learning using real-world data.

Unit 1

Introduction: Basic definitions – Learning - Machine Learning vs AI - Machine Learning – features – samples – labels - Real-world applications and problems – hypothesis test - approaches of machine learning model - Data preprocessing.

Unit 2:

Representation of formal ML model: The statistical learning framework – training - testing – validation - cross validation - parametric and non parametric methods - Difference between Parametric and Non-Parametric Methods and examples.

Unit 3

Supervised learning Algorithms: Introduction – Approaches for classification – Decision Tree classification algorithm – Tree pruning - Rule based Classification –IF-THEN rules classification - Naïve Bayesian classification - Neural Network classification -Classification by Backpropagation algorithm. Support Vector Machines (SVM) - Lazy learners: k-Nearest Neighbor (k-NN) Algorithm – Case Based Reasoning (CBR) - Random Forest algorithm.

Unit 4

Unsupervised learning algorithms: Introduction– Defining Unsupervised learning – Cluster Analysis – Distance measures - Types of Clustering – Partition algorithms of clustering – Hierarchical clustering algorithms - Density based methods.

Unit 5

Reinforcement Learning and ELM: Introduction: Markov Decision process - Monte Carlo Prediction - case studies – Applications. Introduction to Extreme Learning Machine (ELM) - Software Tools: Introduction to Weka, Matlab, Rapidminer, tensorflow and keras –case studies.

Unit 6

Deep learning fundamentals: Introduction –Deep Belief Networks (DBN), A Restricted Boltzmann machine (RBM) - Recurrent Neural Networks (RNN) - Time series forecasting. Convolutional Neural Networks (CNN) - Auto-encoders: Auto-encoders and unsupervised learning - Regularization - Dropout and Batch normalization.

Reference and text Books.

1. Anuradha Srinivasaraghavan,Vincy Joseph (2019),*Machine Learning*, Wiley.
2. BalasKausikNatarajan(1991), "*Machine Learning: A Theoretical Approach*", Morgan Kaufmann
3. Dinesh Kumar U ManaranjanPradhan(2019), *Machine learning using Python*, Wiley.

4. EthamAlpaydin(2015), *Introduction to Machine Learning*, third edition, PHI Learning Pvt. Ltd.
5. Jiawei Han, Micheline Kamber, Jian Pei(2012), *Data mining concepts and techniques*, Morgan Kaufmann Publishers, Elsevier.
6. Lovelyn Rose S, Dr. L Ashok Kumar, Dr. D KarthikaRenuka(2019), *Deep Learning Using Python*,Wiley,
7. Rajiv Chopra(2018), *Deep Learning - A Practical Approach*, Khanna Books 2018.
8. Shai Shalev-Shwartz and Shai Ben-David(2014), *Understanding machine learning from theory to algorithms*,Cambridge university press.
9. UCI Machine Learning Repository :http://archive.ics.uci.edu/ml/index.php

******

Semester	Course Code	Title of the Course	Credits	Hours
II	**22**	**PRINCIPLES OF SOFT COMPUTING**	**2**	**6**

Course Objective:

- To learn the key aspects of Soft computing.
- To know about the components and building block hypothesis of Genetic algorithm.
- To study the fuzzy logic components.

Course Outcome:

- Write Genetic Algorithm to solve the optimization problem
- Understand fuzzy concepts and develop a Fuzzy expert system to derive decisions.

Unit 1

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.

Unit 2

Perceptron Network – Adaline and Madaline Networks – Back Propagation Network - Radial Basis Function Network. Associative Memory Networks – BAM - Hopfield Network - Boltzmann Machine.

Unit 3

Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

Unit 4

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

Unit 5

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.

Unit 6

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function - Genetic Operators– Classification of Genetic Algorithm – Applications of GA.

Reference and Text Books:

1. Goldberg David E.(2003), "*Genetic Algorithms*", Pearson Education.
2. Haykin Simon (1999) , "*Neural Networks*", Prentice Hall, 1993/Pearson Education.
3. JangJ.S.R., C.T. Sun, E. Mizutani(2004), "*Neuro-Fuzzy and Soft Computing*", Prentice Hall India.
4. Kumar Satish, "*Neural Networks: Classroom Approach*", Tata McGraw Hill.
5. Koza J. (1993), "*Genetic Programming*", MIT Press.
6. KecmanVojislav(2001), "*Learning and Soft Computing*", MIT Press.
7. Konar Amit (2008), "*Artificial Intelligence and Soft Computing – Behavioural and CognitiveModeling of the Human Brain*", Special Indian Edition, CRC Press.
8. Rajasekaran S (2004), G.A.V. Pai, "*Neural Networks, Fuzzy Logic, Genetic Algorithms*", Prentice Hall India, 2004.
9. Rajase, Kharan S. and VijayalakshmiPai S. A.(2003), "*Neural Networks, Fuzzy Logic & Genetic Algorithms",* Prentice-Hall of India
10. Sivanandam, "*Introduction to Neural Networks with MATLAB 6.0*", Tata McGraw Hill Publications.
11. Sivanandam S.N, S.N. Deepa (2007), "*Principles of Soft Computing*", Wiley India.
12. Yen John and Langari Reza (2003), "*Fuzzy Logic, Intelligence, Control, and Information*", Pearson Education.

****

Diploma in Artificial Intelligence and Machine Learning

Credit Based Curriculum and Evaluation System

Semester	Course Code	Title of the Course	Credits	Hours
II	23	PYTHON PROGRAMMING	2	6

Course Objectives:

The learning objectives of this course are;

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.

.

.

Course Requirements:

- Before studying this course, the student has knowledge about basic principles of programming
- Experience with a high-level language (C/C++, Java, MATLAB) is suggested. Prior knowledge of a scripting language (Perl, UNIX/Linux shells) and Object-Oriented concepts is helpful but not mandatory.

Course Outcome:

After the completion of this course, the student will able to;

- To write programs using structures, strings, arrays, pointers and strings for solving complex computational problem.
- Use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario
- Master Object-oriented programming to create an entire Python project using objects and classes
- Store and retrieve information using variables
- Develop cost-effective robust applications using the latest Python trends and technologies

Unit 1

Introduction – Overview of programming languages - History of Python – Installing Python – Executing Python programs – Comments - Python Character set – token core datatypes – printf()

function – Assigning value to variables – input() – eval() – formatting Number and strings – Inbuilt functions - Operators and Expressions.

Unit 2

Decision Statements: Introduction - if , if-else , nested if statements – multi-way if-elif statements. Loop Control Statements: Introduction – while loop – range() function – for loop = nested loops – break and continue statements.

Unit 3

Functions: Introduction – Syntax and basics of function – use of function – parameters and arguments in function – local and global variables – return statement. Strings: Introduction – The str class – built in functions for string – index[] operator - traversing string – immutable strings – string operators – string operations.

Unit 4

Lists : Introduction – creating lists – accessing the elements of a list – negative list indices – list slicing – built-in functions for list – list operator – list methods – passing list to a function – returning list from function.Introduction to tuples - creating – tuple() function – built-in functions for tuples - indexing -slicing – operators – list and tuples – sorting -traversing.

Unit 5

Introduction to tuples - creating – tuple() function – built-in functions for tuples - indexing -slicing – operators – list and tuples – sorting -traversing. Sets – creating – set in and not in operator – set classes - operations. Dictionaries: Introduction – creating, adding, replacing, retrieving values – formatting – deletion of items – comparing dictionaries – methods of dictionary class – nested dictionaries - traversing dictionaries

Unit 6

File Handling: Introduction – Need for file handling – Text input and output using file – seek() function. Introduction to Scientific computing with Scipy, Mathematical computing with Numpy, Scikit learn, Data visualization using Matplotlib, Data manipulation with pandas and sympy – Case studies.

Reference and text books:

1. Ashok NamdevKamthane(2018), Amit Ashok Kamthane, *Programming and Problem solving with Python*, Mc GrawHill Education.
2. Dinesh Kumar UManaranjanPradhan(2019), *Machine learning using Python*, Wiley
3. Manisha Bharambe(2019), *Python programming*, NiraliPrakashan.

4. Robert Sedgewick,Kevinwayne , Roberdondero(2016), *Introduction to Programming in Python: An Interdisciplinary Approach,* 1e , Pearson.
5. Wesley J. Chun(2009), "*Core Python Programming*", 2nd Edition, Prentice Hall.

***

Semester	Course Code	Title of the Course	Credits	Hours
II	**24**	**MACHINE LEARNING USING PYTHON LAB**	**2**	**60**

Course Objectives:

The learning objectives of this course are:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to design object-oriented programs with Python classes.
- To learn how to use class inheritance in Python for reusability.

.

Course Requirements:

- Before studying this course, the student has knowledge about basic principles of programming.
- Experience with a high-level language (C/C++, Java, MATLAB) is suggested. Prior knowledge of a scripting language (Perl, UNIX/Linux shells) and Object-Oriented concepts is helpful but not mandatory.

Course Outcome:

After the completion of this course, the student will able to;

- To write programs using structures, strings, arrays, pointers and strings for solving complex computational problem.
- Use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario.
- Master Object-oriented programming to create an entire Python project using objects and classes.
- Store and retrieve information using variables.

- Develop cost-effective robust applications using the latest Python trends and technologies.
- Write program to solve real-world machine learning problems.

Lab Experiments based on Python programming and machine learning problems.

Simple Python programs.
Experiments using decision control statements.
Exercises using functions and recursion.
Exercises using arrays and strings.
Experiments using list processing.
Object oriented Programming Lab Problems using Python.
Experiments using Tuples, sets and dictionaries.
Programs using file handling.
Programs using graphics programming.
Experiments for data visualization using Matplotlib.
Scientific computing with Scipy.
Data manipulation with pandas and sympy.
Mathematical computing with Numpy.
Programs to perform Supervised learning algorithms (k-NN algorithm.)
Programs to perform Unsupervised learning algorithms (k-means clustering.).

Reference Books:

1. Ashok NamdevKamthane(2018), Amit Ashok Kamthane, *Programming and Problem solving with Python*, Mc GrawHill Education.
2. Dinesh Kumar UManaranjanPradhan(2019), *Machine learning using Python*, Wiley
3. Manisha Bharambe(2019), *Python programming*, NiraliPrakashan.
4. Robert Sedgewick,Kevinwayne , Roberdondero(2016), *Introduction to Programming in Python: An Interdisciplinary Approach*, 1e , Pearson.
5. Wesley J. Chun(2009), "*Core Python Programming*", 2nd Edition, Prentice Hall.

******