Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB207T	PROBABILITY AND STATISTICS	3	1	0	4

Prerequisite Course (s)

Advanced Calculus and Complex Analysis

Course Objective (s):

The purpose of learning this course is to:

1	Have a well – founded knowledge of standard distributions which can describe real life phenomena.
2	Acquire skills in handling situations involving more than one random variable and functions of random variables.
3	Understand and characterize phenomena which evolve with respect to time in a probabilistic manner.
4	Gain the knowledge on test of hypothesis and how they relate to engineering applications.
5	Classify the experimental design.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Apply basic probability techniques and models to analyze the performance of computer systems.
CO2	Illustrate and apply the concept of pairs of random variables from the knowledge of distributions.
CO3	Apply the concept of random processes in engineering disciplines.
CO4	Identify the right test statistic to test the hypothesis formulated from the given data.
CO5	Apply the basic concepts of classifications of design of experiments in the real life phenomena.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO3	2	2	2	1	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	1	-	-	-	-	-	-	-	1	2	-
CO5	3	3	1	1	-	-	-	-	-	-	-	1	2	-
CO (Avg)	2.4	2.4	1.4	0.6	-	-	-	-	-	-	-	1	2	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

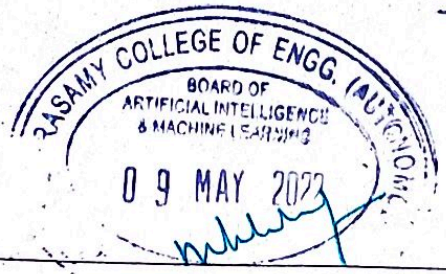
UNIT I	RANDOM VARIABLE AND STANDARD DISTRIBUTIONS	9 +
Random variable - Probability mass function - Probability density functions- Properties - Moment Moment generating functions and their properties. Binomial, Poisson, Geometric, Uniform, Exponenti and Normal distributions and their properties .		
UNIT II	**TWO DIMENSIONAL RANDOM VARIABLES**	**9 + 3**
Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regressior Transformation of random variables - Central limit theorem.		
UNIT III	**MARKOV PROCESSES AND MARKOV CHAINS**	**9 + 3**
Classification-First order, Second order, strictly stationary order, wide-sense stationary - Marko process - Markov chains – Transition probabilities - Poisson process.		
UNIT IV	**TESTING OF HYPOTHESIS**	**9 + 3**
Sampling distributions - Tests for single mean, Proportion, Difference of means (large and smal samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit - Independence of attributes.		
UNIT V	**DESIGN OF EXPERIMENTS**	**9 + 3**
Completely randomized design – Randomized block design – Latin square design - 2^2 – factorial design.		

Text Book (s)

1	Oliver Ibe, "Fundamentals of Applied Probability and Random Processes" 2nd Edition, Elsevier, 2014.
2	Douglas C. Montgomery, George C. Runger, "Applied Statistics and Probability for Engineers", Third Edition, John Wiley & Sons, 2003.

Reference (s)

1	R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2	M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum"s Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3	I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", 9th Edition, Pearson, 2017.
4	Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
5	Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.



Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC201T	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To understand the main approaches to artificial intelligence.
2	To Explore areas of application based on knowledge representation
3	To Develop abilities to apply, build and modify decision models to solve real problems.
4	To Familiarize the Artificial Intelligence techniques for building well-engineered and efficient intelligent systems.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand the importance of agents with its types.
CO2	Analyze the search strategies and its types
CO3	Analyze the structures and algorithms selection in Artificial Intelligence techniques related to knowledge representation and reasoning.
CO4	Analyze the knowledge of AI applications.
CO5	Understand the basics of an expert system.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	2	1	-	-	-	1	1	3	2
CO2	3	2	3	3	3	2	1	-	-	2	1	1	3	2
CO3	2	2	3	3	3	2	1	-	-	-	1	1	3	2
CO4	2	2	3	3	3	2	1	-	-	-	1	1	3	2
CO5	3	2	3	3	3	2	1	-	-	-	1	1	3	2
CO (Avg)	2.6	2	3	3	3	2	1	-	-	0.4	1	1	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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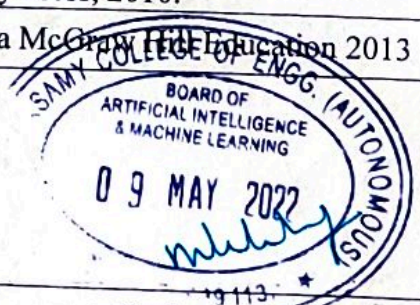
UNIT I	OVERVIEW OF AI	9
Introduction - Definition - Characteristics of Intelligent Agents - Typical Intelligent Agents - Problem Solving Approach to Typical AI problems, History of Artificial Intelligence, The State of the Art, Future of Artificial Intelligence, Risks and Benefits of AI.		
UNIT II	**INTELLIGENT AGENTS**	**9**
Agents and Environment, The Concept of Rationality: Performance measures, Rationality, Omniscience, learning, and autonomy , Agent architectures (e.g., reactive, layered, cognitive),The Nature of Environments: Specifying the task environment, Properties of task environments, The Structure of Agents.		
UNIT III	**SEARCH TECHNIQUES**	**9**
Uninformed search strategies: breadth first search, depth first search, depth limited search, bidirectional search. Heuristic search strategies: Greedy best-first search, A* search, AO* search, memory bounded heuristic search, Optimization problems: Hill climbing search, simulated annealing search, local beam search. Constraint satisfaction problems: Adversarial search, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, iterative deepening.		
UNIT IV	**KNOWLEDGE & REASONING**	**8**
Logical Agents: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Syntax, Semantics, A simple knowledge base, A simple inference procedure, Propositional Theorem Proving : Inference and proofs, Proof by resolution, Conjunctive normal form, A resolution algorithm, Completeness of resolution, Forward and backward chaining.		
UNIT V	**ADVERSARIAL SEARCH AND GAMES**	**8**
Game theory, classification of games, game playing strategies, prisoner"s Dilemma, Game playing techniques, minimax procedure, alpha-beta cut-offs, Complexity of alpha-beta search, Limitations of game search algorithms.		

Text Book (s)

1	S.Russell and P.Norvig, Artificial Intelligence:A Modern Approach, Prentice Hall, Fourth Edition, 2021.

Reference (s)

1	I. Bratko ,Prolog : Programming for Artificial Intelligence, Fourth edition , Addison-Wesley Educational Publishers Inc, 2011
2	David L. Poole and Alan K. Mackworth, Artificial Intelligence : Foundations of Computational Agents, Cambridge University Press, 2010.
3	Deepak Khemani, Artificial Intelligence, Tata McGraw Hill Education 2013



Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC202J	OBJECT ORIENTED PROGRAMMING WITH JAVA using	3	0	2	4

Prerequisite Course (s)

Programming for Problem Solving

Course Objective (s):

The purpose of learning this course is to:

1	To understand Object Oriented Programming concepts and basic characteristics of Java.
2	To know the principles of packages, inheritance and interfaces.
3	To define exceptions and use I/O streams.
4	To develop a java application with threads and generics classes.
5	To design and build simple Graphical User Interfaces.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Develop Java programs using OOP principles.
CO2	Develop Java programs with the concepts inheritance and interfaces.
CO3	Build Java applications using exceptions and I/O streams.
CO4	Develop Java applications with threads and generics classes.
CO5	Develop interactive Java programs using Applets.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	-	-	1	-	1	2	3	3
CO2	3	3	3	3	3	1	-	-	1	-	1	2	3	3
CO3	3	3	3	3	3	2	-	-	2	-	1	2	2	3
CO4	3	3	3	3	3	1	-	-	2	-	1	2	2	3
CO5	3	3	3	3	3	2	-	-	3	-	1	3	3	3
CO (Avg)	3	3	3	3	3	1.4	-	-	1.8	-	1	2.2	2.6	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	6

OOP in Java – Characteristics– The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – Constructors, Methods - Access Specifier - Static Members - Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT II	INHERITANCE AND INTERFACES	6

Inheritance – Super classes- Sub Classes – Protected Members – Constructors In Sub Classes- The Object Class – Abstract Classes and Methods - Final Methods and Classes – Interfaces – Defining an Interface, Implementing Interface, Differences Between Classes,Interfaces and Extending Interfaces - Object Cloning - Inner Classes

UNIT III	EXCEPTION HANDLING AND I/O	6

Exceptions - Exception Hierarchy - Throwing and Catching Exceptions – Built-In Exceptions, Creating Own Exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV	MULTITHREADING AND GENERIC PROGRAMMING	6

Multi-threading - Multitasking, Thread Life Cycle, Creating Threads, Synchronizing Threads, Inter-Thread Communication, Daemon Threads, Threads Groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V	EVENT DRIVEN PROGRAMMING	6

Applet Basics - Applet Architecture - Applet Display Methods - Event Handling Mechanisms - Event Classes - Event Listener - Working with Windows, Graphics, Colours and Fonts - AWT Controls – Database Connectivity and JDBC Concepts

LIST OF EXPERIMENTS	15

1. Implementing Object Oriented Concepts.
2. Implementing Control Statements
3. Implementation of Interface and Package program.
4. Implement the concept of Exception Handling using predefined and user defined exceptions
5. Implement Multithreading concepts.
6. Implementation of Collection interfaces
7. Implement conversion of InputStream into Byte Array
8. Implement a simple calculator. Use a grid Layout to arrange buttons for the digits and for the +, -, *, / operations. Add a text field to display the results.
9. Implement Mouse events and Keyboard event.
10. Create a database connectivity using any front end with Ms Access/JDBC

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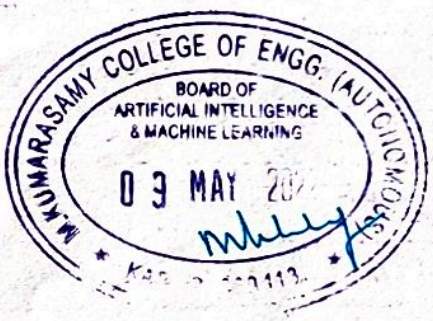
Text Book (s)	
1	Herbert Schildt, —Java The complete reference, 11th Edition, McGraw Hill Education, 2019
2	Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentals, 9th Edition, Prentice Hall, 2013.
Reference (s)	
1	Paul Deitel, Harvey Deitel, —Java SE 8 for programmersl, 3rd Edition, Pearson, 2015.
2	Steven Holzner, —Java 2 Black bookl, Dreamtech press, 2011.
3	Timothy Budd, —Understanding Object-oriented programming with Javal, Updated Edition, Pearson Education, 2000.



Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC203T	DATA STRUCTURES USING C++	3	0	0	3

Prerequisite Course (s)

Programming for Problem Solving

Course Objective (s):

The purpose of learning this course is to:

1	Understand the concepts of Object Oriented Programming.
2	Implement ADTs such as arrays, lists, stacks, queues, trees, graphs, search trees in C++ to solve real world problems.
3	Analyze various searching and sorting techniques.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify the features of object oriented concepts in C++
CO2	Implement the operations and applications of Stack ADT, Queue ADT and List ADT
CO3	Classify the types of tree data structures and explain the tree traversal methods
CO4	Outline the features and applications of graph data structure
CO5	Design algorithms for searching and sorting techniques

CO-PO Mapping

Cos	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	3	-	-	-	2	2	3	3
CO2	3	2	3	3	3	2	3	-	-	-	2	2	3	3
CO3	3	3	3	3	3	2	3	-	-	-	2	2	3	3
CO4	3	3	3	3	3	2	3	-	-	-	2	2	3	3
CO5	3	3	3	3	3	2	3	-	-	-	2	2	3	3
CO (Avg)	3	2.8	3	3	3	2	3	-	-	-	2	2	3	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION	9
Need for Object Oriented Programming-Characteristics of Object Oriented Programming-Classes and Objects-Member Functions- Constructors and Destructors - Operator Overloading-Inheritance - Function Overloading.		
UNIT II	**LINEAR DATA STRUCTURES - STACKS, QUEUES**	**9**
Classification of Data Structures-Abstract Data Types(ADTs)- Array Implementation -Linked List Implementation - Types of Linked List - Applications of List - Stack ADT - Operations - Applications of Stack - Queue ADT - Operations - Circular Queue- Priority Queue - Dequeue - Applications of Queue.		
UNIT III	**NON-LINEAR DATA STRUCTURES – TREES**	**9**
Tree ADT - Tree Traversals - Binary Tree ADT - Expression Trees - Applications of Trees - Binary Search Tree ADT - AVL Trees - Heap Tree - B-Tree - B+ Tree - Heap - Applications of Heap.		
UNIT IV	**SEARCHING, SORTING AND HASHING TECHNIQUES**	**9**
Searching : Linear Search - Binary Search. Sorting : Bubble sort - Selection sort - Insertion sort – Shell sort - Radix sort. Hashing : Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.		
UNIT V	**NON-LINEAR DATA STRUCTURES – GRAPHS**	**9**
Definition - Representation of Graph - Types of graph - Breadth-first traversal - Depth-first traversal - Topological Sort - Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm Kruskal's Algorithm.		

Text Book (s)

1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson Education, 2014.

Reference (s)

1	Michael T. Goodrich, Roberto Tamassia and David M. Mount, Data structures and Algorithms in C++, Second Edition, Wiley India, 2011.
2	E.Balagurusamy, "Object Oriented Programming with C++", Seventh Edition, McGraw Hill Education, 2017.
3	Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, 2010.
4	Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.

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Regulation 2018		Semester III	Total Hours		
Category	Course Code	Course Name	Hours / Week		
			L	T	P
C	18AMC204T	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Recognize the basic structure of a digital computer and representation of non-numeric data.
2	Learn different arithmetic operations and organization of control unit.
3	Study memory organization, different ways of communication with I/O devices and parallel processors.
4	Understand the concept of pipelining and its impact in processor design.
5	Learn the hierarchical memory system.

Course Outcome (s) (COs):

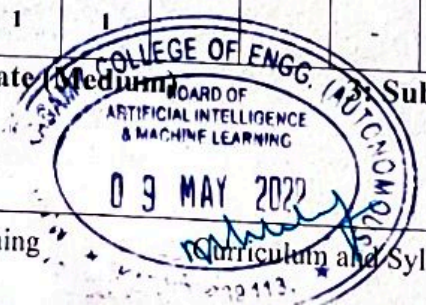
At the end of this course, learners will be able to:

CO1	Discuss the functionalities of various blocks of a digital computer and express the data representation.
CO2	Illustrate the logic design of Arithmetic and control Unit.
CO3	Infer the concepts of memory system, concurrence access in parallel processors and classify the approaches for I/O communication.
CO4	Distinguish hazards in pipelining and outline its impact in the performance of the processors.
CO5	Determine the performance of different types of memory.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
CO1	2	2	2	3	3	1	1	-	-	-	1	1	3	1
CO2	3	3	3	3	3	1	1	-	-	-	1	1	3	1
CO3	2	3	2	3	3	1	1	-	-	-	2	1	3	1
CO4	2	2	2	3	3	1	1	-	-	-	2	1	3	1
CO5	2	2	2	3	3	1	1	-	-	-	2	1	3	1
CO (Avg)	2.2	2.4	2.2	3	3	1	1	-	-	-	1.6	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



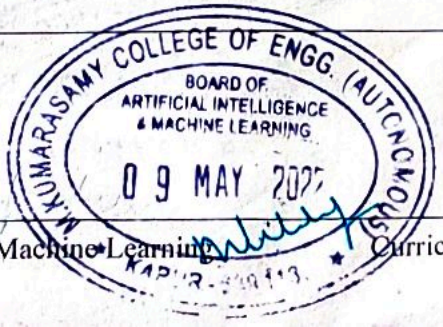
UNIT I	INTRODUCTION TO COMPUTER ARCHITECTURE	9
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs. Data representation: Signed number representation, fixed and floating-point representations, character representation.		
UNIT II	**COMPUTER ARITHMETIC**	**9**
Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and- add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.		
UNIT III	**CONTROL UNIT AND PIPELINING**	**9**
Introduction to x86 architecture. CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.		
UNIT IV	**PERIPHERAL DEVICES AND THEIR CHARACTERISTICS**	**9**
Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB.		
UNIT V	**MEMORY ORGANIZATION AND SYSTEM DESIGN**	**9**
Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies. Memory system design: Semiconductor memory technologies, memory organization.		

Text Book (s)

1	Morris Mano, "Computer System Architecture" 3rd Edition, Prentice Hall of India, New Delhi, 2014.

Reference (s)

1	David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition 2013.
2	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Naraig Manjikian, "Computer Organization and Embedded Systems" McGraw-Hill, 6th Edition 2014.
3	John P. Hayes, Computer Architecture and Organization, McGraw-Hill ,3rd Edition,2013.
4	William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2015.
5	Vincent P. Heuring and Harry F. Jordan," Computer System Design and Architecture", Prentice Hall, 2 nd Edition, 2004.



Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC205T	FUNDAMENTALS OF OPERATING SYSTEMS	3	0	0	3

Prerequisite Course (s)

Data structures

Course Objective (s):

The purpose of learning this course is to:

1	To understand the basic concepts and functions of operating systems.
2	To understand Processes and Threads and Scheduling algorithms.
3	To understand the concept of Deadlocks.
4	To analyze various memory and storage management schemes.
5	To understand basic concepts of virtualization.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Illustrate the operating system concepts and its functionalities.
CO2	Compare various CPU scheduling algorithms.
CO3	Explain the need for process synchronization.
CO4	Identify the issues in memory management.
CO5	Illustrate how to optimize the performance of virtualization.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1	-	-	-	-	1	1	2	3
CO2	3	2	3	2	3	1	-	-	-	-	1	2	3	3
CO3	3	2	2	3	3	1	-	-	-	-	1	2	3	3
CO4	3	2	2	2	3	1	-	-	-	-	1	3	3	2
CO5	3	2	2	3	2	1	-	-	-	-	1	2	3	2
CO (Avg)	3	2	2.4	2.6	2.6	1	-	--	-	-	1	2	2.8	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION	9

Introduction - Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – Distributed Systems – Computing Environments – System Structures: Operating System Services – User Operating System Interface – System Calls – Types of System Calls – System Programs.

UNIT II	PROCESS MANAGEMENT AND SYNCHRONIZATION	9

Process Concept: Process Scheduling – Operations on Processes – Inter-process Communication.

Multithreaded Programming: Overview – Multithreading Models – Threading Issues

Process Synchronization: Introduction - The Critical Section Problem - Synchronization Hardware – Semaphore

UNIT III	CPU SCHEDULING AND DEADLOCK	9

CPU Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Synchronization – The Critical-Section Problem – Peterson's Solution – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors.

Deadlocks: System Model – Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock

UNIT IV	MEMORY MANAGEMENT	9

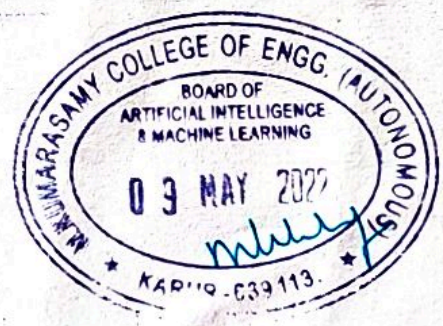
Memory Management Strategies: Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table – Segmentation

Virtual Memory Management: Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing.

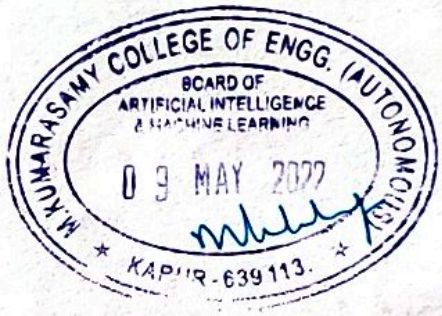
UNIT V	STORAGE MANAGEMENT	9

Secondary Storage Structure: Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Devices – Device controllers- Device drivers.

File System: File Concept – Access Methods – Directory Structure – File Sharing – Protection - File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management.



Text Book (s)	
1	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 2013.
Reference (s)	
1	Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of India Pvt. Ltd, 2010
2	D M Dhamdhere, " Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
3	William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Eighth Edition, 2015.



Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC206L	DATA STRUCTURES LABORATORY	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To apply the concepts of List ADT in the applications of various linear and nonlinear data structures.
2	To demonstrate the understanding of stacks, queues and their applications.
3	To analyze the concepts of tree data structure.
4	To understand the implementation of graphs and their applications.
5	To be able to incorporate various searching and sorting techniques in real time scenarios.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Analyze the various data structure concepts.
CO2	Implement Stacks and Queue concepts for solving real-world problems.
CO3	Analyze and structure the linear data structure using tree concepts.
CO4	Critically Analyse various non-linear data structures algorithms.
CO5	Apply different Sorting, Searching and Hashing algorithms.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	1	-	-	-	-	2	1	3	2
CO2	3	3	2	3	3	1	-	-	-	-	2	2	3	2
CO3	3	3	2	3	3	1	-	-	-	-	2	2	3	2
CO4	3	3	2	3	3	1	-	-	-	-	2	2	3	2
CO5	3	3	2	3	3	1	-	-	-	-	2	1	3	2
CO (Avg)	3	2.8	1.2	3	3	1	-	-	-	-	2	1.6	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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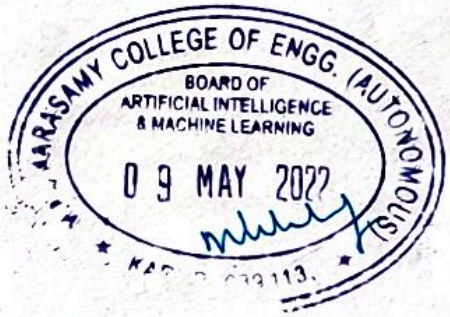
LIST OF EXPERIMENTS	30

1. Array Implementation of List ADT.
2. Array Implementation of Stack and Queue ADTs.
3. Linked list Implementation of Stack, Queue and List ADTs.
4. Implementation of Binary Search Tree.
5. Implementation of AVL Tree.
6. Implementation of Heaps.
7. Graph representation and Traversal algorithms.
8. Applications of graphs.
9. Implementation of Searching and sorting algorithms.
10. Hashing – any two collision techniques.



Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC207L	OPERATING SYSTEMS LABORATORY	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To study the basic concepts and functions of operating systems.
2	To learn about Processes, Threads, Scheduling algorithms and Deadlocks.
3	To study various Memory Management schemes.
4	To learn I/O Management and File Systems.
5	To learn the basics of Distributed operating systems.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Explain the concepts and structures of Operating Systems.
CO2	Design various Scheduling algorithms and methods to avoid Deadlock.
CO3	Compare and contrast various memory management schemes.
CO4	Summarize the concepts of I/O management and design a prototype file system.
CO5	Describe the concepts of Distributed operating systems.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	1	-	1	2	2	2	3	2
CO2	3	3	3	3	3	-	-	-	2	-	2	2	3	2
CO3	3	3	3	3	3	-	-	-	1	-	2	2	3	2
CO4	3	3	3	3	3	-	-	-	2	-	2	2	3	2
CO5	3	3	3	3	3	-	-	1	1	-	2	2	3	2
CO (Avg)	3	3	3	3	3	-	0.2	0.2	1.4	0.4	2	2	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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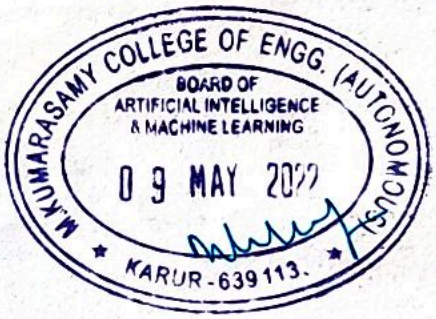
LIST OF EXPERIMENTS	30

1. Study of LINUX - Basic Commands
2. Shell programming (Using looping, control constructs etc.,)
3. Write programs using the following system calls of UNIX operating system: fork, exec, getpid
4. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc).
5. Implementation of CPU scheduling algorithms: FCFS & SJF
6. Implementation of CPU scheduling algorithms: Round Robin & Priority Scheduling
7. Implement the Producer – Consumer problem using semaphores.
8. Implementation of Banker's algorithm
9. Implement some memory management schemes (First fit, Best fit & Worst fit)
10. Implement some page replacement algorithms (FIFO & LRU)



Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18AIP201L	MINOR PROJECT - I	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

Identify the suitable idea and methods to develop the project idea into demonstrative or to explain the concepts in standard procedure and to prepare report.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify the requirement and develop the concepts or models through standard procedures and preparation of report.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	1	3	1	3	3	3	3
CO (Avg)	3	3	3	3	3	1	1	1	3	1	3	3	3	3

Strategy(s)

- The Student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a project report after completing the work to the satisfaction.
- The student will be evaluated through continuous assessment by a panel formed under the approval of head of the department.

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Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM201L	COMPETENCIES IN SOCIAL SKILLS	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To sharpen problem solving skill and to improve thinking capability of the students.
2	To hone soft skill and analytical ability of students.
3	To engage learners in using language purposefully and cooperatively.
4	To expertise the writing and presentation skill to fulfill the corporate expectations.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Students should be able to solve both analytical and logical problems in an effective manner.
CO2	Students can design and deliver information in a proper manner.
CO3	Presentation skills of students will be improved individually as well as a team member.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1	-	-	-	-	3	2	1	2	2	1
CO2	3	1	3	1	-	-	-	2	3	2	1	2	2	1
CO3	3	1	3	1	-	-	-	-	2	-	-	-	2	1
CO (Avg)	3	1	3	1	-	-	-	0.67	2.8	1.33	0.67	1.33	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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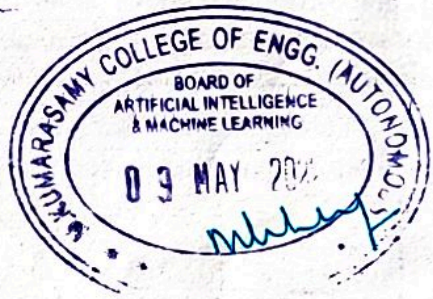
UNIT I	Module – 1	6
Aptitude: Coding & Decoding - Direction Sense Test. **Communication:** Self-Introduction and SWOT analysis - Letter writing - types.		
UNIT II	**Module – 2**	**6**
Aptitude: Venn Diagrams - Data Interpretation. **Communication:** Phrasal verbs - Voice of Valluvar.		
UNIT III	**Module – 3**	**6**
Aptitude: Averages. **Communication:** Idioms and Phrases - Skits.		
UNIT IV	**Module – 4**	**6**
Aptitude: Time and Distance - Problems on Trains. **Communication:** Prefix/Suffix - Root words - Adjectives - JAM (Extempore Speech).		
UNIT V	**Module – 5**	**6**
Aptitude: Clocks & Calendars. **Communication:** Homophones - Frame Tales.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015



Regulation 2018		Semester III	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18CYM201T	ENVIRONMENTAL SCIENCE	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To demonstrate in-depth knowledge within environmental engineering and an awareness of social, economic, political, and environmental impacts of engineering practices.
2	To have competence for working with multi-disciplinary teams to arrive at solutions to environmental engineering problems.
3	To get solutions which will minimize the negative impact of human activities on the environment and to protect human health?

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Improve fundamental knowledge of the inter-relationships between the built environment and natural systems.
CO2	Characterize and mitigate man-made hazards like nuclear hazards. Understand the principles involved in the generation of different forms of energy.
CO3	Improve the reliability, performance, disaster-management of natural calamities and solid waste and water supplies and treatment processes.
CO4	Understand the source, effects and control measure of various environmental pollution.
CO5	Apply information technology in the control of human population and women and child welfare.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	3	-	-	-	-	-	1	1
CO2	2	2	2	-	-	3	3	-	-	-	-	-	1	1
CO3	2	2	2	2	-	3	3	-	-	-	-	-	1	1
CO4	2	2	2	-	-	3	3		-	-	-	-	1	1
CO5	2	2	2	2	-	3	3	-	-	-	-	-	1	1
CO (Avg)	2.00	2.00	2.00	0.8	-	2.4	3.00			-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENVIRONMENT& BIODIVERSITY	3
Definition-types of environment, components of environment, scope-importance of environmental studies- Bio diversity-definition-value of biodiversity-Threats to biodiversity - India a mega diversity nation-endangered and endemic species of India-conservation of biodiversity.		
UNIT II	**ENERGY SOURCES**	**3**
Energy resources- Growing energy needs- Renewable and Nonrenewable energy sources- Use of alternate energy sources - Nuclear Energy- Alternative energy fuels-power alcohol-Bio diesel (preparation, properties &uses)		
UNIT III	**SOCIAL ISSUES AND ENVIRONMENT**	**3**
Environment ethics – Climate change – Global warming – Acid rain – Ozone layer depletion – Nuclear accidents-holocaust. Solid waste management - Rain water Harvesting-watershed management		
UNIT IV	**ENVIRONMENTAL POLLUTION & ACTs**	**3**
Source, types, effects & control- Air pollution -Water pollution – Soil pollution – Marine pollution and Plastic Pollution -The Environment (Protection) Act - Air (Prevention and control of pollution) Act - Water (Prevention and control of pollution) Act- Role of individual in prevention of pollution.		
UNIT V	**HUMAN POPULATION AND ENVIRONMENT**	**3**
Sustainable development – Urban Population growth and distribution – Population explosion – Family Welfare Program –Women and child welfare- Role of information technology in environment and human health- case studies		

Text Book (s)

1	Dr.J.P.Sharma, "Environmental studies", Laxmi Publications(p) Ltd, New Delhi.
2	Miller "Environmental Science" 11th Edition, Cengage Learning India Private Limited, New Delhi, (2006).

Reference (s)

1	Master. G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt Ltd., (2004)
2	Dr.A.Ravikrishnan " Environmental Science and Engineering " Sri Krishna publications, Chennai(2015)
3	P.Anandan, R.Kumaravelan "Environmental Science and Engineering" Scitech Publication (India) Pvt. Ltd, Chennai, Reprint 2009.

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03 MAY 202

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB206T	DISCRETE MATHEMATICS	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Obtain general knowledge about the area of propositional calculus and apply in Science and Engineering
2	Obtain the basic knowledge in predicate calculus and apply in Decision making problems
3	Apply the basics of Set theory in real life problems
4	Model situations in a mathematical way using combinatorics and derive useful results
5	Gain well founded knowledge in the areas of Graph Theory and apply in the computing fields

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Demonstrate their knowledge in propositional calculus
CO2	Demonstrate their knowledge in predicate calculus
CO3	Obtain the perception in the area of sets and the knowledge about functions.
CO4	Obtain perception in the area of combinatorics
CO5	Obtain perception in the area of graph theory

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	-
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	-
CO3	2	1	2	2	1	-	-	-	-	-	-	1	3	-
CO4	2	1	2	2	1	-	-	-	-	-	3	1	3	-
CO5	3	2	2	2	1	-	-	-	-	-	1	1	3	-
CO (Avg)	2.6	1.6	2	2	1	-	-	-	-	-	0.8	1	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	PROPOSITIONAL CALCULUS	9 + 3
Propositions- Logical connectives-Compound propositions-Conditional and Biconditional propositions- Truth tables - Tautologies and Contradictions - Logical and equivalences and implications - DeMorgan's Laws-Normal forms-Principal conjunctive and disjunctive normal forms - Rules of inference-Arguments-Validity of arguments.		
UNIT II	**PREDICATE CALCULUS**	**9 + 3**
Predicates-Statement Function -Variables-free and bound variables- Quantifiers- Universe of discourse- Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.		
UNIT III	**SET THEORY AND FUNCTIONS**	**9 + 3**
Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering-Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions- inverse functions.		
UNIT IV	**COMBINATORICS**	**9 + 3**
Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations-Recursion and Recurrence relations-Generating Functions- Mathematical Induction- Inclusion – Exclusion		
UNIT V	**GRAPH THEORY**	**9 + 3**
Introduction to Graphs-Graph Operations- Graph and Matrices-Graph Isomorphism- Connected Graphs- Euler Graphs- Hamilton Paths and Circuits- Planar Graph-Graph Colouring-Trees- Shortest Path Problem-Directed and Undirected Graphs- Flows in Networks.		

Text Book (s)

1	Trembly J.P and Manohar R, —Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2003.
2	Ralph. P. Grimaldi, —Discrete and Combinatorial Mathematics: An Applied Introductionl, Fourth Edition, Pearson Education Asia, Delhi, 2002.

Reference (s)

1	Kenneth H Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, Seventh Edition, McGraw Hill Education India Private Limited, New Delhi, 2013.
2	A.Doerr and K.Levasseur, Applied Discrete Structures, Galgotia Publication, New Delhi, 2004.
3	Gilbert Strang, "Introduction to Linear Algebra", 4th edition Wellesley- Cambridge Press, 2009.
4	Johnson baugh, Richard, "Discrete Mathematics", Sixth Edition, Maxwell, International Edition, 2006.

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC208T	MACHINE LEARNING ALGORITHMS	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To understand the concepts of Machine Learning.
2	To appreciate supervised learning and their applications.
3	To know about the concepts and algorithms of unsupervised learning.
4	To understand the basic concept of reinforcement learning algorithm and its applications.
5	To study about modelling, aggregation and knowledge representation using graphical models.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify applications suitable for different types of Machine Learning with suitable justification.
CO2	Implement supervised Learning algorithms for real time data sets for Intelligent decision making.
CO3	Apply Machine Learning techniques to classification and clustering to unstructured data.
CO4	Apply reinforcement learning techniques for real life problems.
CO5	Implement probabilistic discriminate and generative algorithms for an applications of your choice and analyze the results.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	-	-	-	-	2	2	3	2
CO2	3	3	3	3	3	1	-	-	-	-	2	2	3	2
CO3	3	3	3	3	3	1	-	-	-	-	2	2	3	2
CO4	3	3	3	3	3	2	-	-	-	-	2	2	3	2
CO5	3	3	3	3	3	1	-	-	-	-	2	2	3	2
CO (Avg)	3	3	3	3	3	1.2	-	-	-	-	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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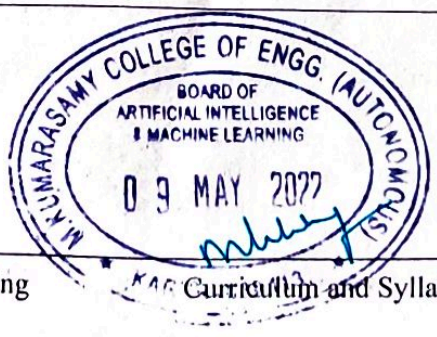
UNIT I	INTRODUCTION TO MACHINE LEARNING	9
Machine Learning - Machine Learning Foundations - Overview - applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning -Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison		
UNIT II	**SUPERVISED LEARNING**	**9**
Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- Regression Trees - Pruning. Ensemble methods- Bagging- Boosting.		
UNIT III	**UNSUPERVISED LEARNING**	**9**
Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces - The Curse of Dimensionality - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis		
UNIT IV	**REINFORCEMENT LEARNING**	**9**
Passive reinforcement learning- direct utility estimation- adaptive dynamic programming- temporal difference learning- active reinforcement learning- exploration- learning an action-utility function- Generalization in reinforcement learning- policy search- applications in game playing- applications in robot control		
UNIT V	**PROBABILISTIC GRAPHICAL MODELS**	**9**
Graphical Models - Undirected Graphical Models - Markov Random Fields-Directed Graphical Models - Bayesian Networks-Conditional Independence properties-Markov Random Fields-Hidden Markov Models - Conditional Random Fields(CRFs).		

Text Book (s)

1	Kevin P. Murphy, Machine Learning : A Probabilistic Perspective, MIT Press, 2012

Reference (s)

1	Stephen Marsland, Machine Learning- An Algorithmic Perspective, Chapman and Hall, CRC Press, Second Edition, 2014.
2	Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Third Edition, 2014.
3	Christopher Bishop, Pattern Recognition and Machine Learning Springer, 2007.
4	P. Flach, Machine Learning : The art and science of algorithms that make sense of data, Cambridge University Press, 2012.



Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC209T	INTERNET PROGRAMMING	3	0	0	3

Prerequisite Course (s)

- Object Oriented Programming

Course Objective (s):

The purpose of learning this course is to:

1	To understand different internet technologies and to design website using HTML.
2	To build dynamic webpages
3	To create server-side programs using JSP and Servlets
4	To construct simple web pages in PHP and to represent data in XML format.
5	To demonstrate Java-specific web services

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Construct a basic website using HTML and Cascading Style Sheets
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms
CO3	Develop server side programs using Servlets and JSP
CO4	Construct simple web pages in PHP and to represent data in XML format
CO5	Apply AJAX and web services to develop interactive web applications

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	-	-	-	2	1	3	2
CO2	3	3	3	3	3	1	1	-	-	-	2	1	3	2
CO3	3	3	3	3	3	1	1	-	-	-	2	1	3	2
CO4	3	3	3	3	3	1	1	-	-	-	2	1	3	2
CO5	3	3	3	3	3	1	1	-	-	-	2	1	3	2
CO (Avg)	3	3	3	3	3	1	1	-	-	-	2	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	WEBSITE BASICS, HTML, CSS	9
Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML – Tables – Lists – Image – HTML control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.		
UNIT II	**CLIENT SIDE PROGRAMMING**	**9**
Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.		
UNIT III	**SERVER SIDE PROGRAMMING**	**9**
Servlets: Java Servlet Architecture - Servlet Life Cycle - Parameter Data - Session Handling Understanding Cookies - Installing and Configuring Apache Tomcat Web Server - DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages - JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.		
UNIT IV	**PHP and XML**	**9**
An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).		
UNIT V	**INTRODUCTION TO AJAX and WEB SERVICES**	**9**
AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application – SOAP – REST based web services – Introduction to Java Web Development Frameworks.		

Text Book (s)	
1	Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.
2	Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
Reference (s)	
1	Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition, 1999.
2	Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3	Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of

	India, 2014.
4	Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.
5	Nicholas S. Williams, Professional Java for Web Applications, Wrox Publisher, First Edition, 2014.

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC210T	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To infer the essentials of data models to intellectualize and illustrate a database system using ER diagram.
2	To conceptualize the relational database implementation using SQL with effective relational database design concepts.
3	To elaborate the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
4	To demonstrate Query evaluation and optimization techniques.
5	To signify the concepts of Database Security, Object Oriented, Data Warehousing and Data Mining.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Distinguish database systems from file systems and describe data models and DBMS architecture.
CO2	Identify the basic issues of transaction processing and concurrency control.
CO3	Demonstrate with understanding of SQL Programming language and normalization theory.
CO4	Practice the basic query evaluation techniques, query optimization and familiar with basic database storage structures and access techniques.
CO5	Analyze and derive an information model expressed in the form of an entity relation diagram and transform into a relational database schema.

CO-PO Mapping

Cos	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	-	-	-	-	2	1	3	2
CO2	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO3	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO4	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO5	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO (Avg)	3	3	2	3	3	1	-	-	-	-	2	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
Introduction to Database. Hierarchical, Network and Relational Models. Three-Schema Architecture and Data Independence– The Database System Environment– Data models: Entity-relationship model, network model, relational and object oriented data models, SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL.		
UNIT II	**RELATIONAL QUERY LANGUAGES AND DATABASE DESIGN**	**9**
Relational algebra, Relational Calculus, DDL and DML constructs. Relational Database Design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.		
UNIT III	**TRANSACTION PROCESSING**	**9**
Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery		
UNIT IV	**PROCESSING & OPTIMIZATION**	**9**
Query Processing Overview – Algorithms for SELECT and JOIN operations - Evaluation of relational algebra expressions, Query equivalence, Query optimization algorithms.		
UNIT V	**DATABASE STORAGE STRATEGIES & SECURITY**	**9**
RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing Database Security: Authentication, Authorization and Access Control.		

Text Book (s)	
1	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, March 2019.
2	R. Elmasri and S. Navathe ,"Fundamentals of Database Systems", Pearson 7th Edition, 2017.
Reference (s)	
1	J. D. Ullman,"Principles of Database and Knowledge – Base Systems", Vol 1,Computer Science Press ,Inc. New York, 1998.
2	Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011
3	Serge Abiteboul, Richard Hull, VictorVianu ,"Foundations of Databases", Addison-Wesley Publishing Company, 1995.

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Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC211T	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To know about different types of computing problem algorithms and learn how to analyze its efficiency.
2	To make the students understand how computing problems are solved using brute force and divide and conquer methods.
3	To know about problems solved using dynamic programming and greedy techniques
4	To make the students learn about iterative improvement method for problem solving
5	To make students understand the limitations of algorithms and learn about backtracking, branch and bound techniques.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Interpret the fundamental needs of algorithms in problem solving.
CO2	Classify the different algorithm design techniques for problem solving.
CO3	Develop algorithms for various computing problems.
CO4	Analyze the time and space complexity of various algorithms.
CO5	To identify the types of problem, formulate, analyze and compare the efficiency of algorithms.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	2	1	2	1
CO2	3	3	3	2	3	-	-	-	-	-	2	1	2	1
CO3	3	3	3	2	3	-	-	-	-	-	2	1	2	1
CO4	3	3	3	3	3	-	-	-	-	-	2	1	2	1
CO5	3	3	3	3	3	-	-	-	-	-	2	1	2	1
CO (Avg)	3	3	3	2.6	3	-	-	-	-	-	2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION	9
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms – Visualization		
UNIT II	**BRUTE FORCE AND DIVIDE-AND-CONQUER**	**9**
Brute Force – Computing an– String Matching – Closest-Pair and Convex-Hull Problems - Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem.Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex – Hull Problems.		
UNIT III	**DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE**	**9**
Dynamic programming – Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem – Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern – Huffman Trees.		
UNIT IV	**ITERATIVE IMPROVEMENT**	**9**
The Simplex Method – The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.		
UNIT V	**COPING WITH THE LIMITATIONS OF ALGORITHM POWER**	**9**
Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search – Assignment problem – Knapsack Problem – Travelling Salesman Problem – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.		

Text Book (s)

1	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, PearsonEducation, 2012.

Reference (s)

1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3	Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3 , Pearson Education, 2009.
4	Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

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Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC212T	SOFTWARE ENGINEERING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Gain knowledge about the various phases in a software development life cycle.
2	Understand the basic of software requirements, project management and cost estimation.
3	Learn the metrics and models used to estimate the software quality and reliability.
4	Understand the various methodologies in software design using case tools.
5	Learn various testing strategies used to identify faults and failures in software development.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Explain the various phases in a software development life cycle.
CO2	Elucidate the software requirement specification and cost estimation for a project management.
CO3	Utilize the metrics and models for estimating the software quality and reliability.
CO4	Develop software using object oriented case tools for a real time application.
CO5	Explain various testing techniques used in verification and validation of a software.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	1	-	3	-	3	1	2	1
CO2	3	3	2	2	2	1	1	-	3	-	3	2	2	1
CO3	3	3	3	2	2	1	1	-	3	-	3	2	2	1
CO4	3	3	3	2	2	1	1	-	3	-	3	2	2	1
CO5	3	3	2	2	2	1	1	-	3	-	3	2	2	1
CO (Avg)	3	2.8	2.2	2	2	1	1	-	3	-	3	1.8	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	SOFTWARE PROCESS AND REQUIREMENTS ANALYSIS	9
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models- Waterfall model, Incremental model, Iterative model, RAD model. Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation		
UNIT II	**INTRODUCTION TO AGILE**	**9**
The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Design and development practices in Agile projects, Pair Programming, Agile Tools.		
UNIT III	**AGILE SCRUM FRAMEWORK**	**9**
Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint Scrum Team.		
UNIT IV	**SOFTWARE DESIGN AND DEVELOPMENT**	**9**
Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control		
UNIT V	**SOFTWARE TESTING**	**9**
The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Behavior-driven development (BDD), Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.		

Text Book (s)

1	Roger S. Pressman and Bruce Maxim, Software Engineering – A Practitioner's Approach, Ninth Edition, Mc Graw-Hill Education, 2019.
2	Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", Pearson Education, 2nd Edition, 2014.
3	Janet Gregory, Lisa Crispin, "Agile Testing Condensed: A Brief Introduction", Addison Wesley, 2019.
4	Ian Sommerville, Software Engineering, Tenth Edition, Pearson Education, 2017

Reference (s)

1	Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", Prentice Hall, 2nd Edition, 2014.
2	Alistair Cockburn, "Agile Software Development: The Cooperative Game (Agile Software Development Series)" 2 nd Edition, Kindle Edition.
3	Mike Cohn, "User Stories Applied: For Agile Software", Addison Wesley, 2 nd Edition, 2016

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Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC213L	MACHINE LEARNING LABORATORY	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To understand the concepts of Machine Learning.
2	To implement supervised learning and their applications.
3	To implement the concepts and algorithms of unsupervised learning.
4	To practice modelling, aggregation and knowledge representation using graphical models.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Implement supervised Learning algorithms for real time data sets for Intelligent decision making.
CO2	Apply Machine Learning techniques to classification and clustering to unstructured data.
CO3	Apply reinforcement learning techniques for real life problems
CO4	Identify and apply Machine Learning algorithms to solve real world problems.
CO5	Apply FIND-S, ID3, back propagation, k-means algorithm

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO2	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO3	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO4	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO5	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO (Avg)	3	3	3	3	3	-	-	-	-	-	1	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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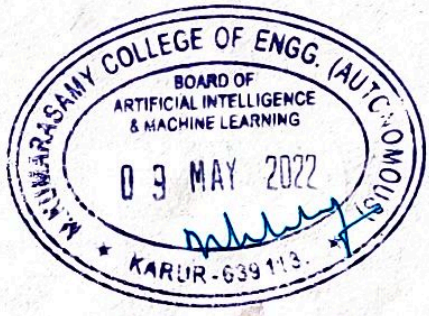
LIST OF EXPERIMENTS	30

1. Load Real Time data Set and Python Libraries, Installing Libraries through Anaconda Prompt, Perform data pre-processing through Pandas Library.
2. Implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
3. Implement 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. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
5. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
6. Implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem
7. Assuming a set of documents that need to be classified, use the Semi Supervised 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.
8. Implement Q Learning with Linear Function Approximation.
9. Implement the Policy Gradient concept in Reinforcement learning. Compare the Reinforce with Baseline with Actor Critic with Baseline.
10. Consider a time series data set. Plot the data, Identify the components of the Time Series data, Calculate the seasonality and stationarity and Identify the trend patter present in the time series data. Remove the white noise if available in the time series data.



Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AMC214L	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To understand data definitions and data manipulation commands
2	To learn the use of nested and join queries
3	To understand views and constraints
4	To Implement programs using SQL and PL/SQL
5	To demonstrate procedural extensions such as procedure, function, cursors and Triggers.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Use typical data definitions and manipulation commands
CO2	Design applications to test Nested and Join Queries
CO3	Implement simple applications that use Views
CO4	Employ PL/SQL blocks such as stored procedures, functions, triggers and cursors
CO5	Critically analyze the use of Tables, Views, Functions and Procedures

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	3	-	2	3	3	2
CO2	3	3	3	3	3	-	-	-	3	-	2	3	3	2
CO3	3	3	3	3	3	-	-	-	3	-	2	3	3	2
CO4	3	3	3	3	3	-	-	-	3	-	2	3	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	3	3	2
CO (Avg)	3	3	3	3	3	-	-	-	3	-	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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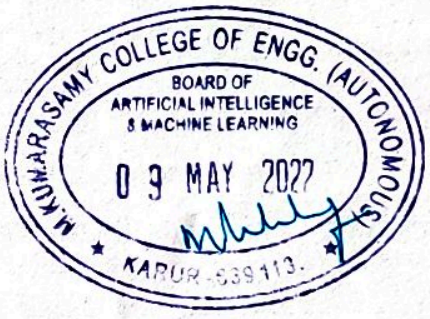
LIST OF EXPERIMENTS	30

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Implementation of DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Creation of Views, Synonyms, Sequence, Indexes, Save point.
6. Implementation of Nested Queries
7. Implementation of Join and Set operators
8. Creating an Employee Database to set various constraints.
9. Implementation of Virtual tables using Views
10. Study of PL/SQL block.
11. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
12. Write a PL/SQL block that handles all types of exceptions.
13. Creation of Procedures and functions.
14. Creation of database triggers and cursors.
15. Application Development using Front End Tools and Database Connectivity.



Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18AIP202L	MINOR PROJECT – II (With AI and ML based solutions using Python)	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

Identify the suitable idea and methods to develop the project idea into demonstrative or to explain the concepts in standard procedure and to prepare report.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify the requirement and develop the concepts or models through standard procedures and preparation of report.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	1	1	1	1	3	3	3	3
CO (Avg)	3	3	3	3	3	3	1	1	1	1	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Strategy(s)

- The Student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a project report after completing the work to the satisfaction.
- The student will be evaluated through continuous assessment by a panel formed under the approval of head of the department.

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Regulation 2018		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM202L	CRITICAL AND CREATIVE THINKING SKILLS	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To focus on listening, speaking, & writing skills through audio & video sessions.
2	To hone soft skill and analytical ability of students.
3	To overcome the fear in group communication and to provide the effective communication.
4	To expertise intelligible pronunciation, stress and intonation patterns.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Students can be able to solve both analytical and logical problems in an effective manner.
CO2	Students can demonstrate an ability to design and deliver messages.
CO3	The quality of student's communication with practical experience is improved.

CO-PO Mapping

COs	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	1	-	-	-	-	2	1	1	-	1
CO2	3	1	2	1	2	-	-	-	-	2	1	1	-	1
CO3	3	1	-	1	1	-	-	-	-	2	1	1	-	1
CO (Avg)	3	1	1.33	1	1.33	-	-	-	-	2	1	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	Module - 1	6
Aptitude: Time and Work - Pipes and Cisterns. **Communication:** Sentence Pattern - Debate.		
UNIT II	**Module - 2**	**6**
Aptitude: Boats and Streams. **Communication:** Tenses and voices - Tech Talk.		
UNIT III	**Module - 3**	**6**
Aptitude: Problems on Ages - Probability **Communication:** Analogies - Biography.		
UNIT IV	**Module - 4**	**6**
Aptitude: Data sufficiency - Logical Puzzles. **Communication:** Punctuation - Connection.		
UNIT V	**Module - 5**	**6**
Aptitude: Mensuration. **Communication:** Preposition - News of the Week.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

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Regulation 2018		Semester III / IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM103T	INDIAN TRADITION AND HERITAGE	1	0	0	-

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1:	Make students understand the role and impact of culture in human life.
CLR-2:	Draw attention towards languages and literatures of ancient period.
CLR-3:	Cultivate secularism in students.
CLR-4:	Equip students with the knowledge of Indian art and architectural evolution over years.
CLR-5:	Make students identify Indian culture in abroad.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the meaning of culture, trace the influence and significance of geographical features on Indian culture.
CO2	Develop an awareness of the variety of languages and literatures in India.
CO3	Recognise the characteristics of various religious movements in ancient India.
CO4	Identify the characteristics and various styles of Indian architecture and sculpture at different times.
CO5	Examine various modes through which Indian culture spread abroad.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO2	-	-	-	-	-	2	2	1	2	2	1	2	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO4	2	2	2	2	2	2	2	2	2	2	1	2	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-
CO (Avg)	0.4	0.4	0.4	0.4	0.4	1.8	1.8	1.6	1.8	1.8	0.6	1.8	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	HISTORY OF INDIAN CULTURE	2
Characteristics of Indian Culture - Significance of Geography on Indian Culture -Society in India through ages- Ancient Period - Varna and Jati, family and marriage in India - Position of women in ancient India- Contemporary period; Caste system and communalism.		
UNIT II	**LITERATURE AND EDUCATION**	**4**
Evolution of script and languages in India : Harappan Script and Brahmi Script, Short History of the Sanskrit Literature: The Vedas, The Brahmanas and Upanishads and Sutras, Epics: Ramayana and Mahabharata & Puranas - History of Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Sangam Literature and Odia Literature.		
UNIT III	**RELIGION AND PHILOSOPHY**	**4**
Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainisim, Indian Philosophy - Vedanta and Mimansa school of Philosophy.		
UNIT IV	**ART AND ARCHITECTURE**	**2**
Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Budhhist Architecture, Medieval Architecture and Colonial Architecture, Indian Painting Tradition, Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Rise of modern theatre and Indian cinema.		
UNIT V	**SPREAD OF INDIAN CULTURE ABROAD**	**3**
Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World through ages.		
Reference (s)		
1	Chakravarti, Ranabir: Merchants, Merchandise & Merchantmen, in: Prakash, Om (ed.): The Trading World of the Indian Ocean, 1500-1800 (History of Science, Philosophy and Culturein Indian Civilization, ed. by D.P. Chattopadhyaya, vol. III, 7), Pearson, Delhi, 2012.	

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