Program: B Tech All Program (except Data	Semester: III / IV / V / VII
Science, Civil and Mechanical, CSE(DS) 311 (VT)]	
MBA Tech All Program (except Data Science),	
B Tech Integrated Computer	
Course: Discrete Mathematics	Course Code: 702BS0C047

Teaching Scheme				Evaluati	on Scheme
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks - 100)
2	0	1	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Linear Algebra and Ordinary Differential Equations

Course Objective

The principal objective of the course is to train the students in the construction and understanding of mathematical proofs and common mathematical arguments. It will instil sound knowledge of different topics of discrete mathematics which students will readily apply in the subsequent courses of their programme.

Course Outcomes

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

- 1. Define and relate basic notions of discrete mathematics
 - 2. Demonstrate the ability to understand mathematical logic, concepts in abstract algebra and mathematical proof techniques
 - 3. Solve problems based on combinatorics, graph theory and abstract algebra
 - 4.Demonstrate understanding of the applications of algebra, combinatorics and graph theory

Detailed Syllabus

Unit	Description	Duration
1.	Set Theory, Relations and Functions Revision of prerequisite concepts - 'Sets, Venn diagrams, Operations on sets, Laws of set theory'. Power set, The principle of Inclusion-Exclusion, Partitions of sets. Relations, Properties and types of binary relations, Equivalence relation. Functions, injective, surjective and bijective functions, Composition,	
	inverse of a function.	

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2.	Logic Revision of prerequisite concepts – 'Propositions, Truth table, Laws of logic, Equivalence'. Satisfiability, tautology, validity, disjunctive and conjunctive normal forms, Predicates and Quantifiers, Proof Techniques, Mathematical Induction.	06
3.	Combinatorics Pigeonhole principle, Homogeneous and non-homogeneous linear recurrence relations with constant coefficients, Generating functions.	04
4.	Graphs and Trees Graphs and their properties, Degree, Connectivity, Path, Cycle, Eulerian graph, Hamiltonian graph, Planar graphs, Graph Coloring. Trees, Rooted trees, Spanning tree and minimum spanning tree, Kruskal's and Prim's algorithms for minimal spanning trees.	08
5.	Abstract algebra Definition and examples of groups, subgroups, cyclic groups, group homomorphism, group isomorphisms. Definitions and Examples of Rings and Fields.	06
	Total	30

Text Books

- 1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, 8th Edition, Tata McGraw Hill, 2018.
- 2. Kolman, Busby and Ross, *Discrete Mathematical Structures*, 6th Edition, Prentice Hall India, 2015.

Reference Books

- 1. C. L. Liu, Elements of Discrete Mathematics, 4th Edition, McGraw Hill, New Delhi, 2017.
- 2. Seymour Lipschutz and Mark Lipson, *Discrete Mathematics*, 3rd Edition, McGraw Hill education, Schaum's Outline Series, 2017.
- 3. I. N. Herstein, "Topics in Algebra", , 2nd Edition, John Wiley and Sons, 1975.
- 4. Narsingh Deo, *Graph theory with Applications to Engineering and computer science*, 1st Edition, Prentice Hall India, 2016.

Laboratory/ Tutorial Work

8 to 10 tutorials based on the syllabus.



Program: B Tech /MBA Tech Artificial Intelligence B Tech (AI and ML and AI and DS)	Semester: III
Course: Random Processes and Estimation Techniques	Code: 702AI0C005

Teaching Scheme		Evaluation Scheme			
Lecture (Hours per	Practical (Hours per	Tutorial (Hours per	Credit	Internal Continuous Assessment (ICA)	Term End Examinations (TEE)
week)	week)	week)		(Marks - 50)	(Marks - 100)
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Probability and Random variables

Course Objective

- 1. To develop sound knowledge and skills in theoretical, computational and applicationoriented statistics.
- 2. To develop the concepts and techniques associated with the understanding of random processes and estimation techniques.

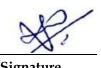
Course Outcomes

After completion of the course, the student will be able to -

- 1. Know the basics of random processes.
- 2. Know the spectral representation of random signals and calculate power spectral density, cross-spectral density.
- 3. Recognize the applications of different types of random processes.
- 4. Demonstrate the ability to understand the concepts of estimation, parametric and nonparametric inference.
- 5. Apply knowledge of parametric and non-parametric techniques in estimation and statistical inference.

Detailed Syllabus

Unit	Description	Duration
1	Introduction to Random Processes: Basic Concepts	08
	Classification of Random Processes, Statistics- first order, Second order,	
	Wide-Sense Stationary Processes, Strict Sense Stationary Processes,	
	Ergodic Random Processes.	
2	Linear Systems with Random Inputs	06
	Fourier Transform of Random signals, Power Spectral Density, Cross	
	Spectral Densities, Overview of linear system with deterministic inputs,	
	Linear system with Discrete and continuous random inputs	
3	Special Random Processes	08





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	The Bernoulli Process, Random walk process, Gaussian process, Poisson process, Markov Process	
4	Estimation Theory Point estimation, Interval estimate and confidence Interval, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.	08
5	 I. Large Sample estimation of the population parameters and Hypothesis testing: Basics of Estimating the populations mean and difference; estimating the proportion and difference; large sample test for population mean, difference; large sample test for proportion, difference. II. Estimation of a population variance: Sampling distribution of variance, estimation. III. Inferences from small sample: Student's t distribution; Small sample t test for following – A population mean, A difference between two means, Confidence interval. IV. Rejection and Non-rejection region, Type I and Type II errors, testing hypothesis about a population mean using the Z- statistic, using p-values to test Hypothesis 	15
	Total	45

Text Books

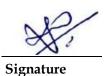
- 1. Oliver C. Ibe, Fundamentals of applied probability and random processes, 2nd Edition, Academic Press, 2014.
- 2. Anthanasios Papoulis, S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, 4th Edition, Tata McGraw-Hill, 2002
- 3. Richard, L & David, Statistics for Management, 7th Edition, E book, Pearson, 2013

Reference Books

- 1. I.R. Miller, J.E. Freund and R. Johnson, *Probability and Statistics for Engineers*, 8th Edition, Pearson Publication, 2015.
- 2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", vol. I & II, World Press.

Laboratory/ Tutorial Work

8 to 10 experiments/programming exercises (and a practicum where applicable) based on the syllabus.





Program: B Tech / MBA Tech Artificial Intelligence	Semester: III
Course: Computer Architecture	Code: 702AI0C003

	Teaching S	Scheme		Evaluati	on Scheme
Lecture (Hours	Practical (Hours per	Tutorial (Hours	Credit	Internal Continuous Assessment (ICA)	Term End Examinations (TEE)
per week)	week)	per week)		(Marks - 50)	(Marks - 100)
2	0	0	2	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Nil

Course Objective

To provide knowledge of the basic principles of the organization, operation and performance of modern day computer systems and the underlying semiconductor circuit architectures used to construct parallel computer components.

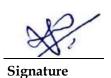
Course Outcomes

After completion of the course, the student will be able to -

- 1. Understand the basic concepts of digital logic circuits
- 2. Apply various operations of memory and ALU techniques
- 3. Analyse processor performance using various components of CPU
- 4. Evaluate various I/O operations and multiprocessor architectures

Detailed Syllabus

Unit	Description	Duration
1	Overview	04
	General Organization and architecture, Structural/functional view of a	
	computer, Computer Functional Components.	
	Number system	
	Decimal, Binary, Hexadecimal notations and problems, Conversions using 1s and 2s complement	
2	System Buses	03
	Overview of basic instruction cycle, Interrupts, Bus interconnection, Elements	
	of bus design, Read and write timings diagram, Bus hierarchy, Bus	
	arbitration techniques	
3	Memory Organization	08
	Internal Memory, Memory characteristics and memory hierarchy, Cache	
	memory, Elements of cache design, Address mapping and Translation-Direct	
	mapping, Address mapping and translation- Associative mapping, Address	
	mapping and translation -Set associative mapping, Performance	





	characteristics of two level memory, Semiconductor main memory- Types of	
	RAM, DRAM and SRAM, Chip logic, Memory module organization. High	
	speed memories- Associative memory, High speed memories- Interleaved	
	memory.	
4	Data path Design IEEE 754 data format, IEEE 754 data format numerical, Design of serial and parallel adder and subtractor, Booth's algorithm, ALU -Combinational and sequential ALU.	04
5	Central Processing Unit Basic Instruction Cycle and Instruction set, Formats and addressing, Processor Organization and Register Organization, Instruction Pipelining, Co-processors, Pipeline processors, RISC and CISC computers	05
6	Control Unit and peripheral devices Control Unit- Micro Operations, Hardwired Implementations, Micro Programmed control, Micro instruction format and applications of microprogramming, I/O processors and channels, General-Purpose Graphics Processing Unit, GPU applications, synchronization, coherence	04
7	Multiprocessor Processor Organizations Flynn's classification of parallel processing Systems, Superscalar Processors.	02
	Total	30

Text Books

- 1. William Stallings, *Computer Organization and Architecture: Designing and Performance*, 10th Edition, Pentice Hall, 2016.
- 2. John P. Hayes Mc-Graw Hill, Computer Architecture and Organization, 2nd Edition, 2010.
- 3. Morris Mano, Computer System Architecture, 3rd Edition, PHI, 2002.

Reference Books

- 1. Tannenbaum, Computer Organization, 3rd Edition, PHI, 2010
- 2. V. Carl Hamacher and Zaky, Computer Organization, 5th Edition, McGraw Hill, 2010.





Signature (Prepared by Concerned Faculty/HOD)

Program:	Semester: III/ V
B Tech / MBA Tech (Computer Engineering and	
Artificial Intelligence),	
B Tech (AI and DS, AI and ML, Computer Science)	
Course: Operating Systems	Code: 702CO1C002

Teaching Scheme				Evaluat	Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (marks -50)	Term End Examinations (TEE) (marks -100)		
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50		

Prerequisite: Programming, Computer Organization and Architecture, Data Structures and Algorithms

Course Objective

The objective of this course is to provide an introduction to functions of the computer operating system.

Course Outcomes

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

- 1. Describe the fundamental concepts of Operating system
- 2. Apply process management strategies
- 3. Simulate memory management, I/O management and file management strategies.

Detailed Syllabus

Unit	Description	Duration
1	Operating System Overview: Operating system objectives and	02
	functions, evolution of operating system, basic concepts:	
	Processes, Files, System Calls, Layered structure v/s Monolithic	
	structure of OS	
2	Process and Process Scheduling: Process Description, Process	06
	Control Block (PCB), Threads, Thread management, comparison	
	between Processes and threads, Process Scheduling: Types, study	
	and comparison of various scheduling algorithms	
3	Process Concurrency: Principles of Concurrency, Mutual	06
	Exclusion-Hardware Approaches, Semaphores, Monitors,	
	Message Passing, Classical IPC Problems: Reader's / Writer's	
	Problem, Producer / Consumer Problem	
4	Deadlock: Principles of Deadlock, Deadlock Prevention, Deadlock	05
	Avoidance: Banker's algorithm, Deadlock detection and Recovery,	
	Dining Philosopher Problem	





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5	Memory Management: Memory Management Requirements,	06
	Memory Partitioning, Paging, Segmentation, Page Replacement	
	algorithms	
6	I/O Management and Disk Scheduling: I/O devices, organization	03
	of I/O function, I/O buffering, Disk structure, Disk scheduling	
	algorithms	
7	File Management: Overview, File Organization, File Directories,	02
	File Sharing	
	Total	30

Text Books

- 1. Silberschatz A. Galvin, *Operating Systems Principles*, 10th Edition, P Wiley Publications, 2018.
- 2. William Stallings, *Operating Systems: Internals and Design Principles*, 8th Edition, Pearson Education, 2015.

Reference Books

1. Andrew S. Tannenbaum, Modern Operating System, 4th Edition, PHI, 2014.

Laboratory Work:

8 to 10 experiments (and a practicum where applicable) based on the syllabus.



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Program: B Tech / MBA Tech Artificial Intelligence			Semeste	er: III		
B Tech (AI and ML)						
Course: Intelligent Systems - I				Code: 7	02AI0C002	
Teaching Scheme				Evaluati	ion Scheme	
Lecture	Practical	Tutorial		Internal Conti	nuous	Term End Examinations
(Hours	(Hours	(Hours	Credit Assessment (ICA)	(TEE)
per	per	per	Credit	Credit		, ,
week)	week)	week)		(Marks - 5		(Marks - 100)
2	2	0	3	3 Marks Scaled to 50 Marks Scaled to 50		Marks Scaled to 50

Pre-requisite: Calculus, Statistics

Course Objective

This course helps students to learn basics of agents and environments and implement different search strategies for problem solving. It also focuses on need for knowledge representation and different ways of doing it.

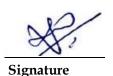
Course Outcomes

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

- 1. Describe approaches to artificial intelligence
- 2. Define and identify different types of agents and environments.
- 3. Implement different search based problem solving techniques.
- 4. Represent and apply propositional logic & predicate logic to simple knowledge-based applications.

Detailed Syllabus

Unit	Description	Duration			
1	Introduction to Artificial Intelligence				
	Definition, Foundations of AI, Approaches to AI.				
2	Intelligent Agents	03			
	How agents should act, structure of Intelligent agents, Environment				
3	Problem-solving by Searching	05			
	Solving Problems by Searching: Problem solving agents, Formulating				
	problems, Search strategies, Informed Search Methods: Best first search,				
	Heuristic functions, A* search, AO* algorithm, Local search algorithms.				
4	Adversarial search	04			
	Games as search problems, Optimal decision in games, Mini-max				
	algorithm, Alpha-beta Pruning, State of the art games.				
5	Constraint Satisfaction Problem	05			
	Defining CSP, Constraint propagation, Backtracking search for CSP,				
	Local search for constraint satisfaction problem				
6	Knowledge and reasoning	05			





	Agents that Reason Logically, The Wumpus world environment, propositional logic, Propositional theorem proving.		
7	First-Order Logic Syntax and Semantics, Using first order logic, Axioms definitions and theorems, Building a Knowledge Base, Inference in First-Order Logic,	06	
	Logical Reasoning System		
	Total	30	

Text Books

1. Stuart Russel and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th edition, Pearson Education, 2021

Reference Books

1. Elaine Rich, Kavin Knight, Shivshankar Nair, *Artificial intelligence*, 3rd edition, Tata McGraw Hill 2019

Laboratory/Tutorial Work

 $8\ {\rm to}\ 10\ {\rm experiments/programming}\ {\rm exercises}\ ({\rm and}\ {\rm a}\ {\rm practicum}\ {\rm where}\ {\rm applicable})\ {\rm based}\ {\rm on}\ {\rm the}\ {\rm syllabus}$





Signature (Prepared by Concerned Faculty/HOD)

Program: B Tech CSBS	Semester: II
B Tech and MBA Tech (All programs except Civil and	III
Mechanical)	
B Tech Computer Science and Engineering (Data Science)	III
B Tech Integrated Computer	VII
Course: Data Structures and Algorithms	Code: 702CO1C001

	Teaching Scheme			Evalua	tion Scheme
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: Programming for Problem Solving

Course Objective

This course imparts knowledge of data structures and algorithms so as to identify and implement appropriate data structure and determine the computational complexity of the given application.

Course Outcomes

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

- 1. Understand the concept of data structures and computational complexity
- 2. Identify and implement appropriate linear data structure for the given problem.
- 3. Identify and implement appropriate non-linear data structure for the given problem.
- 4. Differentiate various searching and sorting algorithms.

Detailed Syllabus

Unit	Description	Duration		
1	Introduction	04		
	Introduction to data structure and its importance, Classification of data structures,			
	Basic operations., Abstract data type, Performance analysis- time and space			
	complexity, Asymptotic Notations.			
2	Linear Data Structure I	10		
	Representation of arrays in memory, Operations on arrays -Traversal, Insertion,			
	Deletion. Introduction to Stacks, Operations on Stacks, Applications of stacks -			
	Expression conversion and evaluation (Polish notation), Balanced parenthesis			
	checker, Recursion, Introduction to Queue,			
	Operation on Queues, Linear queue Circular queue, Priority queue, Application			
	of Queues.			
3	Linear Data Structure II	07		
	Introduction to linked list, Representation of linked list in memory, Singly linked			
	list and its operations, Introduction to Doubly Linked list Linked list			



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	representation of Stack and Queues, Applications of linked list - Polynomial	
	Addition	
4	Non-Linear Data Structures - I	10
	Introduction, Binary tree terminologies, Representation of Binary trees in	
	memory, Binary Tree traversal algorithms, Construction of Binary Tree from	
	traversals, Binary Search Tree: Insertion, Deletion, Applications of tree data	
	structure: Expression trees, Huffman trees.	
5	Non- Linear Data Structures - II	06
	Introduction, Graph theory terminology, Representation of graph: Adjacency	
	Matrix, Adjacency List, Graph Traversal: Breadth first search, Depth first search,	
	Applications of Graphs (Problem Solving): Shortest path (Dijkstra's algorithm),	
	Minimum Spanning Tree.	
6	Searching and Sorting	08
	Linear Search, Binary Search, Selection Sort, Insertion sort, Merge sort,	
	Introduction to Hashing	
	Total	45

Text Books

- 1. Seymour Lipschutz, "Data structures with C", Schaum's Outlines, 1st Edition, 2017.
- 2. Reema Thareja, "Data Structures using C", Oxford University Press, 2nd Edition, 2014.
- 3. Y. Langsam, M.J. Augenstein, A.M. Tenenbaum, "Data Structures using C and C++", PHI 2nd Edition, 2015.

Reference Books

- 1. Richard F. Gillberg, Behrouz A. Forouzen, "Data Structures A Pseudo Approach with C", Cengage Publication, 2nd Edition 2004. (Classic)
- 2. Mark Allen Weiss, "Data Structures and Algorithm analysis in C++", PHI, 4th Edition, 2013.
- 3. Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 3rd Edition 2009.

Laboratory Work

8 to 10 experiments (and a practicum where applicable) based on the syllabus.



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Program: B Tech All Program [except CSBS and CSE(DS) 311	Semester: III /VII
(VT)], MBA Tech All Program,	
B Tech Integrated Mechanical, Computer	
Course: Technical Communication	Code: 702BS0C062

Teaching Scheme				Evaluation Scheme	
Lecture	Practical	Tutorial		Internal Continuous	Term End Examinations
(Hours per	(Hours per	(Hours per	Credit	Assessment (ICA)	(TEE)
week)	week)	week)		(Marks - 50)	
0	0	1	1	Marks scaled to 50	-

Pre-requisite: Fundamentals of English Communication

Course Objective

The objective of the course is to develop students' proficiency in written technical communication so that they are able to produce documents of the kind required in the workplace, such as reports and letters, that are sound, effective, coherent and error-free

Course Outcomes

After completion of the course, the student will be able to -

- 1. Apply the fundamentals of written communication to create written documents that are coherent, error-free and well organized
- 2. Develop the ability to create effective and persuasive business correspondence, such as letters and emails, that follow etiquette and are able to achieve the desired outcomes
- 3. Create basic reports such as memo, letter and survey-based report, using their understanding of report writing

Detaile	Detailed Syllabus					
Unit	Description	Duration				
1.	Principles of Effective Writing					
	Salient features of sentence construction, Paragraph writing, 7 Cs of	02				
	communication, Making outlines, Writing for the Web					
2.	Writing Skills	04				
	Note taking, Summarizing Fiction / Non-fiction	01				
3.	Business Correspondence					
	Business letter writing – principles and types, Business email writing – subject line,	04				
	recipient design, language, structuring content, framing, etiquette, cultural	\ 				
	sensitivity					



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4.	Report Writing	
	Introduction – what is a report, types, and characteristics of reports, pre-writing,	
	principles and of report writing, Ethics in Writing - plagiarism.	
	Survey-based reports	05
	Memo Report	
	Letter Report	
	Academic Report (with References and Citations)	
	m . 1	4=
	Total	15

Text Books

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, 3rd ed. Oxford University Press, 2015

Reference Books

- 1. Shirley Mathew, Communication Skills, Technical Publications, 2013
- 2. Sheryl Lindsell-Roberts, Technical Writing for Dummies, Hungry Minds Inc., 2001
- 3. Mike Markel, Technical Communication, Palgrave Macmillan, 2012



