BIKANER TECHNICAL UNIVERSITY, BIKANER

SYLLABUS

B. TECH.

MACHINE LEARNING AND COMPUTING
Effective From Session: 2020-21

3ML2-01: Probability for Computer Scientists

S.N	Content	Hours
1	Introduction: Objective, scope and outcome of the course	1
2	Introduction to Discrete random variables: Sample space, events, algebra of events, Bernoulli's trials. Probability & Baye's theorem. Random variable and their event space, probability generating function, expectations, moments, computations of mean time to failure, Bernoulli & Poisson processes	8
3	Discrete and continuous distributions: Probability distribution and probability densities: Binomial, Poisson, normal rectangular and exponential distribution and their PDF's, moments and MGF's for above distributions	8
4	Correlation and regression: Linear regression, Rank correlation, Method of least squares Fitting of straight lines and second degree parabola. Linear regression and correlation analysis	8
5	Queuing Theory: Pure birth, pure death and birth-death processes. Mathematical models for M/M/1, M/M/N, M/M/S and M/M/S/N queues.	8
6	Discrete Parameter Markov chains: M/G/1 Queuing model, discrete parameter birth-death process. Markov Processes, Hidden Markov Models	7
	Total	40

Text/References:

1. Probability, Statistic s & Random Process By T. Veerajan, TMH
2. Fundamental of Mathematical Statistics By S.C. Gupta and V.K. Kapoor, Sultan hand & sons.
3. Statistics and Probability Theory By Jain & Rawat ,CBC
4. Statistics and Probability Theory By Schaum's, T.M.H.
5. Probability and Statistics with Reliability, Queuing, and Computer Science Applications, by K. Trivedi, John Wiley and Sons, New York, second edition (2002)
6. Probability and Statistics for Computer Scientists, by M. Baron, Chapman & Hall/CRC Press (2007)
7. Concepts in Probability and Stochastic Modeling, by J. J. Higgins and S. Keller-McNulty, Wadsworth Publishing House (1995)

3ML1-02: Technical Communication

SN	CONTENTS	Hours
1	**Introduction to Technical Communication- Definition** of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4

2	**Comprehension of Technical Materials/Texts and Information Design & development- Reading** of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	**6**
3	**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, and Minutes of Meetings.	**8**
4	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	**8**
	TOTAL	**26**

3ML1-03: Managerial Economics and Financial Accounting.

SN	CONTENTS	Hours
1	**Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	**4**
2	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	**5**
3	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	**5**
4	**Market structure and pricing theory-** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	**4**

5	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds- flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	**8**
	TOTAL	**26**

3ML3-04: Digital Electronics

SN	CONTENTS	Hours
1	**Fundamental concepts:** Number systems and codes, Basic logic Gates and Boolean algebra: Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra.	**8**
2	**Minimization Techniques and Logic Gates**: Principle of Duality - Boolean expression -Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions– Quine - McCluskey method of minimization.	**8**
3	**Digital Logic Gate Characteristics:** TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS& CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET.	**8**
4	**Combinational Circuits:** Combinational logic circuit design, adder, subtractor, BCD adder encoder, decoder, BCD to 7-segment decoder, multiplexer demultiplexer.	**8**
5	**Sequential Circuits:** Latches, Flip-flops - SR, JK, D, T, and Master-Slave Characteristic table and equation, counters and their design, Synchronous counters – Synchronous Up/Down counters – Programmable counters – State table and state transition diagram ,sequential circuitsdesign methodology. Registers –shift registers.	**8**
	TOTAL	**40**

Text/References:

1. Digital integrated electronics, By Herbert Taub, Donald L. S hilling, TMH
2. Digital Logic and Computer Design By M. Morris Mano, Pearson
3. Modern Digital Electronics By R.P. Jain, TMH
4. Fundamentals of Digital circuits By A. Anand kumar, PHI
5. Digital circuit design By S. Salivahanan, Sarivazhagan, Vikas publications

3ML4-05: Data structures and Algorithms

SN	CONTENTS	Hours
1	Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	8
2	Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues-Round Robin Algorithm. Circular Queues, DeQueue Priority Queues. Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, Reversing a single linked list, Advantages and disadvantages of single linked list, circular linked list, double linked list and Header linked list.	10
3	Searching Techniques: Sequential and binary search. Sorting Techniques: Basic concepts, Sorting by: bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, radix sort and counting sorting algorithms.	7
4	Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree , B+ tree, AVL tree, Threaded binary tree.	7
5	Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree(Prims &Kruskal), Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculationtechniques, Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	8
	TOTAL	**40**

Text/References:

1. An Introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH
2. Data Structures in C/C++, Horowitz, Sawhney, Galgotia
3. Data Structures in C/C++, Tanenbaum, Pearson
4. Data Structures and Algorithms, Aho and Ullman

3ML4-06: Concepts in Artificial Intelligence

S.N	Content	Hours
1	Introduction: Objective, scope and outcome of the course	1
2	Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.	7

3	Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic , logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, inferencing, monotonic and nonmonotonic reasoning. Introduction to prolog.	**8**
4	Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.	**8**
5	Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, min-imax procedure, alpha-beta cut-offs. Complexity of alpha-beta sear h. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multi-agent planning	**8**
6	Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models	**8**
	Total	**40**

Text/References:

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Introduction to AI & Expert System: Dan W. Patterson, PHI.
3. Artificial Intelligence by Luger (Pearson Education)
4. Russel & Norvig, Artificial Intelligence: A Modern Approach, Pearson Education

3ML4-07: Object Oriented Programming in Java

S.N	Content	Hours
1	Introduction: Objective, scope and outcome of the course	**1**
2	Programming methodologies (Design, Flow chart, Pseudo code). Lexical elements, data types, operators and expressions. Control structures. Classes and objects. Methods and messages. Classification, generalization and specialization. Constructs of an OOP language. Features of JAVA, byte code, JVM.	**10**
3	Introduction to different programming paradigm, characteristics of OOP, Class, Object, data member, member function, structures in java, different access specifiers, defining member function inside and outside class, array of objects. Packages, CLASSPATH, access modifiers, defining and implementing interfaces.	**10**
4	Dynamic memory allocation: Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function over- loading, function with default arguments, constructors and destructors, friend function and classes, using *this* pointer. Inheritance: types of inheritance, virtual base class, function overriding, abstract class and pure virtual function.	**10**

5	Constant data member and member function, static data member and member function, polymorphism, operator overloading, dynamic binding and virtual function. Modularity. Exception handling, Template, Stream class, File handling.	**10**
	Total	**41**

Note: The platform for this course shall be Core-Java

Text/References:

1. C. S. Horstmann and G. Cornell, Core Java 2 (Volume I-Fundamentals), Prentice Hall, 9th Edition, 2012.
2. H. M. Deitel and P. J. Deitel, Java How to Program, Prentice Hall, 9th Edition,2012.
3. A. Kak, Programming with Objects: A Comparative Presentation of Object Oriented Programming with C++ and Java, Wiley-IEEE Press, 2003.
4. D. Liang, Introduction to Java Programming, Prentice Hall, 9th Edition, 2014
5. G. Booch, R. A. Maksimchuk, M. W. Engel, and B J. Young, Object- oriented Analysis and Design with Applications, Addison-Wesley, 3rd Edition, 2007.

3ML4-21: Data Structures and Algorithms Lab

SN	Contents
1	Write a simple C program on a 32 bit compiler to understand the concept of array storage, size of a word. The program shall be written illustrating the concept of row major and column major storage. Find the address of element and verify it with the theoretical value. Program may be written for arrays up to 4-dimensions.
2	Simulate a stack, queue, circular queue and de-queue using a one dimensional array as storage element. The program should implement the basic addition, deletion and traversal operations.
3	Represent a 2-variable polynomial using array. Use this representation to implement addition of polynomials
4	Represent a sparse matrix using array. Implement addition and transposition operations using the representation.
5	Implement singly, doubly and circularly connected linked lists illustrating operations like addition at different locations, deletion from specified locations and traversal.
6	Repeat exercises 2, 3 & 4 with linked structure.
7	Implementation of binary tree with operations like addition, deletion, traversal.
8	Depth first and breadth first traversal of graphs represented using adjacency matrix and list.
9	Implementation of binary sear h in arrays and on linked Binary Sear h Tree.
10	Implementation of different sorting algorithm like insertion, qui k, heap, bubble and many more sorting algorithms.

3ML4-22: Prolog Lab

Sr. No.	Content
1	Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules.
2	Write simple facts for the statements and querying it.
3	Write a program for Family-tree.
4	Write Program for Monkey-bana Problem.
5	Write a program which behaves a small expert for medical Diagnosis.
6	Write programs for computation of recursive functions, like, factorial, Fibonacci numbers, etc.
7	Write program to solve 5-queens problem.
8	Write a Program for water jug problem.
9	Write a program for travelling salesman program.
10	Case study of standard AI programs, like, My in, and AI Shell

3ML4-23: Object Oriented programming in Java Lab

S. No.	Contents
1	Develop an in depth understanding of programming in Java: data types, variables, operators, operator precedence, Decision and control statements, arrays, switch statement, Iteration Statements, Jump Statements, Using break, Using continue, return.
2	Write Object Oriented programs in Java: Objects, Classes constructors, returning and passing objects as parameter, Inheritance, Access Control, Using super, final with inheritance Overloading and overriding methods.
3	Develop understanding to developing packages & Interfaces in Java: package concept of CLASSPATH, access modifiers, importing package, Defining and implementing interfaces.
4	Develop understanding to developing Strings and exception handling: String constructors, special string operations, character extraction, searching and comparing strings, string Buffer class. Exception handling fundamentals, Exception types, uncaught exceptions, try, catch and multiple catch statements. Usage of throw, throws and finally.

5	Develop applications involving file handling: I/O streams, File I/O.
6	Development of programs/projects to demonstrate c oncepts like inheritance, exception handling, packages, interfaces etc.
7	Development of a project to demonstrate various file handling concepts.
8	Develop applications involving Applet: Applet Fundamentals, using paint method and drawing polygons.

3ML4-24: Digital Electronics Lab

S.N	Contents
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs).
2	To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND& NOR gates.
3	To realize an SOP and POS expression.
4	To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.
5	To realize a 4-bit ripple adder/ Subtractor using basic Half adder/ Subtractor & basic Full Adder/ Subtractor
6	To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7	Design & Realize a combinational circuit that will accept a 2421 BCD ode and drive a TIL -312 seven-segment displays.
8	Using basic logic gates, realize the R-S, J-K and D- flip flops with and without clock signal and verify their truth table.
9	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using lo k. Also exercise loading only one of multiple values into the register using multiplexer. Note: As far as possible, the experiments shall be performed on bread board. However, experiment Nos. 1-4 are to be performed on bread board only

II year (4th Semester)
4ML2-01: Discrete Mathematical Structures

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Set Theory: Definition of sets, countable and uncountable sets, Set operations, Partition of set, Cardinality (Inclusion-Exclusion & Addition Principles) Venn Diagrams, proofs of some general identities on sets. Relation: Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Partial ordering relation, Job-Scheduling problem. Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle. Theorem proving Techniques: Mathematical induction, Proof by contradiction. Composition ofFunctions. The Pigeonhole and Generalized Pigeonhole Principles.	7
3	Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers. 2 way predicate logic. Introduction to finite state machine Finite state machines as models of physical system equivalence machines, Finite state machines as language recognizers.	8
4	Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices. Combinatorics: Introduction, Permutation and combination, Binomial Theorem, Multimodal Coefficients Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Generating functions, Solution by method of generating functions.	8
5	Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.	8
6	Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs, matching, vertex/edge covering.	8
	Total	40

Text/References:

1. Discrete Mathematics with Applications, Koshy, Elsevier
2. Discrete Mathematical Structures By Lipshutz & Lipson, TMH

3. Discrete Mathematical Structures, Kolman et.al, Pearson

4. Fundamentals of Discrete Mathematical Structures, K R Chowdhary, 3ed,PHI

3ML1-03: Managerial Economics and Financial Accounting

SN	CONTENTS	Hours
1	**Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	4
2	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	**Market structure and pricing theory-** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds- flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	TOTAL	**26**

3ML1-02: Technical Communication

SN	CONTENTS	Hours
1	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4

2	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	**6**
3	**Technical Writing, Grammar and Editing-** Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	**8**
4	**Advanced Technical Writing-** Technical Reports, types of technical reports, Characteristicsandformats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	**8**
	TOTAL	**26**

4ML2-04: Stochastic Calculus

S.N	Content	Hours
1	Introduction: Objective, scope and outcome of the course	1
2	General Probability Theory: Probability spaces, random variable and distributions, expectations, convergence of integrals, change of measure.	7
3	Information and Conditioning: Information and σ-algebras, independence, general conditional expectations	8
4	Random motion, scaled random walks, Brownian motion, quadratic variation, first order time distribution, reflection principle	8
5	Oto's Integral, Ito's integral for simple and general integrands, Ito's-Doeblin formula, Black-Scholes-Merton equation.	8
6	Risk-Neutral Pricing: Risk-neutral Measure. Stock and pricing under Risk-neutral Measure. Introduction to dividend-paying stocks.	8
	Total	40

Text/References:

1. Stochastic Calculus for finance II, Steven E. Shreve
2. Stochastic Calculus, Filtering, and Stochastic Control, Ramon van Handel.

4ML4-05: Database Management System

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to database systems: Overview and History of DBMS. File System v/s DBMS. Advantage of DBMS Describing and Storing Data in a DBMS. Queries in DBMS. Structure of a DBMS. Entity Relationship model: Overview of Data Design Entities, Attributes and Entity Sets, Relationship and Relationship Sets. Features of the ER Model- Key Constraints, Participation Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Data Base, and Design with ER Model- Entity v/s Attribute, Entity vs Relationship Binary vs Ternary Relationship and Aggregation v/s ternary Relationship Conceptual Design for a Large Enterprise.	7
3	Relationship Algebra and Calculus: Relationship Algebra Selection and Projection, Set Operations, Renaming, Joints, Division, Relation Calculus, Expressive Power of Algebra and Calculus.SQL queries programming and Triggers: The Forms of a Basic SQL Query, Union, and Intersection and Except, Nested Queries, Correlated Nested Queries, Set-Comparison Operations, Aggregate Operators, Null Values and Embedded SQL, Dynamic SQL, ODBC and JDBC, Triggers and Active Databases.	8
4	Schema refinement and Normal forms: Introductions to Schema Refinement, Functional Dependencies, Boyce-Codd Normal Forms, Third Normal Form, Normalization-Decomposition into BCNF Decomposition into 3-NF.	8
5	Transaction Processing: Introduction-Transaction State, Transaction properties, Concurrent Executions. Need of Serializability, Conflict vs.View Serializability, Testing for Serializability, Recoverable Schedules, Cascadeless Schedules.	8
6	Concurrency Control: Implementation of Concurrency: Lock-based protocols, Timestamp-based protocols, Validation-based protocols, Deadlock handling, Database Failure and Recovery: Database Failures, Recovery Schemes: Shadow Paging and Log-based Recovery, Recovery with Concurrent transactions.	8
	Total	40

4ML4-06: Introduction to Machine Learning

S.N	Contents	Hours
1	Introduction: Objective, scope and outcome of the course	**1**
2	Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, bia, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods	**10**
3	Neural Networks, threshold logic units, linear machines, networks of threshold	**6**

	learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems	
4	Statistical Learning, background and general method, learning belief networks, nearest neighbor. Decision-trees, supervised learning of uni-variance decision trees, network equivalent of decision trees, overfitting and evaluation.	**6**
5	Inductive Logic Programming, notation and definitions, introducing recursive programs, inductive logic programming vs decision tree induction.	**5**
6	Computational learning theory, fundamental theorem, Vapnik-Chernonenkis dimension, linear dichotomies and capacity. Unsupervised learning, clustering methods based on ecludian distance and probabilities, hierarchical clustering methods. Introduction to reinforcement and explanation-based learning.	**12**
	Total	40

Text/References:

1. Introduction to Machine learning, Nils J. Nilsson

2. Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch

3. Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O' Reilly

4ML4-07: Computer Architecture

S	Contents	H
1	Introduction: Objective, scope and outcome of the course	1
2	Introduction to Computer Architecture and Organization. Von Neuman Architecture, Flynn Classification. Register Transfer and Micro operations: Register transfer language, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Bus and memory transfers. Computer Organization and Design: Instruction cycle, computer registers, common bus system, computer instructions, addressing modes, design of a basic computer	9
3	Central Processing Unit: General register organization, stack organization, Instruction formats, Data transfer and manipulation, program control. RISC, CISC characteristics. Pipeline and Vector processing: Pipeline structure, speedup, efficacy, throughput and bottlenecks. Arithmetic pipeline and Instruction pipeline.	8
4	Computer Arithmetic: Adder, Ripple carry Adder, carry look Ahead Adder, Multiplication: Add and Shift, Array multiplier and Booth Multiplier, Division: restoring and Non-restoring Techniques. Floating Point Arithmetic: Floating point representation, Add, Subtract, Multiplication, Division	8
5	Memory Organization: RAM, ROM, Memory Hierarchy, Organization, Associative memory, Cache memory, and Virtual memory: Paging and Segmentation	8
6	Input-Output Organization: Input-Output Interface, Modes of Transfer, Priority Interrupt, DMA, IOP processor.	6

Text/References:

1. Computer Organization and Architecture - William Stallings (Pearson Education Asia)

2. Computer Organization and Architecture -John P. Hayes (M Graw -Hill)

3. Computer Organization -V. Carl. Hama her (M Graw-Hill)

4ML-21: Python Programming Lab

Sr. No.	Contents
1	Installation of Python, and learning interactively at command prompt and writing simple programs.
2	Learning the conditions and iterations in Python by writing and running simple programs.
3	Random number generations, and problems based on random numbers.
4	Handling tuples and exercises based on tuples.
5	Functions and files
6	Linear and binary search
7	Handeling tokens
8	Finding unique and duplicate items of a list.
9	Matrix addition, multiplications, and unity matrix.
10	Text processing using python
11.	Programs related to python libraries like Numpy, Pandas, Scipy etc.

4ML4-22: Database Management Lab

List of Experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE.
4. Write the queries to implement the joins.
5. Write the query for implementing the following functions: MAX (), MIN (), AVG () and COUNT ().
6. Write the query to implement the concept of Integrity constrains.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion , updation and deletion
10. Using the referential integrity constraints.
11. Write the query for creating the users and their role.

Data Base Designing Project:

For better understanding students (group of 3-4 students) should design data base for any data base project, understand the requirement and design methodology of project by its own.

Some example of data base design project like:

College management system, Inventory management system and Hospital management system.

4ML4-23: OpenCV Lab

Sr. No.	Content
1	Introduction to OpenCV function for image processing and vision algorithms (cv)
2	Introduction to Auxiliary OpenCV functions (cvaux)
3	Study of OpenCV data structure, XML support drawing functions (cxcore)
4	Study of GUI functions, Image and Video I/O (highgui)
5	Processing of Binary Image.
6	Processing of Grays scale Image.
7	Processing of RGB image
8	Operations on Images like, display, copy image, save image, morphological operations.
9	Video Input, Camera Input, playing with mouse, displaying image in full screen.
10	Haar cascade, image cropping, blob and edge detection.

4ML3-21: Machine Learning Lab

Sr. No.	Contents
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV le
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library lasses/API.
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library lasses/API in the program.
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

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