



BIKANER TECHNICAL UNIVERSITY, BIKANER
बीकानेर तकनीकी विश्वविद्यालय, बीकानेर
OFFICE OF THE DEAN ACADEMICS



SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

**(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
III-IV Semester**



Effective for the students admitted in year 2020-21 and onwards.

**Office: Bikaner Technical University, Bikaner
Karni Industrial Area, Pugal Road, Bikaner-334004
Website: <https://btu.ac.in>**

**B.Tech.: Artificial Intelligence & Machine Learning
2nd Year - III Semester**

THEORY											
SN	Category	Course		Contact hrs./week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
1	BSC	3AM2-01	Advanced Engineering Mathematics	3	0	0	3	30	120	150	3
2	HSMC	3AM1-02/ 3AM1-03	Technical Communication/ Managerial Economics and Financial Accounting	2	0	0	2	20	80	100	2
3	ESC	3AM3-04	Digital Electronics	3	0	0	3	30	120	150	3
4	PCC	3AM4-05	Data Structures and Algorithms	3	0	0	3	30	120	150	3
5		3AM4-06	Concepts in Artificial Intelligence	3	0	0	3	30	120	150	3
6		3AM4-07	Object-Oriented Programming	3	0	0	3	30	120	150	3
Sub Total				17	0	0		170	680	850	17
PRACTICAL & SESSIONAL											
7	PCC	3AM4-21	Data Structures and Algorithms Lab	0	0	3	2	45	30	75	1.5
8		3AM4-22	Object-Oriented Programming Lab	0	0	3	2	45	30	75	1.5
9		3AM4-23	Artificial Intelligence Lab	0	0	3	2	45	30	75	1.5
10	ESC	3AM3-24	Digital Electronics Lab	0	0	3	2	45	30	75	1.5
11	PSIT	3AM7-30	Industrial Training	0	0	1		0	0	50	1
12	ANAND AM	3AM8-00	ANANDAM							100	2
Sub- Total				0	0	13		180	120	450	9
TOTAL OF III SEMESTER				17	0	13		350	800	1300	26

L: Lecture, T: Tutorial, P: Practical, Cr: Credits
ETE: End Term Exam, IA: Internal Assessment

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**B.Tech.: Artificial Intelligence & Machine Learning
2nd Year - IV Semester**

THEORY											
S.No.	Category	Course		Contact hrs./week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
1	BSC	4AM2-01	Discrete Mathematics Structure	3	0	0	3	30	120	150	3
2	HSMC	4AM1-03/ 4AM1-02	Managerial Economics and Financial Accounting / Technical Communication	2	0	0	2	20	80	100	2
3	ESC	4AM3-04	Introduction to Machine Learning	3	0	0	3	30	120	150	3
4	PCC	4AM4-05	Database Management Systems	3	0	0	3	30	120	150	3
5		4AM4-06	Theory of Computation	3	0	0	3	30	120	150	3
6		4AM4-07	Human Information Processing and Artificial Intelligence	3	0	0	3	30	120	150	3
Sub Total				17	0	0		170	680	850	17
PRACTICAL & SESSIONAL											
7	PCC	4AM4-21	Python Programming Lab	0	0	3	2	45	30	75	1.5
8		4AM4-22	Database Management System Lab	0	0	3	2	45	30	75	1.5
9		4AM4-23	Linux & Shell Programming Lab	0	0	3	2	45	30	75	1.5
10		4AM4-24	Machine Learning Lab	0	0	3	2	45	30	75	1.5
11	Anandam	4AM8-00	ANANDAM							100	2
				0	0	12		180	120	400	8
TOTAL OF IV SEMESTER				17	0	12		350	800	1250	25

L: Lecture, T: Tutorial, P: Practical, Cr: Credits

ETE: End Term Exam, IA: Internal Assessment



3AM2-01: Advanced Engineering Mathematics

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	Contents	Hours
1	Random Variables: Discrete and Continuous random variables, Joint distribution, Probability distribution function, conditional distribution. Mathematical Expectations: Moments, Moment Generating Functions, variance and correlation coefficients, Chebyshev's Inequality, Skewness and Kurtosis.	7
2	Binomial distribution, Normal Distribution, Poisson Distribution and their relations, Uniform Distribution, Exponential Distribution. Correlation: Karl Pearson's coefficient, Rank correlation. Curve fitting. Line of Regression.	5
3	Historical development, Engineering Applications of Optimization, Formulation of Design Problems as a Mathematical Programming Problems, Classification of Optimization Problems	8
4	Classical Optimization using Differential Calculus: Single Variable and Multivariable Optimization with & without Constraints, LaGrange's theorem, Kuhn Tucker conditions	6
5	Linear Programming: Simplex method, Two Phase Method and Duality in Linear Programming. Application of Linear Programming: Transportation and Assignment Problems.	14
TOTAL		40

Suggested Books

- Higher Engineering Mathematics B S grewal Khanna Publisher
- Advance Engineering Mathematics R K jain and SRK Ayngar. Narosa Publication
- Advance Engineering Mathematics H K Dass S chand Publication.
- AdvanceEngineering Mathematics Erwin kreyszig Willey publication



3AM1-02: Technical Communication

Credit: 2		Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P		End Term Exams: 2hr
S.No.	Contents	Hours
1	Introduction to Technical Communication- Definition of technical communication, Aspects of technical communication, forms of technical communication, the 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 errors 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 Applications, 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

Suggested Books

- Effective Technical Communication M Ashraf Rizvi McGraw Hill Education (India) Private limited
- Technical Communication A Practical Approach William Sanborn Pfeiffer Pearson Education India



3AM1-03: Managerial Economics and Financial Accounting

Credit: 2		Max Marks: 100 (IA :20, ETE:80)	
2L+ 0T+ 0P		End Term Exams: 2hr	
S.No.	Contents	Hours	
1	Basic Economics 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	

Suggested Books

- M. KAsi Reddy and S. Saraswati, Managerial Economics and Financial Accounting, Prentice Hall India Learning Private Limited, 2007.
- P, Vijaya Kumar and N. Appa Rao, Managerial Economics & Financial Analysis, Cengage, 1st edition, 2011
- SA Siddiqui and AS Siddiqui, Managerial Economics and Financial Analysis, New Age International (P) Ltd Publishers, 2nd Edition, 2017
- A R Aryasri, Managerial Economics and Financial Analysis, by, The McGraw-Hill Publishing Company Limited, Delhi, Third Edition, 2007
- M S Bhat and A V Rau, Managerial Economics and Financial Analysis, BS Publications, 2016



3AM3-04: Digital Electronics

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	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: 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 to7-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 circuits design methodology. Registers –shift registers.	8
TOTAL		40

Suggested Books

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



3AM4-05: Data Structures and Algorithms

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	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.	8
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.	8
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.	8
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 calculation techniques, and Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	8
TOTAL		40

Suggested Books

- An Introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH
- Data Structures in C/C++, Tanenbaum, Pearson
- Data Structures and Algorithms, Aho and Ullman
- Simplified Approach to Data Structures , Shroff Publications and Distributors Lalit Goyal, Visal Goyal, Pawan Kumar
- Data Structures – Horowitz Sahni PHI
- Data Structures – Lipschutz TMH



3AM4-06: Concepts in Artificial Intelligence

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	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 non-monotonic 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 the 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, minimax procedure, alpha-beta cut-offs. The complexity of the alpha-beta search. 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

Suggested Books

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



3AM4-07: Object Oriented Programming

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	CONTENTS	Hours
1	Introduction to different programming paradigms, characteristics of OOP, Class, Object, data member, member function, structures in C++, different access specifiers, defining member function inside and outside class, array of objects.	8
2	Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function overloading, function with default arguments, constructors and destructors, friend function and classes, using this pointer.	8
3	Inheritance, types of inheritance, multiple inheritance, virtual base class, function overriding, abstract class and pure virtual function	9
4	Constant data member and member function, static data member and member function, Polymorphism, operator overloading, dynamic binding, and virtual function	9
5	Exception handling, Template, Stream class, File handling.	6
TOTAL		40

Suggested Books

- Balagurusamy E., “Object oriented programming with C++”, Fifth Edition, Third Reprint, Tata McGraw–Hill Education 2011.
- Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, Second Edition, Reprint 2004
- Lippman S. B., Josee Lajoie, Barbara E. Moo, “C++ Primer”, Fourth Edition, Pearson Education, 2005.



3AM4-21: Data Structures and Algorithms Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P		End Term Exams: 2hr
S.No.	List of Experiments	
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 the 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 dequeue using a one-dimensional array as a storage element. The program should implement the basic addition, deletion and traversal operations.	
3	Represent a 2-variable polynomial using an array. Use this representation to implement addition of polynomials	
4	Represent a sparse matrix using an 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 search in arrays and on linked Binary Search Tree.	
10	Implementation of different sorting algorithms like insertion, quick, heap, bubble and many more sorting algorithms.	

Suggested Books

- An Introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH
- Data Structures in C/C++, Tanenbaum, Pearson
- Data Structures and Algorithms, Aho and Ullman
- Simplified Approach to Data Structures" , Shroff Publications and Distributors Lalit Goyal, Visal Goyal, Pawan Kumar, "
- Data Structures – Horowitz Sahni PHI
- Data Structures – Lipschutz TMH



3AM4-22: Object-Oriented Programming Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)	
0L+ 0T+ 3P		End Term Exams: 2hr	
S.No.	List of Experiments		
1	Understand the basics of C++ library, variables, data input-output.		
2	C++ program using the concept of structures.		
3	Implement class and object concepts and function overloading.		
4	Write programs to understand dynamic memory allocation and array of objects.		
5	Program to understand different types of constructors and destructors.		
6	Implement friend function to access private data of a class and usage of this pointer.		
7	Write programs to understand the usage of constant data member and member function, static data member and member function in a class.		
8	Implement different types of inheritance, function overriding and virtual Function		
9	Implement Operator overloading concepts.		
10	Write programs to understand function template and class template.		
11	Write programs to understand exception handling techniques.		
12	Write programs to understand file handling techniques.		

Suggested Books

- Balagurusamy E., “Object oriented programming with C++”, Fifth Edition, Third Reprint, Tata McGraw–Hill Education 2011.
- Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, Second Edition, Reprint 2004.
- Lippman S. B., Josee Lajoie, Barbara E. Moo, “C++ Primer”, Fourth Edition, Pearson Education, 2005.



3AM4-23: Artificial Intelligence Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)	
0L+ 0T+ 3P		End Term Exams: 2hr	
S.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-banana Problem.		
5	Write a program which behaves like a small expert for medical Diagnosis.		
6	Write programs for computation of recursive functions like factorial Fibonacci numbers, etc.		
7	Write a program to solve the 5-queens problem.		
8	Write a Program for water jug problems.		
9	Write a program for travelling salesman program.		
10	Case study of standard AI programs like Mycin and AI Shell.		



3AM3-24: Digital Electronics Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P		End Term Exams: 2hr
S.No.	List of Experiments	
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also, to verify the 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. Construct an 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 code 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 counters. 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 a multiplexer. Note: As far as possible, the experiments shall be performed on a breadboard. However, experiment Nos. 1-4 are to be performed on bread board only	

**4AM2-01: Discrete Mathematics Structure**

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	Contents	Hours
1	Introduction: Objective, scope and outcome of the course. Set Theory: Definition of sets, countable and uncountable sets, Set operations, Partition of the 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 of Functions. The Pigeonhole and Generalized Pigeonhole Principles.	1 + 7
2	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
3	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
4	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
5	Graph Theory: Introduction and basic terminology of graphs, Planar 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

Suggested Books

- Singaravelu, M. P. Jeyaraman, "Discrete Mathematics", Meenakshi Agency, 2013.
- Kenneth H. Roshan, "Discrete Mathematics and its Applications", Tata McGraw Hill, 2011.
- Trembly J.P and Monohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2003.
- Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, 2002.
- J. A. Bondy and U.S.R Murty, "Graph Theory", Springer, 2008.



4AM1-02: Technical Communication

Credit: 2		Max Marks: 100 (IA :20, ETE:80)	
2L+ 0T+ 0P		End Term Exams: 2hr	
S.No.	CONTENT	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 Text, 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 errors 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	

Suggested Books

- Technical Communication A Practical Approach William Sanborn Pfeiffer Pearson Education India
- Effective Technical Communication M Ashraf Rizvi McGraw Hill Education (India) Private limited

**4AM1-03: Managerial Economics and Financial Accounting**

Credit: 2		Max Marks: 100 (IA :20, ETE:80)
2L+ 0T+ 0P		End Term Exams: 2hr
S.No.	CONTENTS	Hours
1	Basic Economics 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

Suggested Books

- M. Kasi Reddy and S. Saraswati, Managerial Economics and Financial Accounting, Prentice Hall India Learning Private Limited, 2007.
- P, Vijaya Kumar and N. Appa Rao, Managerial Economics & Financial Analysis , Cengage, 1st edition, 2011
- SA Siddiqui and AS Siddiqui, Managerial Economics and Financial Analysis, New Age International (P) Ltd Publishers, 2nd Edition, 2017
- A R Aryasri, Managerial Economics and Financial Analysis, by, The McGraw-Hill Publishing Company Limited, Delhi, Third Edition, 2007
- M S Bhat and A V Rau, Managerial Economics and Financial Analysis, BS Publications, 2016



4AM3-04: Introduction to Machine Learning

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	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, bias, 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.	08
3	Neural Networks, threshold logic units, linear machines, networks of threshold learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems	07
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, over fitting and evaluation.	07
5	Inductive Logic Programming, notation and definitions, introducing recursive programs, inductive logic programming vs decision tree induction.	07
6	Computational learning theory, fundamental theorem, Vapnik- Chernenko's dimension, linear dichotomies, and capacity. Unsupervised learning, clustering methods based on Euclidean distance and probabilities, hierarchical clustering methods. Introduction to reinforcement and explanation-based learning.	08
Total		38

Suggested Books

- Introduction to Machine learning, Nils J.Nilsson
- Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
- Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly

**4AM4-05: Database Management Systems**

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	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. Advantages of DBMS Describing and Storing Data in Masquerades 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, Joins, 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, Cascade less 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

Suggested Books

- Abraham Silberschatz, Henry F. Korth and S. Sudarshan- —Database System Concepts, Sixth Edition, McGraw-Hill, 2011.
- Ramez Elmasri and Shamkant B. Navathe, —Fundamental Database Systems, Seventh Edition, Pearson Education, 2016.
- Raghu Ramakrishnan, —Database Management System, Tata McGraw-Hill Publishing Company, Third Edition, 2014.
- Jiawei Han, Micheline Kamber, Jian Pei -Data Mining Concepts and Techniques, Morgan Kaufmann, Third Edition, 2012.

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**4AM4-06: Theory of Computation**

Credit: 3		Max Marks: 150 (IA :30, ETE:120)
3L+ 0T+ 0P		End Term Exams: 3hr
S.No.	Contents	Hours
1	Finite Automata & Regular Expression: Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and nondeterministic finite automaton, Equivalence of DFA and NDFAs, Decision properties, minimization of finite automata, Mealy & Moore machines. Alphabet, words, Operations, Regular sets, relationship and conversion between Finite automata and a regular expression and vice versa, designing regular expressions, closure properties of regular sets, Pumping lemma and regular sets, Myhill- Nerode theorem, Application of pumping lemma, Power of the languages.	8
2	Context Free Grammars (CFG), Derivations and Languages, Relationship between derivation and derivation trees, leftmost and rightmost derivation, sentential forms, parsing and ambiguity, simplification of CFG, normal forms, Greibach and Chomsky Normal form, Problems related to CNF and GNF including membership problem.	8
3	Nondeterministic PDA, Definitions, PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL, the pumping lemma for CFL's, Closure Properties and Decision properties for CFL, Deciding properties of CFL.	8
4	Turing Machines: Introduction, Definition of Turing Machine, TM as language Acceptors and Transducers, Computable Languages and functions, Universal TM & Other modification, multiple tracks Turing Machine. Hierarchy of Formal languages: Recursive & recursively enumerable languages, Properties of RL and REL, Introduction of Context sensitive grammars and languages, The Chomsky Hierarchy.	8
5	Tractable and Intractable Problems: P, NP, NP complete and NP hard problems, Undecidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling salesman problem.	8
Total		40

Suggested Books

- Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education.
- John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill Publishing Company, New Delhi
- Marvin L. Minsky "Computation: Finite and Infinite" – Prentice Hall, 1967
- Michael Sipser "Introduction to the Theory of Computation", Third Edition, 2012 Cengage Learning
- Peter Lenz – An Introduction to Formal languages and Automata – 3rd Edition Narosa, 2003
- Thomas A. Sukamp – An introduction to the theory of computer science languages and machines – 3rd edition, Pearson Education, 2007.

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4AM4-07: Human Information Processing and Artificial Intelligence

Credit: 3		Max Marks: 150 (IA :30, ETE:120)	
3L+ 0T+ 0P		End Term Exams: 3hr	
S.No.	Contents	Hours	
1	Introduction: Objective, scope, and outcome of the course	1	
2	Introduction: Definition, psychological antecedents, cognition, and intelligence. Fundamental ideas. Cognitive neuroscience: cognition in the brain, structures, and functions of the brain, brain disorders. Intelligence and neuroscience, thinking about thinking.	7	
3	Visual perception: from sensation to representation, approaches to perception, perception of objects and forms, the role of environment in seeing, deficits in perception, and perception in practice. Attention, consciousness and its nature, when attention fails, habituation and adaptation. Automatic and controlled processes in attention.	9	
4	Memory and models: tools for measuring memory, exceptional memory and neuropsychology. Memory processes, encoding and transfer of information, retrieval, the process of forgetting, and distortion. Constructive nature of memory. Landscape of memory, mental images, maps, and propositions. The mental representation of knowledge, mental manipulation of images, synthesizing images and propositions, spatial cognition and cognitive Maps	8	
5	Organization of knowledge in mind: declarative vs procedural knowledge, organization of declarative knowledge, representation of thinking process. Integrative models for representing declarative and non-declarative knowledge.	8	
6	Language & its comprehension, reading, understanding conversation and essays. Language context, language, and thought, language in a social context. Do animals have language? Neuropsychology of language. Introduction to problem solving and creativity; decision making and reasoning	7	
Total		40	

Suggested Books

- D. L. Medin, B. H. Ross and A. Markman (2005) Cognitive Psychology, 4th Edition. Wiley Publishers



4AM4-21: Python Programming Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)	
0L+ 0T+ 3P		End Term Exams: 2hr	
S. No.	List of Experiments		
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	Handling 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.		



4AM4-22: Database Management Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)	
0L+ 0T+ 3P		End Term Exams: 2hr	
S.No.	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, NOTNULL 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 constraints.		
7.	Write the query to create the views.		
8	Perform the queries for triggers.		
9.	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.		
10.	Database Designing Project: For better understanding students (group of 3-4students) should design a database for any database project, understand the requirements and design methodology of the project on its own.		



4AM4-23: Linux & Shell Programming Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P		End Term Exams: 2hr
S.No.	List of Experiments	
1.	Use of Basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, df, space, du, ulimit.	
2.	Commands related to inode, I/O redirection and piping, process control commands, mails.	
3.	Shell Programming: Shell script based on control structure- If-then-fi, if-then- else-if, nested if-else, to find: <ul style="list-style-type: none">○ Greatest among three numbers.○ To find a year is a leap year or not.○ To input angles of a triangle and find out whether it is a valid triangle or not.○ To check whether a character is an alphabet, digit or special character.○ To calculate profit or loss.	
4.	Shell Programming - Looping- while, until, for loops <ul style="list-style-type: none">○ Write a shell script to print all even and odd numbers from 1 to 10.○ Write a shell script to print table of a given number○ Write a shell script to calculate the factorial of a given number.○ Write a shell script to print the sum of all even numbers from 1 to 10.○ Write a shell script to print the sum of digits of any number.○ Shell Programming - case structure, use of break○ Write a shell script to make a basic calculator which performs addition, subtraction, Multiplication, division○ Write a shell script to print days of a week.○ Write a shell script to print starting 4 months having 31 days.	
5.	Shell Programming - Functions <ul style="list-style-type: none">○ Write a shell script to find a number is Armstrong or not.○ Write a shell script to find a number is palindrome or not.○ Write a shell script to print Fibonacci series.○ Write a shell script to find the prime number.○ Write a shell script to convert binary to decimal and decimal to binary○ Write a shell script to print different shapes- Diamond, triangle, square, rectangle, hollow square etc	
6.	Shell Programming – Arrays <ul style="list-style-type: none">○ Write a program to read and print elements of an array.○ Write a program to find the sum of all array elements.○ Write a program to find the reverse of an array.○ Write a program to search an element in an array.○ Write a program to sort array elements in ascending or descending order.	



4AM4-24: Machine Learning Lab

Credit: 1.5		Max Marks: 75 (IA :45, ETE:30)
0L+ 0T+ 3P		End Term Exams: 2hr
S.No.	List of Experiments	
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 file	
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 the standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/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	