D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

NBA Accredited

Accredited by NAAC with 'A' Grade

Structure and Syllabus of Third Year B. Tech in Computer Science and Engineering (Artificial Intelligence–Machine Learning)

Department of

Computer Science and Engineering

(AI-ML)

Effective from Academic year 2022-23

D.Y.PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR
Teaching and Evaluation Scheme from Year 2022-23
Third Year B.Tech. Computer Science and Engineering(Artificial Intelligence & Machine Learning)
SEMESTER-V

| Sr. No. | Course Code | Course Type | Name of the Course | Teaching Scheme per Week | | | | Total Marks | Evaluation Scheme | | | |
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. Marks for Passing	
1	201AIMLL301	PCC	System Programming and Compilers	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201AIMLL302	PCC	Cloud Computing	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201AIMLL303	PCC	Machine Learning	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201AIMLL304	PCC	Database Engineering	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201AIMLP305	LC	Data Visualization and R Programming	1	-	2	2	25	ISE	25	10	10
6	201AIMLP306	PCC-LC	Machine Learning Laboratory	-	-	2	1	50	ISE	25	10	20
									ESE-POE	25	10	
7	201AIMLP307	PCC-LC	Database Engineering Laboratory	-	-	2	1	50	ISE	25	10	20
									ESE-POE	25	10	
8	201AIMLP308	PCC-LC	Cloud Computing Laboratory	-	-	2	1	25	ISE	25	10	10
9	201AIMLP309	PROJ	Project–I	-	-	2	2	75	ISE	25	10	30
									ESE-POE	50	20	
10	201AIMLMC310	MC	Human Values and Ethics (Mandatory Course–III)	2	-	-	-	50	ESE	50	20	20
	Total			15	0	10	19	675				270

ISE: In Semester Evaluation *MSE: Mid Semester Examination* *ESE: End Semester Examination*

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Teaching and Evaluation Scheme from Year 2022-23
Third Year B.Tech . Computer Science and Engineering(Artificial Intelligence & Machine Learning)
SEMESTER-VI

Sr. No.	Course Code	Course Type	Name of the Course	Lecture	Tutorial	Practical	Credits	Total Marks	Type	Max. Marks	Min. Marks for Passing	
1	201AIMLL311	PCC	Advanced Database Systems	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201AIMLL312	PCC	Advanced Machine Learning	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201AIMLL313	PCC	Information Security	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201AIMLL314-316	PEC	Professional Elective-I	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201AIMLL317	OEC	Open Elective-I	3	1	-	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
6	201AIMLP318	PCC	Fundamentals of Data Science	2	-	2	3	75	ISE	25	10	30
									ESE-POE	50	20	
7	201AIMLP319	PCC-LC	Advanced Database Systems Laboratory	-	-	2	1	25	ISE	25	10	10
8	201AIMLP320	PCC-LC	Advanced Machine Learning Laboratory	-	-	2	1	50	ISE	25	10	20
									ESE-POE	25	10	
9	201AIMLP321	PROJ	Project-II	-	-	2	1	100	ISE	50	20	20
									ESE-POE	50		
Total				17	1	08	22	750				280

ISE: In Semester Evaluation   *MSE: Mid Semester Examination*   *ESE: End Semester Examination*

Professional Elective-I	Open Elective-I
1. Human Computer Interaction 2. Ethics in AI 3. Advanced Data Structures.	1. Applications of AIML

Open Elective:

Open elective courses are offered to gain the knowledge of multidisciplinary areas. Students must choose one open elective course from the list of courses offered by other departments (excluding open elective courses offered by their department). Following is the list of open elective courses. The detailed syllabus is available on to the college website under academic tab.

Sr. No.	Department	Course Code	Open Elective-I Course
1	Chemical	201CHL318	Industrial Safety and Act
		201CHL319	Energy Conservation and Audit
2	Mechanical	201MEL313	Human Resource Management
		201MEL314	Electric Vehicle
3	Civil	201CEL330	Disaster Management
		201CEL331	Green Building
4	Architecture	201ARL318	Residential Gardening
		201ARL319	Role of Art & Technology in Interior Design
5	Electronics and Telecommunication	201ETL318	Sensor Technology
		201ETL319	Electronic Instrumentation
6	Computer Science & Engineering	201CSL319	E- Commerce & Digital Marketing
		201CSL320	Python Programming
7	Computer Science & Engineering (Data Science)	201DSL319	Basics of Data Science
		201DSL320	Basics of Database

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T. Y. B. Tech. CSE (Artificial Intelligence and Machine Learning)

SEM-V(AcademicYear-2022-23)

Course Plan

Course Title: System Programming and Compilers	
Course Code: 201AIMLL301	Semester :V
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+30	ESE:50

Course Description:

The compiler is the programmer's primary tool . Understanding the compiler is the refore critical for programmers, even if they never build one. This course introduces students to the essential elements of building a compiler. It deals with the basic concepts of system programs as well as provides deeper in sights into Compiler and its phases .This course will help students to learn about lexical analysis , parsing , semantic analysis , intermediate code generation , code optimization , and code generation.

Course Objectives:

1. To expose the students to the fundamentals of various system programs.
2. To introduce the fundamentals of Compiler and its phases.
3. To expose the students to various compiler construction tools.

Course Outcomes (COs):

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

C301.1	Understand the basics of system programs , Assemblers , Macros , Linkers , Loaders
C301.2	Recall the compiler phases and compiler construction tools
C301.3	Learn Lexical analysis and various parsing techniques.
C301.4	Understand syntax-directed translation , intermediate code generation ,and target code generation
C301.5	Identify appropriate code optimizing transformation for given code

Prerequisite:	Theory of Computation, Assembly language

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C301.1	2	-	-	-	-	-	-	-	-	-	-	1	1	-	2
C301.2	2	-	-	-	-	-	-	-	-	-	-	1	1	-	2
C301.3	2	1	1	-	-	-	-	-	-	-	-	1	1	-	3
C301.4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C301.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3

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Content	Hours
Unit1: Language Processors: Introduction, Language processing activities, Fundamentals of language Processing , Language processor development tools : LEX and YACC. Compiler construction tools , cousins of the compiler.	5
Unit2: Assemblers , Linkers , and Loaders: Elements of assembly language programming , A simple assembly scheme , pass structure of assemblers, and Design of a two-pass assembler. **Macros and Macro Pre-Processors**: Macro definition and call , Macro expansion , Nested macro calls **Linkers & Loaders** : Introduction	7
Unit3: Compilers , Phases of a compiler , Role of a Lexical analyzer , input buffering ,specification and recognition of tokens, finite automata implications.	5
Unit 4: Syntax Analysis: Role of Parser, Recursive descent and predictive parsers (LL) , Operator precedence parsing ,Working of LR Parser and introduction to its types SLR , canonical LR , and LALR.	6
Unit5: Syntax Directed Translation and Intermediate Code Generation: Syntax – directed definitions , construction of syntax tree , S-attributed definitions , L-attributed definitions , Intermediate languages , assignment statements , back patching.	6
Unit6: Code Generation , Code Optimization and Parallel Processing Issues in the design of a code generator and target machine , Basic blocks and flow graphs , Next use information and simple code generator, Issues of register allocation , Principal sources of optimization , optimization of Basic Blocks , Peephole optimization , and example on how to optimize python code . Introduction to Parallel Algorithm : Computational Model and Fundamental Techniques and Algorithms – PRAM , MESH	8

Text Books:
1. System Programming and operating systems, D. M. Dhamdhere, 2nd Edition (TMGH) (Unit1,2)
2. Compilers - Principles, Techniques, and Tools A. V. Aho, R. Sethi and J. D. Ullman Pearson Education (Unit 3,4,5,6)
3. Fundamentals of Computer Algorithms – Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran Universities Press ,Second edition (Unit6 Parallel processing)

Reference Books:
1.Compiler construction D.M. Dhamdare Mc-Millan

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Online Resources:

https://onlinecourses.nptel.ac.in/noc20_cs13/preview

https://nptel.ac.in/courses/106108113

https://nptel.ac.in/courses/106105190https://www.coursera.org/lecture/nand2tetris2/unit-4-1-syntax-analysis-5pC2Z

https://www.analyticsvidhya.com/blog/2019/09/4-methods-optimize-python-code-data-science/

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SEM-V(AcademicYear-2022-23)

Course Plan

Course Title : Cloud Computing	
Course Code : 201AIMLL302	Semester : V
Teaching Scheme :L-T-P:3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

Course Description: This course is intended to analyze the basics of distributed system and cloud computing, and gives an overview of computing paradigm. The course students with exposes the students with diversified technologies working for cloud architecture , and virtualization .Course will be focusing on various cloud architecture like IaaS , PaaS & SaaS.

Course Objectives :
1. To familiar with computational distributed system.
2. To become familiar with Cloud Computing and its ecosystem.
3. To learn basics of virtualization and its importance.
4. To evaluate in-depth analysis of Cloud Computing capabilities.
5. To give technical overview of Cloud Programming and Services.
6. To understand security issues in cloud computing.

Course Outcomes (COs):

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

C302.1	Understand the basic concept of distributed system.
C302.2	Describe the main concepts ,key technologies , strengths , and limitations of cloud Computing and the possible applications for state-of-the-art cloud computing.
C302.3	Explain the architecture and infrastructure of cloud computing , including SaaS , PaaS , IaaS , public cloud , private cloud , hybrid cloud , etc.
C302.4	Identify problems , and explain , analyses , and evaluate various cloud computing solutions.
C302.5	Choose the appropriate technologies , algorithms , and approaches for the relate dissues.

Prerequisite:	Operating Systems , Fundamentals of Computer Networks.

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) :

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C302.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
C302.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C302.3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
C302.4	-	-	2	-	-	-	-	-	-	-	-	-	1	-	3
C302.5	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3

Content	Hours
Unit 1: Overview of computing paradigm: Recent trends in Computing - Grid Computing ,Cluster Computing , Distributed Computing , Utility Computing , Cloud Computing . Evolution of cloud computing-Business driver for adopting cloud computing. Definition , Goals , Types of distributed systems : Distributed computing system , Information System , Architecture : Architectural , Styles , System Architecture.	7
Unit 2: Inter Process and Communication : Remote Procedure call, Message Oriented Transient Communication , Physical Clock , Synchronization , Logical Clock , Mutual Exclusion , Election Algorithms. **Introduction to Cloud Computing:** Cloud Computing - Introduction to Cloud Computing , History of Cloud Computing , Cloud service providers . Properties , Characteristics & Disadvantages – Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud Computing vs. Cluster computing vs. Grid computing. Role of Open Standards.	7
Unit 3: Cloud Computing Architecture: Cloud computing stack - Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS) - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Deployment Models ,Public cloud, Private cloud, Hybrid cloud, Community cloud	6
Unit4:Virtualization: Introduction and benefits, Implementation Levels of Virtualization, Virtualization at the OS Level Virtualization Structure, Virtualization Mechanism, Open-Source Virtualization Technology, Xen Virtualization Architecture, Binary Translation with	6

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Full Virtualization, Para virtualization, Virtualization of CPU, Memory and I/O Devices	
Unit 5: Cloud Patterns and Platforms: Infrastructure as a Service (IaaS) Introduction to IaaS - IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM). Resource Virtualization- Server, Storage, Network. Virtual Machine (resource) provisioning and manageability, storage as aservice, Data storage in cloud computing (storage as a service). Renting, EC2 Compute Unit, Platform and Storage, pricing, customers. **Platform as a Service (PaaS):** Introduction to PaaS - What is PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management-computation, storage **Software as a Service(SaaS):** Introduction to SaaS, Web services, Web2.0, Web OS, Case Study on SaaS	7
Unit6: Case study on Open Source and Commercial Clouds–Amazon EC2, Google Compute Engine, Microsoft Azure, Cloud foundry, Open Stack	5

Text Books:
1. Distributed System: principles and paradigms-Tanenbaum, Steen .Unit I, II
2. Cloud Computing for Dummies, Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper, Wiley India Edition, Unit -I,II,IV,V
3. Cloud Computing Black Book, Jayaswal, Kallakurchi, Houde, Shah, Dreamtech Press, Unit-III
4. Cloud Security, Ronald Krutzand Russell Dean Vines, Wiley-India, Unit-V
5. Enterprise Cloud Computing, Gautam Shroff, Cambridge, Unit-VI

Reference Books:
1. Google Apps, Scott Granneman, Pearson
2. Cloud Security & Privacy, Tim Mather, S. Kumar aswammy, S. Latif, SPD, O'REILLY
3. Cloud Computing: A Practical Approach, Anthony T. Velte, et. al, McGraw Hill
4. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley India
5. Cloud Computing for Dummies, Judith Hurwitz, Marcia Kaufman, Fern Halper, Robin Bloor, Wiley Publication
6. Cloud Computing Bible, Barrie Sosinsky, Wiley India
7. Cloud Computing, Michael Miller, Que Publishing

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SEM-V(AcademicYear-2022-23)

Course Plan

Course Title: Machine Learning	
Course Code:201AIMLL303	Semester: V
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE+MSE marks: 20+30	ESE Marks: 50

Course Description:

This course is an introduction to the theoretical aspects of the design of algorithms that enable machines to " learn " from examples (i.e., Machine Learning). This course will provide students an in-depth knowledge to the areas of Supervised and introduction of Unsupervised Machine Learning. The course will cover core Machine Learning algorithms for classification, regression and clustering.

Course Objectives:

1. To understand pattern classification algorithms to classify multivariate data
2. To understand the basics of implementation of genetic algorithms
3. To understand new machine learning techniques.

Course Outcomes (COs):

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

C303.1	Understand the paradigms of supervised and unsupervised machine learning
C303.2	Identify the differences of multiple machine learning algorithms.
C303.3	Understand at as kasa machine learning problem.
C303.4	Apply suitable algorithms to tackle different machine learning problems.

Prerequisite:	Linear Algebra, Statistics, Probability Theory.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C303.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	2
C303.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
C303.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	2
C303.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3

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Content	Hours
Unit1: Introduction to Machine Learning Machine Learning: Definition, Terminology, Types of learning, Machine Learning Problem categories, Machine process, Lifecycle, Performance measures, tools and framework, data visualization.	06
Unit2: Regression: Simple regression–hypothesis, cost function ,parameter learning with gradient descent, learning rate, Gradient Descent for linear regression. **Multivariate Linear Regression**–Multiple features, hypothesis functions, Gradient Descent for multiple variables, Features caling	07
Unit3: Classification-logistic regression: Definition, Hypothesis representation, decision boundary, cost function, Gradient Descent for Logistic Regression. Multiclass Classification, Regularization –Overfitting & Underfitting, cost function, Regularized Linear Regression, Regularized Logistic Regression, K-Nearest Neighbour Classifier	05
Unit 4: Bayesian Learning- Introduction Bayes theorem, Naïve Bayes theorem, Naïve Bayes Classifier, Bayesian belief Networks, Introduction to Hidden Markov Model Issues in Hidden Markov Model.	06
Unit5: Decision trees and SVM Definition, terminology, the need, advantages, and limitations. Constructing and understanding Decision trees, common problems with Decision trees, Decision tree algorithms, random forest, and examples. Introduction to Support Vector Machines, Linear Support Vector Machines soft margin SVM, hard margin SVM, Kernel Tricks, Primal and Dual Form, Cost Function.	07
Unit6: Clustering and Text Mining : Introduction to Clustering, Types of Clustering , Partitioning Methods of Clustering, Hierarchical Methods. Introduction to text mining, Methods and techniques of text mining, Application of text mining.	05

Text Books:

1. Machine Learning, Anuradha Srinivasa raghavan, and Vincy Joseph ,Kindle Edition, 2020, WILEY.
2. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
3. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd

Reference Books:

1.Machine Learning by Tom M.Mitchell, International Edition 1997,McGraw Hill Education

Online Resources:

https://www.coursera.org/learn/machine-learninghttps://nptel.ac.in/courses/106106139

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SEM-V(AcademicYear-2022-23)

Course Plan

Course Title: Database Engineering	
Course Code: 201AIMLL304	Semester: V
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE+ MSE Marks: 20 +30	ESE Marks: 50

Course Description:

This course introduces the fundamental concepts, principles and tools of database system. The course includes relational data model and languages, database design techniques, SQL, data storage and indexing techniques. Also, the focus is given on concurrency control and recovery techniques.

Course Objectives:

1. To understand fundamental concepts of database systems.
2. To gain familiarity with SQL, PLSQL and DBMS.
3. To learn database design techniques.
4. To understand indexing, transaction management, recovery and security techniques.

Course Outcomes (COs):

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

C304.1	Understand fundamental concepts of database systems.
C304.2	Construct logical design of database using E-R Diagram.
C304.3	Study and apply SQL queries, PLSQL procedures to design & manage the database.
C304.4	Analyze & construct good database design.
C304.5	Understand transaction concepts and concurrency control techniques.
C304.6	Understand failures in database, appropriate recovery and security techniques.

Prerequisite:	Set Theory and Data Structures

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C304.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
C304.2	-	2	2	-	-	-	-	-	-	-	-	-	-	-	5
C304.3	-	3	3	1	-	-	-	-	-	-	-	-	2	-	3
C304.4	-	2	2	-	-	-	-	-	-	-	-	2	2	-	4
C304.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C304.6	2	-	2	-	-	-	-	-	-	-	-	-	-	-	2

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Content	Hours
Unit1: Introduction to databases and E-R model Purpose of Database Systems, View of data, Database architecture, Database users and administrator, E-R model**:** Entity sets, Relationship sets, Mapping Constraints, Keys, E-R Diagram, Reducing E-R Diagrams to relational schemas, Extended E-R features: Specialization, Generalization, and Aggregation	6
Unit2: Relational Model, SQL and PLSQL Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagram, Relational Algebra. SQL: Overview of the SQL Query Language, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries, Modification of the Database, Join Expressions, Views. PLSQL: Triggers, Stored Procedures, PL/SQL Processing with Cursors, PL/SQL Stored Functions.	9
Unit3: Relational Database Design Referential Integrity, features of good relational designs, functional dependency, closure of a set of functional dependencies and Canonical cover. Normalization: Purpose of normalization, First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF).	7
Unit4: Data Storage and Indexing Storage and File structure: Overview of physical storage media, RAID, File Organization, Organization of Records in Files, Data Dictionary Storage, Database Buffer. Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple Key Access. Static Hashing, Dynamic Hashing, Index definition in SQL.	8
Unit5: Concurrency Control and Crash Recovery Transaction concept, Transaction state, Concurrent Executions, Serializability, Recoverability, Testing for Serializability, Lock-Based Protocols, Graph based Protocols, Timestamp Based Protocols, Validation based protocols, Failure Classification, Recovery and Atomicity, Log-Based Recovery, Check points, Shadow Paging, Buffer Management	7
Unit6:Database Security and Authorization: Introduction to Database Security Issues, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, Introduction to Statistical Database Security	3

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Text Books:
1. A. Silberschatz, H.F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill Education. (Unit 1,2, 3,4,5)
2. Thomos Connolly, CarolynBegg, "Database Systems- A practical approach to Design, Implementation and Management", 3rd Edition, Pearson Education. (Unit3-Normalization)
3. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition, Cengage Learning, (Unit2-PLSQL)
4. Ramez Elmasriand Shamkant Navathe, "Fundamentals of Database Systems", Pearson Education, Fifth Edition (Unit 6)

Reference Books:

1.Raghu Ramkrishnan, Johannes Gehrke, "Database Management System", Fourth Edition, McGraw Hill Education.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs46/preview

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T. Y. B. Tech. CSE (Artificial Intelligence and Machine Learning)

SEM-V(AcademicYear-2022-23)

Course Plan

Course Title: Data Visualization and R Programming	
Course Code: 201AIMLP305	Semester: V
Teaching Scheme: L-T-P: 1-0-2	Credit: 2
Evaluation Scheme: ISE Marks: 25	ESE Marks: NA

Course Description: -

R is a well-developed, simple, and effective programming language, which includes conditional loops, user defined recursive functions, input and output facilities, graphical facilities for data analysis, effective data handling and storage facility. It is a very flexible language. It provides an extensive, coherent, and integrated collection of tools for data analysis and it is actively used for statistical computing and design.

Course Objectives

1. To make students aware of the features of R.
2. To provide knowledge of various packages & functions used in R.
3. To interpret and apply R programming from a statistical perspective.

Course Outcomes

After successful completion of the course, students will be able to-

CO's	Course Outcomes	BTL
C305.1	Use the features of R to implement data structures & data frames in their application.	3
C305.2	Apply different packages & functions to create the application.	3
C305.3	Perform data manipulation & statistical tests on dataset.	2
C305.4	Perform graphical analysis using plotting commands & functions.	4

Prerequisite	Python programming

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C305.1	2	-	2	-	-	-	-	-	-	-	-	-	-	-	3
C305.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	3
C305.3	2	2	3	-	2	-	-	-	-	-	-	-	2	-	3
C305.4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	3

Contents	Hours
Unit 1: Introduction to R programming What is R? Basic Features of R, Programming features of R, Installing R and RStudio, RStudio Overview, working in the R Console, Getting Help in R and Quitting RStudio.	2
Unit 2: R Data structures and Manipulation Creating Variables, expressions, R data types and objects, Numeric, Character and Logical Data, Vectors, Scalars, Declarations, Common Vector operations, Conditional statements and loops, Arithmetic Operators, and Logical Operations. Reading datasets and exporting data from R, Manipulating and processing data in R.	3
Unit 3: R packages and functions Building R Packages, Installing and loading packages, Running and Manipulating Packages, Setting up your working directory, Downloading and importing data, working with objects, Viewing Objects within Objects, Constructing Data Objects, Functions in R, Creating functions, calling functions, Writing R scripts.	3
Unit 4: Matrices, Arrays and Lists Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, Vector/Matrix Distinction, Avoiding Dimension Reduction, Higher Dimensional arrays. Lists – Creating lists, General list operations, accessing list components and values, applying functions to lists, recursive lists.	3
Unit 5: Data Frames Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors, Working with tables, functions are objects, Environment and Scope issues, Writing Upstairs, Recursion, Replacement functions, Tools for composing function code.	2

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Unit 6: Introduction to Graphical Analysis and plots Using Plots (Box Plots, Scatter plot, Pie Charts, Bar charts, Line Chart), Plotting variables, Designing Special Plots, Histograms.	2

List of Experiments			
Expt. No.	Name of Experiment	S/O	Hours
1	Installation of R and RStudio.	O	2
2	Demonstration of declaring R variables, objects, expressions, and vectors, assigning values, & Perform program for reading data from R and writing data into R.	O	2
3	Implementation of package in R & creates a program for calling functions in R.	O	2
4	Perform various matrix operations & implement the higher dimensional array in R.	O	2
5	Create list in R and perform various list operations to access list elements in R.	O	2
6	Create a data frame in R and perform various operations on data frame & Demonstrate the common functions on factors and tables in R	O	2
7	Demonstration of plots in R as Box Plots, Pie Charts, Bar charts, Line Chart.	O	2
8	Study of Simple Linear Regression and Multiple Regression in R.	S	2
9	Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.	O	2
10	Create and customize histograms using R programming	O	2
11	Show Advanced Plot Techniques with ggplot2	O	2
12	Perform complex data frame operations.	O	2
13	Perform advanced operations on lists or complex list manipulations	O	2

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14	Import a data from web storage. Name the dataset, and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not.	O	2
15	Mini-Project	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series.

2. Norman Matloff, "The Art of R Programming".

3. Big Data (Black Book)- DT Editorial Services- Dreamtech Press.

Reference Books:

1. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

2. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013.

3. Michael Akritas, " Probability & Statistics with R for Engineers and Scientists", 2nd Edition on, CRC Press, 2016.

Online Resources:

1. https://www.coursera.org/learn/r-programming

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Course Plan

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Course Title: Machine Learning Laboratory	
Course Code: 201AIMLP306	Semester: V
Teaching Scheme: L-T-P:0-0-2	Credits:1
Evaluation Scheme: ISE Marks: 25	ESE-POE Marks:25

Course Description:

This course focuses on implementation of machine learning theories and algorithms. The course is designed to develop Supervised Learning algorithms like Regressions, Multiclass Classification, Classifiers, Decision Tree, SVM and Clustering.

Course Objectives:

1. To apply classification algorithms to classify multivariate data
2. To understand the implementation of genetic algorithms
3. To describe, compare, and contrast different machine learning algorithms.

Course Outcomes (COs):

C306.1	Describe the types of problems that machine learning techniques are used to solve, and which machine learning algorithms are appropriate for solving each type of problem.
C306.2	Implement machine learning algorithms using labeled data.
C306.3	Implement solutions to complex, real world machine learning problems.
C306.4	Describe evaluation techniques for assessing and comparing machine learning techniques.

Prerequisite:	Basics of Machine Learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C306.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	3
C306.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3
C306.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3
C306.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	5

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Exp. No.	Name of Experiment	S/O	Hours
	List of Experiments		
1	Implementation of simple Linear Regression	O	2
2	Implementation of Multivariate Linear Regression	O	2
3	Implementation of Logistic Regression for Binary Classification	O	2
4	Implementation of Multiclass Classification	O	2
5	Implementation of KNN Classifier	O	2
6	Implementation of Naïve Bayes Classifier	O	2
7	Implementation of Bayesian Network	O	2
8	Implementation of Decision Tree	O	2
9	Implementation of SVM	O	2
10	Implementation of K-means Clustering	O	2
11	Implementation of Agglomerative Clustering	O	2
12	Design and analysis of sentiment analysis model	O	2

S-STUDY,O-OPERATIONAL

Note: All Experiments should be performed.

Text Books:

1. Machine Learning, Anuradha Srinivasaraghavan, and Vincy Joseph, Kindle Edition, 2020, WILEY.
2. Machine Learning– An Algorithmic Perspective by Stephen Marsland.

Reference Books:

1.Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources

https://www.coursera.org/learn/machine-learninghttps://nptel.ac.in/courses/106106139

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Course Plan

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Course Title: Database Engineering Laboratory	
Course Code: 201AIMLP307	**Semester: V**
Teaching Scheme: L-T-P: 0-0-2	**Credits: 1**
Evaluation Scheme: ISE Marks: 25	**ESE-POE Marks: 25**

Course Description:

This course focuses on implementation of the fundamental concepts and principles of database engineering. Focus is given on hands-on practical's considering SQL-DDL, DML, DCL commands, database connectivity and implementation of views.

Course Objectives:

1. To demonstrate fundamental concepts of database systems.
2. To gain familiarity with SQL, PLSQL and DBMS.
3. To construct the database for a given application.

Course Outcomes (COs):

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

C307.1	Install and use database management systems.
C307.2	Represent logical design of database using E-R Diagram.
C307.3	Apply and demonstrate SQL queries, PLSQL Procedures to design and manage the database.
C307.4	Analyze and construct good database design.

Prerequisite:	Set Theory and Data Structures

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C307.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
C307.2	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3
C307.3	-	3	3	1	-	-	-	-	-	-	-	2	2	-	3
C307.4	-	2	2	-	-	-	-	-	-	-	-	2	2	-	4

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Sr. No.	List of Experiments	S/O	Hours
1	ER Diagram of an Organization- Draw an E-R Diagram for any organization like Insurance Company, Library systems, College Management systems, Hospital Management systems etc. Use data modeling tools like Oracle SQL developer, To draw ER diagram.	S	2
2	Conversion of ER Diagram to Tables- Convert the Above mentioned E-R Diagram in Relational Tables.	S	2
3	DDL Statements – Execute DDL commands to create, alter, rename, truncate and drop tables in SQL. Apply all types of constraints such as primary key, foreign key, not null, unique, check.	O	2
4	DML Statements – Use DML Queries to insert, delete, update & display records of the tables.	O	2
5	SQL character functions, String functions – Display the results using String operations.	O	2
6	Aggregate functions – Display the records using Aggregate functions and Group by, having, between, Order by clauses.	O	2
7	Join operations and set operations – Display the results of union, intersection, set difference, Cartesian product and Join operations of two different tables.	O	2
8	Views, Sub queries –Create Views for the table . Solve sub queries for given questions	O	2
9	Demonstrate PLSQL Functions and Procedures.	O	2
10	Demonstrate Cursors, and triggers using PL/SQL.	O	2
11	Database Connectivity – Write a program of Database connectivity with any object oriented language.	O	2
12	Write a program to implement Static Hashing.	O	2
13	Study of DCL commands (Grant, Revoke)	O	2

S-STUDY,O-OPERATIONAL

   Note: Minimum 12 experiments to be performed based on above guide lines

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Text Books:

1. A. Silberschatz, H. F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill Education.
2. Thomos Connolly, Carolyn Begg, "Database Systems -   A practical approach to Design, Implementation and Management", 3rd Edition, Pearson Education.
3. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition, Cengage Learning
4. Ramez Elmasri and Shamkant Navathe, "Fundamentals of Database Systems", Pearson Education, Fifth Edition**.**

Reference Books:

1.Raghu Ramkrishnan, Johannes Gehrke, "Database Management System", Fourth Edition, McGraw Hill Education.

Online Resources:

1.https://onlinecourses.nptel.ac.in/noc19_cs46/preview

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Course Plan

Course Title: Cloud Computing Laboratory	
Course Code: 201AIMLP308	Semester: V
Teaching Scheme: L-T-P:0-0-2	Credits: 1
Evaluation Scheme: ISE Marks:25	ESE-POE Marks: Not Applicable

Course Description:

The course is designed to develop skills to design and analyze Cloud Computing. It strengthens the ability to the students to identify and apply the suitable Cloud Computing for the given real-world problem. It enables them to gain knowledge in practical applications of Cloud Computing.

Course Objectives:

1. To Configuring the Client/Server for Distributed System.
2. To learn the how to implement different services of cloud computing
3. To learn the deployment and configuration options in Amazon (AWS), Google Cloud, Microsoft Azure.

Course Outcomes (COs):

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

C308.1	Configure various virtualization tools such as Virtual Box, VMware workstation.
C308.2	Install OS on a Virtual Machine Monitor.
C308.3	Study and implementation of infrastructure as Service using Open Stack
C308.4	How to install and configure Google App Engine.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C308.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
C308.2	-	3	3	-	-	-	-	-	-	-	-	-	-	-	2
C308.3	-	2	2	-	-	-	-	-	-	-	-	-	1	-	3
C308.4	3	-	3	-	-	-	-	-	-	-	-	-	-	-	3

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List of Experiments			
Experiment No.	**Name of Experiments**	**S/O**	**Hours**
1	Implementation of RPC	O	2
2	Configuring the Client/Server for NTP	O	2
3	Simulation of Mutual Exclusion Algorithm.	O	2
4	Simulation of Election Algorithm	O	2
5	Working and Implementation of Infrastructure as a service.	O	2
6	Working and Implementation of Software as a service.	O	2
7	Working and Implementation of Platform as a services.	O	2
8	Practical Implementation of Storage as a Service.	O	2
9	Installing a private cloud.	O	2
10	Installing OS on a Virtual Machine Monitor.	O	2
11	Offline migration of virtual OS.	O	2
12	Live migration of virtual OS.	O	2
13	Study and implementation of infrastructure as Service using Open Stack.	O	2
14	Assignment to install and configure Google App Engine.	O	2
15	Hands on virtualization using Xen Server.	O	2
16	Hands on containerization using Docker.	O	2
17	Deployment and Configuration options in Amazon (AWS).	O	2
18	Deployment and Configuration options in Google Cloud.	O	2
19	Deployment and Configuration options in Microsoft Azure.	O	2

S-STUDY,O-OPERATIONAL

- **Note: Minimum of 12 Experiments to be performed from the list given above.**

Text Books:
1. Cloud Security, Ronald Krutz and Russell Dean Vines, Wiley-India.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge

Reference Books:
1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley India
2. Cloud Computing for Dummies, Judith Hurwitz, Marcia Kaufman, Fern Halper, Robin Bloor, Wiley Publication

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Course Plan

Course Title: Project – I	
Course Code: 201AIMLP309	Semester: V
Teaching Scheme: L-T-P: 0-0-2	Credits: 2
Evaluation Scheme: ISE Marks: 25	ESE-POE Marks: 50

Course Description:

This course gives emphasis on a problem-based learning approach. It is a group activity / work where students have to present an idea/ solution for the problem chosen. Then requirement analysis and design specification of the system is to be developed by the students. This is followed by software implementation of the design, testing and finally demonstrate the results obtained. This course helps the students to learn how to analyze the demands of a customer and represent them in the form of software requirements specification (SRS Document) including quality requirements. Ultimately, this course enhances students programming skills and enables them to learn how to perform requirements analysis, system designing, testing, coding and report writing.

Course Objectives:

1. To formulate the problem statement.
2. To follow the SDLC model for development of project.
3. To learn the skills of team building and team work.
4. To develop the logical skills and use of appropriate data structures for solving the engineering problems.

Course Outcomes (COs):
Upon successful completion of this course, the students will be able to:

C309.1	Frame appropriate problem statement for real time problem.
C309.2	Organize an effective project plan with clear objectives and prepare a synopsis.
C309.3	Design the various modules of the project to provide a solution to the problem with The help of various design tools.
C309.4	Develop the proposed system using suitable development platform.
C309.5	Able to present their work and prepare their project report.

Prerequisite:	Mathematics, Data Structures, Software Engineering and knowledge of Programming language.

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C309.1	2	2	-	2	-	-	-	-	-	-	-	-	1	-	2
C309.2	2	3	-	-	-	-	-	-	-	-	-	-	1	-	3
C309.3	-	-	2	-	2	-	-	-	-	3	-	-	1	-	3
C309.4	3	-	3	-	3	-	-	-	3	3	-	3	2	-	3
C309.5	-	-	-	-	2	-	-	-	3	3	-	2	1	-	3

Course Contents:

The Project-I should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project.

The group will select a project with the approval from the panel and submit the name of the project with a synopsis not more than 02 to 03 pages.

Project-I should consist of defining the problem and analyzing it, designing the solution and implementing it using a suitable programming language. A presentation and demonstration based on the above work is to be given by the group.

The work will be jointly assessed twice in a semester by a panel of teachers of the department. A hard copy of project report of the work done is to be submitted along with the softcopy of the project during ESE.

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Course Plan

Course Title: Human Values and Ethics (Mandatory Course-III)	
Course Code: 201AIMLMC310	Semester: V
Teaching Scheme: L-T-P: 2-0-0	Credits: Not Applicable
Evaluation Scheme: ISE Marks: Not Applicable	ESE Marks: 50

Course Description:

The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dog maor value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values.
2. To understand social responsibility of an engineer.
3. To appreciate ethical dilemma while discharging duties in professional life.

Course Outcomes (COs):

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

C310.1	Understand the significance of value inputs in a classroom and start applying them in Their life and profession
C310.2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
C310.3	Understand the role of a human being in ensuring harmony in society and nature.
C310.4	Distinguish between ethical and unethical practices, and start working out the strategy To actualize a harmonious environment wherever they work.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C310.1	-	-	-	-	-	1	-	2	-	-	-	2	-	2	2
C310.2	-	-	-	-	-	2	-	2	-	-	-	2	-	2	4
C310.3	-	-	-	-	-	2	2	2	2	-	-	2	-	2	2
C310.4	-	-	-	-	-	2	2	2	2	-	2	2	-	2	4

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Content	Hours
UNIT I: Introduction to Value Education Value Education, Definition, Concept and Need for Value Education. The Content and Process of Value Education. Basic Guidelines for Value Education. Self exploration as a Means of Value Education. Happiness and Prosperity as parts of Value Education.	4
UNIT II: Harmony in the Human Being Human Being is more than just the Body. Harmony of the Self ('I') with the Body. Understanding Myself as Co-existence of the Self and the Body. Understanding Needs of the Self and the needs of the Body. Understanding the activities in the Self and the activities in the Body.	4
UNIT III: Harmony in the Family, Society and in the Nature Family as a basic unit of Human Interaction and Values in Relationships. The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour. Harmony in Nature: The Four Orders in Nature. The Holistic Perception of Harmony in Existence.	6
UNIT IV: Social Ethics The Basics for Ethical Human Conduct. Defects in Ethical Human Conduct. Holistic Alternative and Universal Order. Universal Human Order and Ethical Conduct. Human Rights violation and Social Disparities.	6
UNIT V: Professional Ethics Value based Life and Profession. Professional Ethics and Right Understanding. Competence in Professional Ethics. Issues in Professional Ethics – The Current Scenario. Vision for Holistic Technologies, Production System and Management Models.	4
Unit VI: code of ethics for computer engineers: fundamental principles, human welfare, employers and clients, engineering profession and society.	4

Text Books:
1. A. N Tripathy, New Age International Publishers, 2003.
2. Bajpai B. L , , New Royal Book Co, Lucknow, Reprinted,2004.
3. Bertr and Russell Human Society in Ethics & Politics

Reference Books:
1. Corliss Lamont, Philosophy of Humanism
2. Gaur. R.R. ,Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books,2009.
3. Gaur. R. R. , Sangal. R, Bagaria. G. P, Teachers Manual Excel Books, 2009.
4. 4.I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar5.Mortimer.J. Adler,– Whatman has made of man.
5. William Lilly Introduction to Ethic Allied Publisher

Course Plan

Course Title: Advanced Database Systems	
Course Code: 201AIMLL311	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE+ MSE Marks: 20 + 30	ESE Marks: 50

Course Description:

This course focuses on different database systems like parallel databases, distributed databases and object relational databases. It also focuses on NoSQL, Data warehousing, Data mining and Web mining.

Course Objectives:

1. To acquire knowledge on parallel and distributed databases and its applications.
2. To understand the fundamentals of object oriented databases.
3. To study the usage and applications of SQL and NOSQL databases.
4. To understand the usage of data warehousing, data mining, web mining techniques.

Course Outcomes (COs):

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

C311.1	Understand and identify issues arising from parallel and distributed processing of data.
C311.2	Demonstrate the usage of object oriented databases.
C311.3	Compare and Contrast NoSQL databases with each other and Relational Database Systems.
C311.4	Make use of data mining, web mining techniques and business intelligence to solve problems

Prerequisite:	Database engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C311.1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	Understand
C311.2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	Apply
C311.3	2	-	2	-	-	-	-	-	-	-	-	-	2	-	Analyze
C311.4	-	2	2	-	-	-	-	-	-	-	-	-	-	-	Apply

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Content	Hours
Unit I: Parallel and Distributed Databases Parallel Systems, Parallel Database Architectures, Parallel Databases --I/O Parallelism, Design of Parallel Systems, Distributed Systems, Distributed Database Concepts, Distributed Data Storage, Distributed Transactions, Commit Protocols, Distributed Query Processing, Case Study-Distributed Databases in Oracle.	6
Unit 2: Object Relational Databases Motivating example, Structured data types, Operations on structured data, Encapsulation and ADTs, Inheritance, Objects, OIDS and Reference types, Database design for an ORDBMS, Object identity, Nested collections, Storage and access methods, Query processing and optimization, Comparison of RDBMS and ORDBMS. Case Study: Multimedia databases, spatial databases	5
Unit 3: NoSQL Database Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding Case Study: Cassandra, DynamoDB	7
Unit 4: Business Intelligence and Decision Support The Need for Data Analysis, Business Intelligence, Business Intelligence Architecture, Introduction to decision support, Data Warehousing, OLAP, Implementation Techniques for OLAP, Star Schemas, Views and decision support, View materialization, Maintaining materialized views. Case Study: Introduction to Business Intelligence tool- Power BI	5
Unit 5: Data Mining and Information Retrieval Introduction, Basic Data Mining Tasks, Data Mining Versus Knowledge Discovery in Databases, Data Mining Issues, Counting Co-occurrences, Mining for rules, Tree structured rules, Clustering: K-Means algorithm and BIRCH algorithm, Similarity search over sequences, Introduction to Information Retrieval: Vector space model, TF/IDF weighting of terms, indexing for text search	8
Unit 6: Web Mining Introduction, Web Content Mining, Crawlers, Harvest System, Virtual Web View, Personalization, Web Structure Mining, PageRank, HITS algorithm, Clever, Web Usage Mining, Preprocessing, Data Structures, Pattern Discovery, Pattern Analysis	5

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Text Books:

1. A. Silberschatz, H.F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill Education. (Unit 1)
2. Raghu Ramkrishnan, Johannes Gehrke, "Database Management System", Fourth Edition, McGraw Hill Education.(Unit 2, 4,5)
3. Pramod J. Sadalage and Marin Fowler "NoSQL Distilled: A brief guide to merging world of Polyglot persistence", Addison Wesley, 2012. (Unit 3)
4. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education (Unit 3)
5. Margaret H. Dunham "Data Mining" Pearson Education (Unit 5, 6)

Reference Books:

1. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011,ISBN 1743045743, 9781743045749
2. Ralph Kimball, "The Data Warehouse Lifecycle toolkit', 2nd edition, Wiley India.

Online Resources:

1. NoSQL-https://nptel.ac.in/courses/106104189

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SEM-VI (Academic Year - 2022-23)

Course Plan

Course Title: Advanced Machine Learning	
Course Code: 201AIMLL312	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE+ MSE Marks: 20+30	ESE Marks: 50

Course Description:

This course improves your understanding of machine learning. Explore advanced techniques and how to use them. The topics covered will be Artificial Neural Network, Back Propagation algorithm, Ensemble learning and Recommendation system, Dimensionality Reduction, Evolutionary Learning and Applications of Machine Learning.

Course Objectives:

1. To understand pattern classification algorithms to classify multivariate data
2. To understand the implementation of genetic algorithms
3. To understand new machine learning techniques.

Course Outcomes (COs):

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

C312.1	Develop models and apply machine learning frameworks to solve practical problems.
C312.2	Ability to select and implement machine learning techniques .
C312.3	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.
C312.4	Identify and integrate more than one techniques to enhance the performance of learning

Prerequisite:	Basics of Machine Learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C312.1	2	3	2	2	-	-	-	-	-	-	-	2	2	-	6
C312.2	2	2	2	2	-	-	-	-	-	-	-	2	1	-	3
C312.3	1	2	3	2	-	-	-	-	-	-	-	2	2	-	6
C312.4	2	2	2	2	-	-	-	-	-	-	-	2	1	-	2

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Content	Hours
Unit 1: Artificial Neural Network : The brain and the Neuron- Hebb's rule, McCulloch and Pits Neurons, Perceptron – Representational Power of Perceptrons ,The Perceptron Training Rule, Gradient Decent and Delta Rule, Mutlilayer Perceptron algorithm	06
Unit 2: Multilayer Network Feed forward Network- Multilayer networks and Back Propagation algorithm : The Differentiable Threshold Unit, The Back propagation Algorithm	06
Unit 3: Ensemble learning and Recommendation system Boosting-AdaBoost, stumping, Bagging: subagging, Introduction to Recommendation systems	06
Unit 4: Introduction to Evolutionary Learning and Reinforcement Learning Genetic Algorithm- Representing Hypothesis, Genetic Operators Fitness Function and Selection, Genetic Programming – Representing Programs , Illustrative Examples, Introduction of Reinforcement Learning	06
Unit 5: Dimensionality Reduction Linear Discriminant Analysis , Principal Component Analysis , Introduction of optimization	06
Unit 6: Applications of Machine Learning Introduction to application of Machine Learning, Image Processing and Pattern Recognition, Application in Bio- informatics, Application in Digital Forensics, Application in retails and finance.	06

Text Books:
1. Machine Learning – An Algorithmic Perspective by Stephen Marsland.

Reference Books:
1. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources:
https://livebook.manning.com/book/machine-learning-in-action/about-this-book/
https://www.coursera.org/learn/machine-learning
https://nptel.ac.in/courses/106106139

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Course Plan

Course Title: Information Security	
Course Code: 201AIMLL313	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	ESE Marks: 50

Course Description:

   This course aims to explore information security through some introductory content and gain an appreciation of the scope and context of the course. This includes a brief introduction to the principles of cryptography, security services mechanism, and network-level and system-level security concepts. It also explores the features of security services and packages that are practically used/or available for different types of OSI/TCP-IP reference models and relevant tools. Special focus is expected on learning non-cryptographic protocol vulnerabilities and taking appropriate precautionary measures against the possible threats and attacks on the end user Network system. The expected outcomes after taking the course are to gain awareness and acquire the required skills and knowledge for different roles of career opportunities in the field of information security.

Course Objectives:

1. To introduce the principles of Crypto-Systems.
2. To expose students to various security services and mechanisms used.
3. To make the students aware of the security features of PGP, S/MIME, Digital Signatures, IPSec & and SSL.
4. To make the students understand the system-level security issues concerning threats, intruders, and the use of firewalls and trusted systems.
5. To make students explore key cyber security compliance and industry Standards.

Course Outcomes (COs):

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

C313.1	Understand the principles of Crypto-systems.
C313.2	Compare and analyze various security services and mechanisms
C313.3	Discuss and use the features of PGP, S/MIME, DSA, IPSec, and SSL in their profession.
C313.4	Define precautions of their personal computing system from possible threats and attacks.
C313.5	Explore key cyber security compliance and industry Standards

Prerequisite:	Student Must have knowledge of C programming language and OOP's concepts.

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C313.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C313.2	2	2	-	-	-	-	-	-	-	2	-	2	-	-	1
C313.3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3
C313.4	2	-	2	-	2	-	-	-	-	-	-	-	-	-	2
C313.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
Unit 1.Introduction The OSI Security Architecture, Symmetric Cipher Models: Substitution Techniques, Transposition Techniques, Block Cipher Principles, The Data Encryption Standard.	6
Unit2: Principles of Public-Key Crypto systems The RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Authentication requirements, Authentication functions, MAC and Hash functions and their requirements,	5
Unit 3: Digital Signature Digital Signature Standard, Authentication applications - Kerberos, X.509 Authentication service	6
Unit4: Email Security PGP, S/MIME, IP Security - IP Security Architecture, Authentication Header and Encapsulating Security Payload.	6
Unit5: Web and System Security Secure Socket Layer and Transport Layer Security, Secure Electronic Transactions, Intruders, Intruder Detection, Password Management, Firewall Design Principles, Trusted Systems.	7
Unit 6: key cyber security compliance and industry Standards Introduction to GTA, Zero Trust architecture, End Point Security-Introduction, types & examples, SASE: introduction & component of SASE Software Security Software Vulnerabilities: Buffer Overflow, Salami Attack, Format string, cross-site scripting, SQL injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Root kits Introduction to Secured Software Development Life Cycle. Case Study on Software Security.	6

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Text Books:
1. William Stallings, "Cryptography and Network Security", Pearson Education, (Unit I to V)
2. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, (Unit –VI)

Reference Books:
1. Atul Kahate, "Cryptography and network security", TMGH.
2. Forouzan, "Cryptography and Network Security ",TMGH.
3. Joshi et. al, "Network Security Know it All", Morgan Kaufmann Publisher

Online Resources:

1. **https://www.classcentral.com/course/swayam-cyber-security-13978**

2. **https://onlinecourses.swayam2.ac.in/nou19_cs08/preview**

3.   **https://www.coursera.org/browse/computer-science/algorithms**

Professional Elective-I
Course Plan

Course Title: Human Computer Interaction(Professional Elective-I)	
Course Code: 201AIMLL314	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE +MSE Marks: 20 + 30	ESE Marks: 50

Course Description: This course gives in depth knowledge of Human Computer Interaction from the view point of human information processing. Various typical human-computer interaction models, styles and various historic HCI paradigms are included in course.

Course Objectives:
The main objective is to get student to think constructively and analytically about how to design and evaluate interactive technologies.

Course Outcomes (COs):
Upon successful completion of this course, the students will be able to:

C314.1	Explain the capabilities of both humans and computers from the view point of human information processing.
C314.2	Describe typical human– computer interaction (HCI) models, styles, and various historic HCI paradigms.
C314.3	Apply an interactive design process and universal design principles for designing HCI systems.
C314.4	Describe and use HCI design principles, standards and guidelines.
C314.5	Analyze and identify user models, user support, socio- organizational issues, and stakeholder requirements of HCI systems.
C314.6	Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.

Prerequisite:	Web Technologies, Software Engineering, Basic knowledge of designing tools and languages like HTML and Java.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C314.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
C314.2	3	3	-	2	-	-	-	-	-	-	-	-	-	-	2
C314.3	3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
C314.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
C314.5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
C314.6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	4

Content	Hours
UNIT1: Introduction Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession. **Managing Design Processes**: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories.	6
UNIT2: Menu Selection, Form Fill- In and Dialog Boxes Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Dataen try with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays.	6
UNIT3: Command and Natural Languages Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing. **Interaction Devices**: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays – Small and large.	6
UNIT4: Quality of Service Introduction, Models of Response –Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences. **Balancing Function and Fashion**: Introduction, Error Messages, Non anthropomorphic Design, Display Design, Web Page Design, Window Design, Color.	6
UNIT5: User Documentation and Online Help Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.	6
UNIT6: Information Search Introduction, searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces. **Information Visualization:** Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization.	6

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed , Ben Shneider man, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential guide to user interface design, 2/e, Wilbert O Galitz, Wiley Dreama Tech.

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Reference Books:

1. Human Computer, Interaction Dan R. Olsan , Cengage, 2010.
2. Designing the user interface. 4/e, Ben Shneider man, PEA.
3. User Interface Design, Soren Lauesen, PEA.

Course Plan

Course Title: Ethics in AI (Professional Elective-I)	
Course Code: 201AIMLL315	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits: 3
Evaluation Scheme: ISE+MSE Marks: 20 + 30	ESE Marks: 50

Course Description:

Artificial intelligence (AI) is developing at an extremely rapid pace. We should expect to see significant changes in our society as AI systems become embedded in many aspects of our lives. This course will cover philosophical issues raised by current and future AI systems. It will help to establish societal and policy guidelines for such systems to remain human centric, serving human values and ethical principles.

Course Objectives:
1. To introduce the principles of AI & Ethical Decision making.
2. To expose students to basics of ethical AI system.
3. To understand the near future of Artificial Intelligence.
4. To make the students understand long term impact of super intelligence.
5. To understand the artificial intelligence consciousness & its moral states.
6. To make students understand the need of responsible AI system.

Course Outcomes (COs):
Upon successful completion of this course, the students will be able to :

C315.1	Describe the principles of AI & Ethical Decision making.
C315.2	Apply ethics rules & regulations while designing the AI system.
C315.3	Describe near future & long- term impact of super intelligence.
C315.4	Illustrate the artificial intelligence consciousness & its moral states.
C315.5	Analyze the need of responsible AI system.

Prerequisite:	Artificial Intelligence, Professional Ethics.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C315.1	3	2	-	2	-	-	-	3	-	-	-	-	-	1	2
C315.2	-	2	-	2	-	1	1	3	-	-	-	-	-	1	3
C315.3	-	-	-	3	-	2	2	-	-	-	-	3	-	2	2
C315.4	3	-	-	2	-	-	2	3	-	-	-	3	-	2	2
C315.5	2	2	-	3	-	-	1	-	-	-	-	2	-	2	4

Content	Hours
Unit1: INTRODUCTION **Artificial Intelligence-** Autonomy, Adaptability and Interaction. **Ethical Decision Making :-**Ethical Theories, Values, Ethics in Practice, Implementing ethical reasoning	6
Unit2: ETHICAL AI SYSTEM Ethical action, Approaches to ethical reasoning by AI, Designing Artificial Moral Agents, Implementing Ethical Deliberation, Levels of ethical behavior, The ethical status of AI system.	7
Unit3: THE NEAR FUTURE OF ARTIFICIAL INTELLIGENCE Planning for Massun employment, Autonomous weapons and the ethics of artificial intelligence. Near – term artificial intelligence and the ethical Matrix, The ethics of artificial lovers.	7
Unit4: LONG TERM IMPACT OF SUPER INTELLIGENCE Public policy and super intelligence, alignment for advanced learning systems, Moral Machines, machine learning Values.	5
Unit5: ARTIFICIAL INTELLIGENCE , CONSCIOUSNESS AND MORAL STATUS Testing for consciousness in Machines, Designing AI with rights, consciousness, Self-respect & freedom, The moral status & rights of Artificial Intelligence.	6
Unit6: ENSURING RESPONSIBLE ARTIFICIAL INTELLIGENCE Governance for responsible AI, Code of Conduct, Inclusion & Diversity, AI & society, Responsible Artificial Intelligence.	5

Text Books:
1. Mark Coeckel bergh,“ AI Ethics ”, The MIT Press Essential Knowledge series.
2. Meredith Broussard,“ Artificial Un intelligence–How Computers Misunderstand the World ”, The MIT Press Essential Knowledge series.

Reference Books:

1. S. Mathewliao, " Ethics of Artificial Intelligence ",Oxford University Press.
2. Virginia Dignum," Responsible Artificial Intelligence - How to develop & use Ai in responsible way ", Springer.

Online Resources:

https://www.coursera.org/learn/ethics-of-artificial-intelligence

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Course Plan

Course Title: Advanced Data Structures(Professional Elective-I)	
Course Code: 201AIMLL316	Semester: VI
Teaching Scheme: L-T-P: 3-0-0	Credits : 3
Evaluation Scheme: ISE+MSE Marks: 20+30	ESE Marks: 50

Course Description:

The course is intended to provide the foundations of the usage of Data structure and Algorithms to ensure that the student evolves into a competent programmer capable of designing and analyzing the algorithms and data structures, and also expose the student to the algorithm analysis techniques.

Course Objectives:

1. To expose the students to advanced concepts of data structures.
2. To Apply Hashing, Disjoint sets and String-Matching techniques for problem solving.
3. To implement the concepts of advanced Trees and Graphs
4. To analyze the given problem and choose appropriate Data Structures.

Course Outcomes (COs):
  Upon successful completion of this course, the students will be able to:

C316.1	Understand the advanced Hashing and Priority queue concepts
C316.2	Apply the concepts of Trees and Graphs for solving problems effectively
C316.3	Interpret the problems effectively using Disjoint sets and String Matching techniques
C316.4	Analyze the given scenario and choose appropriate Data Structure for solving problems

Prerequisite:	Basic Data Structure concepts, OOP concepts.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C316.1	2	2	2	1	-	-	-	-	-	-	-	1	2	2	2
C316.2	2	2	2	1	-	-	-	-	-	-	-	1	2	2	3
C316.3	2	2	2	1	-	-	-	-	-	-	-	1	2	2	3
C316.4	2	2	2	1	-	-	-	-	-	-	-	1	2	2	4

Content	Hours
Unit 1: Hashing Techniques General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.	05
Unit2: Priority Queues Basic model of priority queue, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations .Binomial Queues: Binomial Queue Structure, Binomial Queue Operations,	07
Unit3: Trees AVL: Single Rotation, Double Rotation, B-Trees, Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. Red-Black Trees– Properties of red-black trees, Rotations, Insertion, Deletion	08
Unit4: Graphs Algorithms Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm	08
Unit 5: Disjoint Set Class Equivalence relation ,Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm.	04
Unit 6: String Matching – The naive string- matching algorithm, The Rabin-Karp algorithm, The Knuth- Morris –Pratt algorithm.	04

Text Books:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014 Pearson.
2. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, 2009,The MIT Press.

Reference Books:

1. Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahani and Rajase kharam, 2nd Edition, 2009, University Press Pvt. Ltd.

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Online Resources:

https://nptel.ac.in/courses/106102064

Easy to Advanced Data Structures (Simpliv) | MOOC List (mooc-list.com)

https://www.coursera.org/learn/data-structures-algorithms-4

Open Elective-I
Course Plan

Course Title: Applications of AI-ML(Open Elective-I)	
Course Code: 201AIMLL317	Semester: VI
Teaching Scheme: L-T-P: 3-1-0	Credits: 4
Evaluation Scheme: ISE+ MSE Marks: 20+30	ESE Mark:50

Course Description:

AI is a part of computer science based on theoretical and applied principles of that field. This course is an introduction to the theoretical aspects of the design and implementation of applications of AI as well as ML. AI consists of understanding and implementing the basic application oriented principles and concepts of AI using an appropriate technique. AI-ML applications include the use of computers to do reasoning, pattern recognition, Image and Text processing learning or some other form of inference.

Course Objectives:

1. To give deep knowledge of Artificial Intelligence & Machine Learning and how AIML can be applied in various fields to make the life easy.
2. To develop professional skills that prepares them to recognize emotions using human face and body language.
3. To develop self-driven system that can make student's industry ready.

Course Outcomes (COs):

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

C317.1	Develop an understanding of Artificial Intelligence (AI) and Machine Learning methods and describe their foundations.
C317.2	Understand development of systems that process unstructured, uncrated data automatically using artificial intelligence (AI) frameworks and platforms.
C317.3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems other machine learning models.
C317.4	Apply different method to analyze Image, Text and video processing techniques.
C317.5	Implement AI frameworks and platforms to improve business, organizational, and technology outcomes.

Prerequisite:	Knowledge of basic Computer Algorithms, Linear Algebra, Statistics, Probability Theory.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C317.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
C317.2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	2
C317.3	3	3	3	2	3	-	-	-	-	-	-	2	2	-	3
C317.4	3	3	3	2	3	-	-	-	-	-	-	2	2	-	3
C317.5	3	3	3	2	3	-	-	-	-	-	-	2	2	-	3

Content	Hours
Unit1:Artificial Intelligence Definitions- Importance of AI ,Evolution of AI- Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty and towards Learning Systems.	06
Unit 2: Machine Learning Machine Learning: Definition, Terminology, Types of learning, Machine Learning Problem categories, Machine process, Life cycle, Performance measures, tools and framework, data visualization.	06
Unit3: AI based Face Detection & Recognition Emotion Recognition using human face and body language, AI based system to predict the Diseases early, AI based biometric system.	06
Unit4: Image Processing Image Processing Image Processing and Pattern Recognition, Application in Bio-informatics, Application in Digital Forensics.	06
Unit5:Text Mining Introduction to text mining, Methods and techniques of text mining, Application of text mining, Linguistic aspects of natural language processing.	06
Unit6: AIML For business A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business, ML in Social Problems handling, Application in retails and finance. AI Platforms-Azure ML, Google AI, Swift AI.	08

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List of Assignments						

Sr. No.	Name of Assignments	S/O	Hours
1	Write a program to predicting user's next location.	O	1
2	Write a program to detecting YouTube comment spam.	O	1
3	Write a program to identifying the genre of a song.	O	1
4	Write a program to shock front classification.	O	1
5	Write a program to develop a Human Face Recognition.	O	1
6	Write a program to develop Speech Recognition System.	O	1
7	Write a program to develop system for Email Spam and Malware filtering.	O	1
8	Write a program to detecting online fraud.	O	1
9	Case study on Real time application on AI ML 　　　　i) Self-driving cars. 　　　　ii) Virtual personal assistant. 　　　　iii) Medical diagnosis.	S	1

Text Books:
1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley & Sons.
2. Artificial Intelligence & Soft Computing for Beginners, 3rd Edition- 2018, by Anindita Das , Shroff Publisher Publisher.
3. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
4. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd

Reference Books:
1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson EducationIndia,6 January 2015.
2. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources:
https://nptel.ac.in/courses/106/102/106102220/
https://onlinecourses.nptel.ac.in/noc21_ge20/preview
https://www.coursera.org/learn/machine-learninghttps://nptel.ac.in/courses/106106139

Course Plan

Course Title: Fundamentals of Data Science Laboratory	
Course Code: 201AIMLP318	Semester: VI
Teaching Scheme: 2-0-2	Credits: 3
Evaluation Scheme: ISE Marks: 25	ESE-POE Marks:50

Course Description: This course is for students with basic programming and data structure background. The aim is to make them a breast with common tools used for Data Science application development. It serves as an introduction to the basics of data science including programming for data analytics.

Course Objectives:
1. To provide the students with the basic knowledge of Data Science.
2. To make the students develop solutions using Data Science tools.
3. To introduce them to Python packages and their usability.

Course Outcomes (COs):
Upon successful completion of the course, student will be able to

COs	
C318.1	Recognize different Data Science process and their application areas.
C318.2	Apply Data Science tools to provide solution to engineering problems.
C318.3	Apply different Python Libraries to provide solution to problems
C318.4	To demonstrate the use of skills for proper usage of online data sets for data preprocessing.

Prerequisite : Knowledge of Statistics, Data Structures and Algorithms.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C318.1	2	1	-	-	-	-	-	-	-	-	-	2	-	-	2
C318.2	2	-	2	2	2	-	-	-	-	-	-	2	2	-	3
C318.3	2	2	2	-	2	-	-	-	-	-	-	2	2	-	2
C318.4	2	-	2	2	2	-	-	-	-	-	-	2	-	-	3

Content	Hours
Unit 1: Data Science and Its Scope: What Is Data Science, Role of Statistics in Data Science, A Brief History , Some Technologies used in Data Science, Benefits and uses of data science, Facets of data, Understanding the data science process, data error minimization.	6
Unit 2: Introduction to NumPy: Creating Arrays from Scratch, NumPy Standard Data Types, The Basics of NumPy Arrays, Array Indexing, slicing, reshaping, Concatenation, splitting, Computation on NumPy Arrays: Universal Functions, Aggregations: Min, Max, Comparison operator, Boolean arrays. **Data Manipulation with Pandas:** Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing. **Combining Datasets**: Concatenate and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables	6
Unit 3: Visualization with Matplotlib: General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Bindings, and Density, feature engineering.	4
Unit 4: Exploratory Data Analysis Fundamentals: Steps in EDA, Numerical data, categorical data, measurement scale, software tools for EDA. data transformation, data analysis.	6
Unit 5: Descriptive Statistics: Understanding statistics, Measures of central tendency:-mean, mode, median, Measures of dispersion:-Standard deviation, variance ,skewness, k urtosis, percentile, quartile.	6
Unit 6:Grouping dataset and Advance data visualization tool: Understanding groupby(), group by mechanics, data aggregation-groupwise operation, GroupWise transformation, Types of analysis, Advance data visualization tool: Tableau-Connecting to data, Creating Sheets and Dashboards, Publishing to the web	6

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Sr. No.	Name of Experiment	S/O	Hours
1	Implementation of Array operations using Numpy	O	2
2	Implementation of universal function in Numpy.	O	2
3	Implementation of data Operation in Pandas.	O	2
4	Implementation of data set Operations in Pandas	O	2
5	Implementations of Different graphs in Matplot lib.	O	2
6	Implementations of Different chart , plots in Matplot lib	O	2
7	Program to get statistical characteristics of data set using pandas	O	2
8	Implementation of data transformation-Handling missing data, filling missing data	O	2
9	Implementation of different distributions (normal, Poisson , uniform, gamma)	O	2
10	Program on Data cleaning	O	2
11	Implementation of grouping and group by	O	2
12	Create simple dashboard using tableau	O	2

❖ **S-Study, O-Operational**

❖ **Note: All Experiments are mandatory. For experiment number 12 instructor has to form groups and give activity in the batch.**

Reference Books:

1. DR. Amar Sahay,“ Essentials of Data Science and Analytics ”,O ’REILLY Publication.
2. Jake Vander Plas ,“ Python Data Science Hand book: Essential Tools for Working with Data ”, O’REILLY Publication.
3. Wes McKinney, “ Python for Data Analysis ”, O’REILLY Publication.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs23/preview

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Course Plan

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Course Title: Advanced Database Systems Laboratory	
Course Code: 201AIMLP319	**Semester: VI**
Teaching Scheme: L-T-P: 0-0-2	**Credits: 1**
Evaluation Scheme: ISE Marks : 25	**ESE Marks: Not Applicable**

Course Description:

This course focuses on different database systems like parallel databases, distributed databases and object relational databases. It also focuses on NoSQL, Data warehousing, Data mining and Web mining.

Course Objectives:

1. To acquire knowledge on parallel and distributed databases and its applications.
2. To understand the fundamentals of object oriented databases.
3. To study the usage and applications of SQL and NOSQL databases.
4. To understand the usage of data warehousing, data mining, web mining techniques.

Course Outcomes (COs):

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

C319.1	Understand and identify issues arising from parallel and distributed processing of data.
C319.2	Demonstrate the usage of object oriented databases.
C319.3	Compare and Contrast NoSQL databases with each other and Relational Database Systems.
C319.4	Make use of data mining, web mining techniques and business intelligence to solve problems

Prerequisite:	Database engineering

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C319.1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	2
C319.2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
C319.3	2	-	2	-	-	-	-	-	-	-	-	-	2	-	4
C319.4	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3

Minimum 12 experiments to be performed based on following guidelines:

Sr. No.	List of Experiments	S/O	Hours
1	Implement partitioning techniques on parallel databases.	O	2
2	Implement vertical or horizontal fragmentation in distributed DBMS.	O	2
3	Implement semi join in distributed DBMS.	O	2
4	Implementation of 2 Phase Commit protocol for distributed databases.	O	2
5	Create structured data types of ORDBM Sand per form operations- create table using structured data types, insert data and solve queries.	O	2
6	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)	O	2
7	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)	O	2
8	Implement aggregation with suitable example using MongoDB	O	2
9	Implement Map Reduce operation with suitable example using MongoDB	O	2
10	Demonstrate all OLAP operations and cube operator in OLAP.	O	2
11	Implement A-priori algorithm in data mining.	O	2
12	Implement K-Means clustering algorithm.	O	2
13	Implement Inverted index.	O	2

Text Books:

1. A. Silberschatz, H.F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, Mc Graw Hill Education.
2. Raghu Ramkrishnan, Johannes Gehrke," Database Management System ", Fourth Edition, McGraw Hill Education.
3. Pramod J. Sadalage and Marin Fowler " NoSQL Distilled: A brief guide to merging world of Poly glotpe rsistence", Addison Wesley, 2012.
4. NoSQL for Mere Mortals-Dan Sullivan-1st Edition, Pearson Education
5. Margaret H. Dunham "Data Mining " Pearson Education

Reference Books:

1. Kevin Roebuck ," Storing and Managing Big Data-NoSQL, HADOOP and More ", Emereo Pty Limited, 2011,ISBN1743045743, 9781743045749
2. Ralph Kimball, " The Data Warehouse Lifecycle toolkit ',2nd edition,Wiley India.

Online Resources:

1. NoSQL-https://nptel.ac.in/courses/106104189

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Course Plan

Course Title: Advanced Machine Learning Laboratory	
Course Code:201AIMLP320	Semester :VI
Teaching Scheme: L-T-P: 0-0-2	Credits: 1
Evaluation Scheme: ISE marks: 25	ESE – POE Marks: 25

Course Description:

This course improves understanding of advanced machine learning concepts. It will explore advanced techniques and how to use them. The experiments covered will be based on Artificial Neural Network, Back Propagation algorithm, Ensemble learning and Recommendation system, Dimensionality Reduction, Evolutionary Learning and Applications of Machine Learning.

Course Objectives:

4. To understand pattern classification algorithms to classify multivariate data
5. To understand the implementation of genetic algorithms
6. To understand new machine learning techniques.
7. To learn and understand various image transform used in digital image processing

Course Outcomes (COs):

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

C320.1	Develop models and apply machine learning frameworks to solve practical problems.
C320.2	Ability to select and implement machine learning techniques.
C320.3	Use different machine learning techniques to design AI machine and developing Applications for real world problems.
C320.4	Identify and integrate more than one techniques to enhance the performance of learning

Prerequisite:	Basic Machine Learning concepts, Algorithms, Python programming

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C320.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	L-2
C320.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	L-2
C320.3	2	2	2	2	-	-	-	-	-	-	-	2	2	-	L-2
C320.4	2	3	2	2	-	-	-	-	-	-	-	2	-	-	L-3

List of Experiments			
Exp. No.	Name of Experiment	S/O	Hours
1	Implement Artificial Neural Network	S	2
2	Implement Feed Forward Network	O	2
3	Implement Back Propagation Algorithm	O	2
4	Implement Boosting algorithm.	O	2
5	Implement Bagging algorithm.	O	2
6	Implement a program of recommendation system	O	2
7	Implement a program of Genetic algorithm system	O	2
8	Implement Reinforcement algorithm	O	2
9	Implement Optimization algorithm.	O	2
10	Design , Implement and Analyze Image Processing with example	O	2
10	Design , Implement and Analyze Pattern Recognition with example	O	2
11	Design , Implement and Analyze Digital Forensics with example	O	2
12	Design , Implement and Analyze Bioinformatics with example	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:
1. Machine Learning – An Algorithmic Perspective by Stephen Marsland.

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Reference Books:

1. Digital Image Processing Using MATLAB
2. Principles of Digital Image Processing, Core Algorithms Wilhelm
3. Fundamentals of Digital Image Processing by Sanjay Sharma
4. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources:

1. https://www.coursera.org/courses?query=image%20processing
2. https://onlinecourses.nptel.ac.in/noc19_ee55/preview
3. https://www.superdatascience.com/pages

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Course Plan

Course Title: Project-II	
Course Code: 201AIMLP321	Semester: VI
Teaching Scheme: L-T-P: 0-0-2	Credits: 1
Evaluation Scheme: ISE Marks: 50	ESE-POE Marks: 50

Course Description

This course emphasis on a Project-based learning approach. It is a group activity /work where students have to present an idea/ solution for the problem chosen. The project should enable the students to combine the theoretical and practical concept applied in his / her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and troubleshooting of their respective problem chosen for the project. Ultimately this course enhances students programming skills and enable them to learn how to perform requirements analysis, system designing, testing, coding and report writing and to find scope for further development of project.

Course Objectives
1. To expose the students to use engineering approaches to solve problems in real time.
2. To use appropriate and more recent technologies in the development of the project.
3. To learn the techniques of working together in at exam.

Course Outcomes (COs)

At the end of the course the student should be able to:

C321.1	Identify specific problem statement from a selected domain.
C321.2	Analyze the problem and prepare SRS and design document.
C321.3	Write code and carry out testing.
C321.4	Write a report covering details of the project and give presentation on a project.

Prerequisite:	Mathematics, Data Structures, Software Engineering and knowledge of Programming language.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C321.1	2	3	-	-	-	2	2	-	-	-	-	-	-	2	2
C321.2	2	3	3	3	2	-	-	-	-	-	-	-	-	2	4
C321.3	-	-	3	-	2	-	-	-	-	3	2	-	3	3	6
C321.4	-	-	3	-	3	-	-	-	3	3	2	3	-	-	5

Course Contents

The Project should be undertaken by a group of 2 to 3 students and every group supposed to select powerful machine learning methods / advanced algorithms from advanced machine learning course. The group should define & analyze the selected problem, design the solution and implementing it using suitable machine learning framework. A synopsis approval presentation should be conducted where the student shall propose the project work. The Project work should be evaluated by a panel of teachers appointed by the department based on a minimum of two reviews. Review I & II should be conducted for 25 Marks using rubrics I & II. Final ISE marks should be the total of review I & II. Final ESE exam should be conducted for 50 marks using rubrics III. It is desirable that the student participates in project competitions, hackathon and paper presentation. Student should not involve in out-sourcing of the project work.