



ANNAMACHARYA UNIVERSITY

**(Estd A.P. Private Universities (Establishment and Regulation) Act, 2016)
RAJAMPET-516126, Annamayya District, A.P, INDIA**

**COURSE STRUCTURE AND SYLLABI of MCA for the
students admitted to
MCA Regular Two-Year Postgraduate Degree
Programme from the Academic
Year 2024-25**



ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

COURSE STRUCTURE MASTER OF COMPUTER APPLICATIONS

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BS	24FMAT11T	Mathematical Foundations of Computer Science	3	0	0	3
2	PC	24FMCA11T	Data Structures and Analysis of Algorithms	3	0	0	3
3	PC	24FMCA12T	Database Management Systems	3	0	0	3
4	PC	24FMCA13T	Computer Organization	3	0	0	3
5	BS	24FMAT12T	Probability and Statistics	3	0	0	3
6	HSM	24FENG11T	Technical Communication	3	0	0	3
7	PC	24FMCA11L	Data Structures through C Laboratory	0	0	3	1.5
8	PC	24FMCA12L	DBMS Laboratory	0	0	3	1.5
9	HSM	24FENG11L	English Language Communication Skills Laboratory	0	0	3	1.5
Total Credits							22.5

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PC	24FMCA21T	Operating Systems	3	0	0	3
2	PC	24FMCA22T	Python Programming	3	0	0	3
3	PC	24FMCA23T	Software Engineering	3	0	0	3
4	PC	24FMCA24T	Computer Networks	3	0	0	3
5			Elective-I	3	0	0	3
	PE	24FMCA2AT	Data Science				
	PE	24FMCA2BT	Object Oriented Analysis and Design				
	PE	24FMCA2CT	Cloud Computing				
6			Elective-II	3	0	0	3
	PE	24FMCA2ET	Social Network Analysis				
	PE	24FMCA2FT	Data Warehousing and Data Mining				
	PE	24FMCA2GT	Big Data Analytics				
PE	24FMCA2HT	Cyber Security					
7	PC	24FMCA21L	Operating Systems Laboratory	0	0	3	1.5
8	PC	24FMCA22L	Python Programming Laboratory	0	0	3	1.5
9	PC	24FMCA23L	Software Engineering Laboratory	0	0	3	1.5
10	AU	24FAUD2AT	Mandatory Audit Course (Universal Human Values)	2	0	0	NA
Total Credits							22.5

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PC	24FMCA31T	Full Stack Development	3	0	0	3
2	PC	24FMCA32T	Machine Learning	3	0	0	3
3	PC	24FMCA33T	DevOps	3	0	0	3
4	PC	24FMCA34T	Artificial Intelligence	3	0	0	3
5	Elective-III			3	0	0	3
	PE	24FMCA3AT	Industry 4.0				
	PE	24FMCA3BT	Neural Networks				
	PE	24FMCA3CT	Block Chain Technologies				
6	Elective-IV			3	0	0	3
	PE	24FMCA3ET	MOOC				
7	PC	24FMCA31L	Full Stack Laboratory	0	0	3	1.5
8	PC	24FMCA32L	Machine Learning Laboratory	0	0	3	1.5
9	PC	24FMCA33L	DevOps Laboratory	0	0	3	1.5
10	SE	24FMCA34S	Technical Seminar	0	0	1	0.5
Total Credits							23

II Year II Semester

S. No.	Category	Course Code	Course Title	Credits
				C
1	PW	24FMCA41P	Project Work	16
2	CV	24FMCA41L	Comprehensive Viva-Voce	2
Total Credits				18



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Mathematical Foundations of Computer Science

Category : BS

Year : I

Semester : I

Course Code : 24FMAT11T

Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

The aim is to cover the basics of mathematical logic and to work with sets, relations, and functions. It also involves studying how combinatorial methods are applied in fields like cryptography, coding theory, and algorithm design, as well as understanding generating functions, recurrence relations, and fundamental concepts of graphs and trees and their practical uses.

COURSE OUTCOMES:

The Student will be able to

1. Understand the fundamental concepts of propositional and predicate calculus to construct valid arguments and engage with logical reasoning effectively.
2. Utilize operations and principles related to sets, including the Principle of Inclusion-Exclusion, to address real-world problems involving set theory.
3. Analyze the application of combinatorial mathematics across various fields, such as computer science, cryptography, and optimization, by exploring its principles and techniques for addressing complex challenges.
4. Solve different types of recurrence relations in computational contexts by applying appropriate methods to model and address various problems effectively.
5. Apply graph theory concepts in network analysis.

Unit 1 Mathematical Logic 10

Propositional Calculus: Statements and Notations, Connectives, Well-formed formulas, Truth tables, Tautologies, Equivalence of formulas, Duality Law, Tautological implications, Normal forms, Theory of Inference for Statement calculus.

Predicate Calculus: Predicates, Predicative logic, Statement functions, Variables and Quantifiers, Free and Bound variables, Inference theory for Predicate calculus

Unit 2 Set Theory 8

Sets: Operations on Sets, Principle of Inclusion-Exclusion. Relations-Properties, Operations, Partition and Covering, Transitive closure, Equivalence, Compatibility and Partial ordering, Hasse diagrams. Functions-Bijective, Composition, Inverse functions, Lattice and its Properties.

Unit 3 Elementary Combinatorics 8

Basics of Counting, Combinations and Permutations, Enumerating Combinations & Permutations with repetitions, Enumerating Permutations with constrained repetitions, Binomial coefficients, Binomial and Multinomial theorems.

Unit 4 Recurrence Relations 8

Generating functions of sequences, calculating coefficients of generating functions, Recurrence relations - Solving recurrence relations by substitution and generating functions, Method of characteristic roots for the Solutions of non-homogeneous recurrence relations.

Unit 5 Graph Theory 10

Definitions, Finite and infinite graphs, Incidence and Degree, Isolated and Pendant vertices, Graph representations- Adjacency and Incidence matrices, Isomorphism, subgraphs, Walk, Path and Circuit, Connected and Disconnected graphs, Components, Multi graphs, Bipartite and Planar Graphs, Euler's formula, Euler graphs, Hamiltonian paths and circuits, Chromatic number, Trees, Spanning trees: DFS, BFS, Minimal Spanning trees: Prim's and Kruskal's algorithms

PRESCRIBED TEXTBOOKS:

1. J.P. Tremblay and R. Manohar. Discrete Mathematical Structures with Applications to Computer Science, Tata Mc Graw Hill Education, 1st Edition, 2002.
2. D. S. Chandra Sekharaiah. Mathematical Foundations of Computer Science, Prism Books, 3rd Edition, 2010.

REFERENCE BOOKS:

1. J.L. Mott, A. Kandel and T. P. Baker. Discrete Mathematics for Computer Scientists and Mathematicians, PHI, 2nd Edition, 2008.
2. C.L. Liu and D.P. Mohapatra, Elements of Discrete Mathematics – A computer-oriented approach, Mc Graw Hill India, 3rd Edition, 2011.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMAT11T.1	2	2	1	-	-	-	-	1
24FMAT11T.2	3	2	1	-	-	-	-	1
24FMAT11T.3	3	3	2	-	-	-	-	1
24FMAT11T.4	3	2	1	-	-	-	-	1
24FMAT11T.5	3	2	1	-	-	-	-	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Data Structures and Analysis of Algorithms

Category : PC

Year : I

Semester : I

Course Code : 24FMCA11T

Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To design and implement Linear data structure.
- To design and implement Non-Linear data structures.
- To understand the graph algorithms.
- To analyze the efficiency of algorithms and using Dynamic Programming technique to solve the problems.
- To solve the problems using Backtracking Technique and understanding the NP-Hard problems and NP-complete problems.

Course Outcomes:

The Student will be able to

1. Summarize the Linear data structures.
2. Comprehend the Non-linear data structures.
3. Summarize the Graph concepts.
4. Apply dynamic programming technique to solve the problems.
5. Apply backtracking technique for solving the problems.

Unit 1 **LINEAR DATA STRUCTURES** **10**

Introduction- Definition, ARRAYS, LINKED LISTS, STACKS AND QUEUES: Arrays: Implementation, Operations, Applications. Linked List: Implementation, Operations, Applications. Stack: Implementation, Operations, Applications. Queues: Implementation, Operations, Applications.

Unit 2 **NON-LINEAR DATA STRUCTURE AND HASHING** **12**

Introduction- Definition and Basic terminologies of trees and binary trees, Representation of trees, Binary Tree traversals, Binary Search Trees: Definition, Operations and applications. Height Balanced Trees or AVL. Threaded binary trees. Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques.

Unit 3 **Graphs** **10**

Introduction - Representation of graph - Graph Traversals: Depth- First Search and Breadth-First Search, Applications of graphs, Shortest-path algorithms: Dijkstra's Algorithm, Floyd Warshal's Algorithm. Spanning Trees , Minimum spanning trees: Prim's Algorithm and Kruskal's Algorithm.

Unit 4 ALGORITHM ANALYSIS & DYNAMIC PROGRAMMING 12

Algorithm Analysis – Asymptotic Notations. Divide and Conquer: General Method, Merge Sort, Quick Sort, Binary Search. Dynamic Programming: Multistate Graphs, Optimal Binary Search Tree, 0/1Knapsack Problem, Travelling Salesman Problem.

Unit 5 BACKTRACKING AND NP-COMPLETENESS 12

Backtracking: General Method, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. Assignment Problem: P & NP problem, NP-Hard, NP-complete problems, Reduction, Satisfiability Problem, Approximation algorithms for NP-hard problem, COOK'S Theorem.

PRESCRIBED TEXTBOOKS:

1. Data Structures and Algorithms Analysis in C, Mark Allen Weiss, 2nd, Edition ,2023,
2. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Universities Press , 2nd Edition, 2019.

REFERENCE BOOKS:

1. A.M.Tenenbaum, Y. Langsam, M.J.Augenstein -Data Structures using C, Pearson, 1st Edition , 2003
2. Reema Thareja, Data Structures Using C , Oxford, 2nd Edition, 2014.
3. Yashavant Kanetkar, Data Structures through C, BPB Publications, 4th Edition, 2022.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA11T.1	2	2	1	1	-	-	-	-
24FMCA11T.2	2	2	1	1	-	-	-	-
24FMCA11T.3	2	2	1	1	-	-	-	-
24FMCA11T.4	3	2	1	2	-	-	-	-
24FMCA11T.5	3	2	1	2	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course	:	Database Management Systems
Category	:	PC
Year	:	I
Semester	:	I
Course Code	:	24FMCA12T
Branch	:	MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Explain database concepts and structures and terms related to database design, transactions and management.
- Demonstrate data modeling, normalization and development of the database.
- Formulate SQL statements for data definition, modification and retrieval of data.
- Design and build a simple database system.
- Analyze how databases are affected by real-world transactions.

COURSE OUTCOMES:

The Student will be able to

1. Explain the significance of database languages, different data models.
2. Apply the Relational Algebra of Queries with TRC & DRC.
3. Apply SQL concepts, including operators, functions, and effectively create and analyze join queries, sub queries, and nested queries.
4. Comprehend the File management and also ordering concepts and PL/SQL.
5. Comprehend transaction management and Rollback.

UNIT I INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS

Data Vs Information, Purpose of databases, Views of data, Database languages, Data models, Database architecture -users and administrators. E-R Model, Entity Relationship diagrams, E-R diagrams design issues, Extended E-R features, Specialization, Generalization, Aggregation. **8**

UNIT II RELATIONAL MODEL **8**

Structure of Relational database, Relational algebra, Tuple relational calculus, Domain relational calculus, QBE (Query-by-Example).

UNIT III STRUCTURED QUERY LANGUAGE (SQL) **12**

Introduction to SQL, SQL Operators, SQL Functions, Join queries, Sub queries, Nested queries, Views, Integrity constraints, Functional Dependencies, Database design Normalization: Normal Forms-1st, 2nd, 3rd and BCNF, Multi - Valued Dependency-4th Normal Form, 5th NF/Projection Join Normal form and De-Normalization.

UNIT IV PL/SQL**12**

Introduction to PL/SQL, PL/SQL Block Structure, Conditional statements, Iterative Processing with Loops, Triggers, Cursor, exception handling, Procedures, Functions.

FILE STRUCTURE: File Organization, Organization of Records in Files and Data-Dictionary Storage. Indexing and Hashing: Ordered Indices, B+-Tree Index Files, B-Tree Index files, Static and Dynamic Hashing.

UNIT V TRANSACTION MANAGEMENT:**8**

Transaction concept, ACID properties, Transaction state, concurrent execution. Recovery System: Storage structure, Recovery and atomicity, Log-Based Recovery, ARIES Recovery Technique and Remote Back systems.

PRESCRIBED TEXTBOOKS:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database system Concepts. McGraw Hill, 7th Edition, 2021.
2. PS Deshpande, SQL/PLSQL for Oracle 11g Black Book, Dreamtec Press, 2011.

REFERENCE BOOKS:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, McGraw Hill. , 3rd Edition, 2002.
2. Elmasri, Navate, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2017.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA12T.1	2	2	1	-	-	-	-	-
24FMCA12T.2	3	2	1	-	-	-	-	-
24FMCA12T.3	3	2	1	-	-	-	-	-
24FMCA12T.4	2	2	1	-	-	-	-	-
24FMCA12T.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course : Computer Organization
Category : PC
Year : I
Semester : I
Course Code : 24FMCA13T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Describe various data representations and explain how arithmetic and logical operations are performed by computers.
- Learn the concepts of memory organization.
- Learn the fundamentals of Basic Central Processing Unit Organization.
- Understand the factors that affect the Computer performance.
- Discuss the techniques that computers use to communicate with I/O devices.

COURSE OUTCOMES :

The Student will be able to

1. Describe various Number Systems and Digital circuits.
2. Apply various Memory Organization and Mapping Techniques for effective processing.
3. Analyze different aspects of Basic Central Processing Unit.
4. Describe the factors that affect the Computer performance.
5. Explain Micro Programmed Control and Input-Output organization.

UNIT I

11

DATA REPRESENTATION: Data Types – Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Complements – $(r-1)$'s Complement, (r) 's Complement, Subtraction of Unsigned Numbers, Floating-point representation, BCD codes, Gray codes.

DIGITAL LOGIC CIRCUITS AND DIGITAL COMPONENTS: Digital Computers, Logic Gates, Boolean algebra – Complement of a Function, Map Simplification – Product-of-Sums Simplification, Don't-Care Conditions, Combinational Circuits – Half-Adder, Full-Adder, Flip-Flops – SR Flip-Flop, D Flip-Flop, JK Flip-Flop, T Flip-Flop, Sequential Circuits – Flip-Flop Input Equations, State Table, State Diagram, Integrated Circuits, Decoders, Encoders, Multiplexers.

UNIT II

10

MEMORY ORGANIZATION: Memory Hierarchy, Main Memory – RAM and, ROM Chips, Memory Address Map, Memory Connection to CPU, Memory Technology, ROM, PROM, EEPROM, Flash Memory, RAM Technologies, Auxiliary Memory – Magnetic Disk, Magnetic Tape, Associative Memory-Hardware Organization, Match Logic, Read Operation and Write Operation, Cache Memory-Associative Mapping, Direct Mapping, Set-Associative Mapping.

UNIT III

10

BASIC CENTRAL PROCESSING UNIT ORGANIZATION: Introduction, General Register Organization – Control Word, Examples of Micro operations, Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats – Three-address Instructions, Two-address Instructions, One-address Instructions, Zero-address Instructions, Addressing Modes, Data Transfer and Manipulation – Data Transfer Instructions, Data Manipulation Instructions, Arithmetic Instructions, Logical and Bit Manipulation Instructions, Shift Instructions.

UNIT IV**9**

PIPELINE AND VECTOR PROCESSING: Parallel Processing – Loosely Coupled and tightly Coupled Computers, Amdahl’s Law and Example, Pipelining – General Considerations, Arithmetic Pipeline, Instruction Pipeline – Example: Four-Segment Instruction Pipeline, Pipeline Hazards, RISC pipeline - Example: Three-Segment Instruction Pipeline, Delayed Load, Delayed Branch, Vector Processing – Vector Operations, Matrix Multiplication, Memory Interleaving, Supercomputers, Array Processors – Attached Array Processor, SIMD Array Processor.

UNIT V**10**

MICRO PROGRAMMED CONTROL: Control Memory, Address Sequencing – Conditional Branching, mapping of Instruction, Subroutines, Micro program Example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, The Fetch Routine, Design of Control Unit – Micro program Sequencer.

INPUT-OUTPUT ORGANIZATION: Peripheral Devices – ASCII Alphanumeric Characters, Modes of Transfer – Example of Programmed I/O, Interrupt-Initiated I/O, Priority Interrupts – Daisy- Chaining Priority, Parallel Priority Interrupt, Direct Memory Access (DMA) – DMA controller, DMA Transfer, Input- Output process or (IOP) - CPU-IOP Communication.

PRESCRIBED TEXTBOOK:

1. M. Morris Mano, Rajib Mall, Computer System Architecture, Pearson Education, Revised 3rd Edition, 2017.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, Computer Organization and Embedded Systems, McGrawHill, 6th Edition, 2023.
2. William Stallings. Computer Organization and Architecture, Pearson Education, 11th Edition, 2022.
3. Sivarama P. Dandamudi, Fundamentals of Computer Organization and Design, Springer Edition, 2013.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA13T.1	2	2	1	-	-	-	-	1
24FMCA13T.2	3	2	1	-	-	-	-	1
24FMCA13T.3	3	3	2	-	-	-	-	-
24FMCA13T.4	2	2	1	-	-	-	-	-
24FMCA13T.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course	:	Probability and Statistics
Category	:	BS
Year	:	I
Semester	:	I
Course Code	:	24FMAT12T
Branch	:	MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

The objective is to introduce the fundamental concepts of probability theory and elucidate probability distributions for problem-solving, including confidence intervals for large sample population parameters. It also involves explaining hypothesis testing for both large and small samples and introducing the concept of queueing theory.

COURSE OUTCOMES:

The Student will be able to

1. Understand the fundamental concepts of probability and random variables.
2. Utilize probability distributions to address real-life problems while illustrating their practical applications in fields such as finance healthcare and education.
3. Analyze the concepts of sampling distributions and the theory of estimation to assess their implications and applications in statistical analysis.
4. Apply hypothesis testing techniques to real-world scenarios in data analysis, research, and decision-making processes.
5. Apply queueing theory principles to real-world problems and scenarios.

UNIT I Probability and Random Variables 10

Sample space and events – Probability – The axioms of probability – Some elementary theorems - Conditional probability – Baye’s theorem. Random variables –Discrete and continuous – Distribution functions - mean and variance.

UNIT II Probability Distributions 8

Binomial distribution –Poisson distribution- Uniform distribution – Normal distribution.

UNIT III Sampling Distribution and Estimation 10

Sampling Distribution: Sampling distribution: Population and sample - Sampling distributions of means (σ known and unknown).

Estimation: Point estimation – interval estimation - one mean –two means (large sample) and one proportion– two proportions (large sample).

UNIT IV Test of Hypothesis 10

Types of errors, one and two tailed tests, level of significance, Testing of hypothesis for large samples-single mean -difference of means - single proportion. Testing of hypothesis for small samples-Student t-distribution test for single mean - two means, Testing of equality of variances (F-test) - χ^2 test for goodness of fit - χ^2 test for independence of attributes.

Pure birth and death process, (M/M/1) model and simple problems.

PRESCRIBED TEXTBOOKS:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 12/e, Sultan Chand & Sons, 2020.
2. R. Lester Lipsky, Queueing Theory (a linear algebraic approach), 2/e, Springer private Limited, 2012.

REFERENCE BOOKS:

1. Ornard O. Allen, Probability, Statistics and Queueing Theory with Computer Science applications, 2/e, Academic press, 1990.
2. Richard A. Johnson, Probability & Statistics for Engineers (Miller and John E. Freund's), 7/e, PHI, 2011.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMAT12T.1	2	2	1	-	-	-	-	1
24FMAT12T.2	3	2	1	-	-	-	-	1
24FMAT12T.3	3	3	2	-	-	-	-	1
24FMAT12T.4	3	2	1	-	-	-	-	1
24FMAT12T.5	3	2	1	-	-	-	-	1



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RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course	:	Technical Communication
Category	:	HSM
Year	:	I
Semester	:	I
Course Code	:	24FENG11T
Branch	:	MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

This course aims to enhance student's understanding of organizational communication, explore key strategies for software development and develop essential soft skills such as teamwork and effective communication. BY focusing on practical skills like writing emails and business letters, the course prepares students for success in professional environments.

COURSE OUTCOMES:

The Student will be able to

1. Understand the significance of effective communication skills to overcome barriers at organizational level.
2. Compose communication and convey through electronic forms of communications.
3. Excel in the interview with confidence.
4. Write Letters, Memos and Emails for official communication.
5. Prepare comprehensive reports to acquire pragmatic results in the organization.

UNIT I

10

Basics of Technical Communication: Introduction, Process of Communication, Language as a Tool, Levels of Communication, Communication Networks.

Active Listening: Introduction, Types of Listening, Traits of a Good Listener, Active versus Passive Listening, Implications of Effective Listening and Barriers to Communication.

UNIT II

9

The Importance of Non-Verbal Communication: Kinesics, Proxemics, Paralinguistics and Chronemics. Effective Presentation Strategies: Introduction, Defining Purpose, Analyzing Audience and Locale, Organizing Contents, Preparing Outline, Usage of Visual Aids, Understanding Nuances of Delivery.

UNIT III

9

Business Letters: Significance, Purpose, Structure, Layout and Principles.

Types of Letters– Claim Letters, Adjustment Letters, Sales Letters and Job Application Letters.

Memos – Structure and Layout, Style and Samples,

E-mail – Style, Structure and Content, E-mail Etiquettes, Sample E-mail Messages, Effectiveness and Security.

UNIT IV**9**

Technical Reports Writing– Introduction, Objectives, Characteristics, Types, Importance, Formats, and Structure of Reports, Sample Report Writing.

Resume Writing: Types, Formats and Structure of Resume.

UNIT V**9**

Organizing Group Discussion: Introduction, Group Discussion as part of selection process.

Meetings and Conferences.

PRESCRIBED TEXTBOOKS:

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press
2. Aruna Koneru, Professional Communication, McGraw-Hill Education Publication.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FENG11T.1	-	-	-	-	2	-	-	1
24FENG11T.2	-	-	-	-	2	-	-	1
24FENG11T.3	-	-	-	-	2	-	-	1
24FENG11T.4	-	-	-	-	2	-	-	1
24FENG11T.5	-	-	-	-	2	-	-	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Data Structures through C Laboratory
Category : PC
Year : I
Semester : I
Course Code : 24FMCA11L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- To develop skills to design and analyze simple Linear data structures.
- To develop skills to design and analyze simple Non-Linear data structures.
- It enables them to gain knowledge in practical applications of data structures .
- Design and Develop programs on derived data types and data structures such as stack, queue, linked list, sorting and searching.
- Design correct programs to solve problems.

COURSE OUTCOMES :

The Student will be able to

1. Apply stacks, queues and linked lists concepts using C-programs.
2. Apply trees and hashing techniques to develop the concepts C-programming.
3. Apply the concepts of Graphs to implement C-programming.
4. Apply sorting and searching techniques for writing C-programs.
5. Apply Back Tracking technique to implement C-programs.

LIST OF SAMPLE PROBLEMS/EXPERIMENTS

1. Write a C program to perform the operations on Arrays.
2. Write a C program to perform the operations on single linked list
3. Write a C program to implement stack data structure using array representation.
4. Write a C program to perform the operations of simple Queue.
5. Write a C program to convert given infix expression to post fix expression.
6. Write a C program for binary tree traversals
7. Write a C program for hashing using linear probing
8. Write a C program for prim's algorithm.
9. Write a C program for Quick Sort.
10. Write a C program for Binary Search.
11. Write a C program for 4-Queen problem.
12. Write a C program for Sum-of-Subset problem.

PRESCRIBED TEXTBOOK:

1. Data Structures and Algorithms Analysis in C, Mark Allen Weiss, 2nd Edition, 2023,

REFERENCE BOOKS:

1. A.M.Tenenbaum, Y. Langsam, M.J.Augenstein -Data Structures using C, Pearson Education, 1st Edition , 2003
2. Reema Thareja, Data Structures Using C, Oxford Publishers, , 2nd Edition ,2014.
3. Yashavant Kanetkar, Data Structures through C, BPB Publications, 4th Edition, 2022.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA11L .1	-	-	-	1	1	-	1	1
24FMCA11L .2	-	-	-	1	1	-	1	1
24FMCA11L .3	-	-	-	1	1	-	1	1
24FMCA11L.4	-	-	-	1	1	-	1	1
24FMCA11L.5	-	-	-	1	1	-	1	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : DBMS Laboratory
Category : PC
Year : I
Semester : I
Course Code : 24FMCA12L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- Explain database concepts and structures and terms related to database design, transactions and management.
- Demonstrate data modeling, normalization and development of the database.
- Formulate SQL statements for data definition, modification and retrieval of data.
- Explore PL/SQL and both static and dynamic hashing techniques.
- Analyze how databases are affected by real-world transactions.

COURSE OUTCOMES:

The Student will be able to

1. Apply integrity constraints to ensure data accuracy in SQL queries.
2. Apply join conditions to combine data from multiple tables.
3. Apply conditional statements and loop structures in PL/SQL.
4. Apply cursor concepts to handle query results.
5. Apply exception handling and packages to manage errors in PL/SQL.

List of Sample Problems/Experiments

1. Creation, altering and drop of tables and inserting, deleting and update the rows into a table using SELECT Command.
2. Queries using integrity constraints.
3. Queries using SQL operators like, relational, logical and set operators.
4. Queries using Aggregate and SQL functions.
5. Queries using join conditions.
6. Create Views, Sequences.
7. Create PL/SQL block using IF/ELSE, IF/NESTED -IF statement.
8. Create PL/SQL block using WHILE/FOR Loops.
9. Create PL/SQL block using CURSORS.
10. Create PL/SQL block using EXCEPTION handling.
11. Create PL/SQL block using FUNCTION, TRIGGER.
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.



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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course	:	English Language Communication Skills Laboratory
Category	:	HSM
Year	:	I
Semester	:	I
Course Code	:	24FENG11L
Branch	:	MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

This course aims to empower students with the skills necessary for effective English language learning through computer-aided multimedia. By providing opportunities for individualized and group practice, the course will enhance student's fluency in spoken English and basic phonetics. Additionally, it will focus on developing practical communication skills for everyday situations, preparing students for job interviews and group discussions, and preparing them to present their ideas confidently.

COURSE OUTCOMES:

The Student will be able to

1. Understand the significance of pronunciation and accent rules in effective communication.
2. Demonstrate effective public speaking, interpersonal and intra personal skills in various contexts.
3. Draft well structured resume and cover letter.
4. Utilize communication skills to deliver effective presentations.
5. Plan and participate skills to deliver effective presentations.

PHONETICS:

UNIT I

Introduction to Sounds of Speech – Vowels – Consonants – Phonetic Transcriptions.

UNIT II SITUATIONAL DIALOGUES:

Role-play – Expressing various Situations – Self Introduction – Introducing others – Greetings – Apologies Requests – Giving Directions.

UNIT III WRITING SKILLS:

Structures, formats and styles of resume–planning-defining career objective-projecting one's strengths and skills – creative self-marketing – sample resumes-cover letter.

Report writing – Technical report writing.

UNIT IV ORAL PRESENTATION:

Collection of data from various sources – planning, preparation, practice and presenting various topics – attention grabbing strategies - transitions – handling questions from audience.

Academic Speech Practice : Welocme Address, Vote of Thanks, Speech on Freshers Day, Speech on Farewell Day, Teachers Day Speech, Motivational Speech etc.

UNIT V INTERVIEW SKILLS and GROUP DISCUSSION:

Interview Skills: Pre-interview planning - preparation- body language – answering strategies.

Group Discussion: Communicating views and opinions - intervening - asking for and giving clarification – providing solution on any given topic.

PRESCRIBED TEXTBOOK:

Lab Manual developed by Faculty Members of English.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FENG11L.1	-	-	-	-	2	-	-	3
24FENG11L.2	-	-	-	-	2	-	-	3
24FENG11L.3	-	-	-	-	2	-	-	3
24FENG11L.4	-	-	-	-	2	-	-	3
24FENG11L.5	-	-	-	-	2	-	-	3



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Operating Systems
Category : PC
Year : I
Semester : II
Course Code : 24FMCA21T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Identify the concepts, principles and services of operating system.
- Understand the operating system functionalities managing with hardware.
- Analyze the structure and design decisions involved in the implementation of an operating system.
- Evaluate different algorithms related to different operating system components.
- Explore various operating system utility commands to manage operating system.

COURSE OUTCOMES:

The Student will be able to

1. Summarize the fundamentals and its components of operating system.
2. Apply scheduling algorithms and techniques.
3. Apply the algorithms to handle the dead lock operations.
4. Describe memory management and file management techniques.
5. Comprehend various protection and security issues.

UNIT I

10

OPERATING SYSTEM INTRODUCTION: Operating System Definition, Evolution of Operating Systems- Simple, Batch, Multi Programmed, Time-Shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System Calls, Types of System Calls.

UNIT II

12

PROCESS AND CPU SCHEDULING: Process Concepts- The Process, Process State, Process Control Block, **Process Scheduling-** Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms,

PROCESS COORDINATION: Process Synchronization, the Critical-Section Problem, Semaphores, Classic Problems of Synchronization.

UNIT III

10

DEADLOCKS: System model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT IV**12**

MEMORYMANAGEMENT: Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms.

FILE SYSTEM INTERFACE: The Concept of a File, Access methods, Directory Structure, Allocation methods, Disk Scheduling algorithms.

UNIT V**10**

PROTECTION: System Protection- Goals of Protection, Principles of Protection, Access Matrix

SECURITY: - The Security Problem, Program Threats, System and Network Threats, User Authentication, Firewalling.

PRESCRIBED TEXTBOOK:

1. Abraham Silberchatz, Peter B. Galvin, Operating System Principles, Wiley, Global Edition, 2019.

REFERENCE BOOKS:

1. Andrew S Tanenbaum, Modern Operating Systems, Pearson/ PHI, 3rd Ed, 2009.
2. R. Elmasri, A.G.Carrick and D.Levine, Operating Systems, MGH, 3rd Edition, 2011.
3. A.S. Godbole. Operating Systems, TMH, 2nd Edition, 2009.
4. W. Stallings, Operating Systems-Internal and Design Principles, Pearson Education, 6th Ed.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA21T.1	2	2	1	-	-	-	-	-
24FMCA21T.2	3	2	1	-	-	-	-	-
24FMCA21T.3	3	2	1	-	-	-	-	-
24FMCA21T.4	2	2	1	-	-	-	-	-
24FMCA21T.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Python Programming
Category : PC
Year : I
Semester : II
Course Code : 24FMCA22T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.
- To utilize high-performance programming constructs available in Python, to develop solutions in real life scenarios.
- To understand the wide range of programming facilities available in Python.
- To import the packages and text files and process them accordingly.
- Understand the object-oriented features of Python.

COURSE OUTCOMES:

The Student will be able to

1. Summarize python fundamental concept.
2. Apply python syntax and semantics use of flow control statements.
3. Analyze functions, turtle graphics using python.
4. Apply the python text-files, exception handling and manipulate dictionary data type.
5. Apply object oriented programming features.

UNIT I

12

INTRODUCTION TO PYTHON: The process of computational Problem solving, The Python Programming Language, A First Program.

DATA AND EXPRESSIONS: Literals, Variables and Identifiers, I/O Functions, Operators, Operator precedence and associativity rules, Expression and Data types with examples.

UNIT II

11

CONTROL STRUCTURES: Boolean Expressions (Conditions), Selection Control, Iterative Control and Examples.

LISTS: List Structures, Lists (Sequences) in Python, Iterating over Lists (Sequences) in Python with Examples, Tuple data type.

UNIT III

12

FUNCTIONS: Program Routines, More on Functions-Calling Value-Returning Functions, Calling Non-Value-Returning Functions, Parameter Passing, Keyword Arguments in Python, Default Arguments in Python, Variable Scope. Lambda function, Map function, Filters function, **RECURSION:** Recursive Functions, Recursive Problem Solving, Iteration vs. Recursion. **OBJECTS:** Software Objects, Turtle Graphics, Turtle programs

UNIT IV**12**

MODULAR DESIGN: Modules, Top-Down Design, Python Modules. Packages **TEXT FILES:** Using Text Files, String Processing, Exception Handling. **DICTIONARIES AND SETS:** Dictionary Type in Python, Set Data Type.

UNIT V**12**

OBJECT-ORIENTED PROGRAMMING: What is Object-Oriented Programming, features of OOP's, Classes, objects, type's of variables, methods, Constructors with examples, Inheritance, Polymorphism, Data Abstraction, Encapsulation

PRESCRIBED TEXTBOOK:

1. Dr. R. Nageswar Rao, Core Python Programming, Dreamtech Press, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2nd Edition, 2012.
2. Wesley J Chun, "Core Python Applications Programming", Prentice Hall, 3rd Edition, 2015.
3. James Payne, Beginning Python: Using Python 2.6 and Python 3, Wiley India, 2nd Edition 2013.
4. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2nd Edition, 2010.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA22T.1	2	2	1	-	-	-	-	-
24FMCA22T.2	3	2	1	-	-	-	-	-
24FMCA22T.3	3	2	1	-	-	-	-	-
24FMCA22T.4	3	2	1	-	-	-	-	-
24FMCA22T.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Software Engineering
Category : PC
Year : I
Semester : II
Course Code : 24FMCA23T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To Apply software engineering principles to real world scenarios and projects.
- To Enable students to understand and document both functional and non-functional requirements various system modeling techniques effectively.
- To Develop skills in making critical architectural decisions that influence the overall system structure.
- To Apply verification, validation, and testing concepts to real-world software projects through hands-on exercises and projects.
- To Apply project management, planning, scheduling, risk management, and cost estimation concepts to real-world software projects.

COURSE OUTCOMES:

The Student will be able to

- Comprehend the basic terminologies associated with software engineering.
- Describe various process models for developing software.
- Apply fundamental design concepts to create software solutions that are modular, scalable, and maintainable.
- Apply various testing strategies for software quality assurance.
- Apply project management and software cost estimation skills to real-world scenarios, considering industry best practices.

UNIT I

10

SOFTWARE, SOFTWARE ENGINEERING, AND PROCESS: The nature of Software, The unique nature of WebApps, Software engineering- A layered technology, General principles of software engineering practice, Software myths, Agile development: What is an Agile Process?, Capability Maturity Model Integration (CMMI).

UNIT II

12

PROCESS MODELS: A Generic process model (framework), Process assessment and improvement, Prescriptive process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process, **SOFTWARE REQUIREMENTS:** Functional and Non-functional requirements; User requirements, The Software Requirements Document, **Requirements Engineering Processes:** Requirements

elicitation and analysis, Requirements validation, Requirements management, **System Modeling**: Context models, Behavioral models, Data models, Object models, Structured Methods.

UNIT III

8

DESIGN CONCEPTS: Design Concepts, **ARCHITECTURAL DESIGN**: Architectural design decisions, System organization, Modular decomposition styles.

OBJECT-ORIENTED DESIGN: Objects and Object Classes, An Object-Oriented design process, Design Evolution.

UNIT IV

10

VERIFICATION AND VALIDATION: Planning verification and validation, Software inspections, Automated static analysis, Verification and formal methods.

SOFTWARE TESTING: System testing, Component testing, Test case design, Test automation, **Quality management**: Software Quality Assurance.

UNIT V

8

PROJECT MANAGEMENT: Management activities, Project planning, Project scheduling, Risk management.

SOFTWARE COST ESTIMATION: Software Productivity, Estimation techniques- The COCOMO II Model, Project duration and staffing.

PRESCRIBED TEXTBOOKS:

1. Roger S. Pressman. Software Engineering - A Practitioners approach, McGraw-Hill, 9th Edition 2020.
2. Ian Sommerville, Software Engineering, Pearson Education Publications, 10th Edition 2017.

REFERENCE BOOKS:

1. Shari Lawrence Pfleeger, Joanne M. Atlee, Software Engineering Theory and Practice, Pearson Education, 4th Edition 2010.
2. Waman S Jawadekar. Software Engineering Principles and Practice, Tata McGraw Hill, 2012.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA23T.1	2	2	1	-	-	-	-	-
24FMCA23T.2	2	2	1	-	-	-	-	-
24FMCA23T.3	3	2	1	-	-	-	-	-
24FMCA23T.4	3	2	1	-	-	-	-	-
24FMCA23T.5	3	2	1	-	-	-	-	-



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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course : Computer Networks

Category : PC

Year : I

Semester : II

Couse Code : 24FMCA24T

Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To know the concepts of the Reference Models and understand the fundamentals of Computer Networks.
- To understand various techniques of data link layer.
- To know various issues of routing, quality of service and congestion control.
- To understand various transport protocols.
- To know various security issues of computer networks.

COURSE OUTCOMES:

The Student will be able to

1. Summarize the concepts of computer networks.
2. Apply the different data link layer techniques.
3. Apply various routing algorithms.
4. Analyze various transport protocols.
5. Comprehend the cryptography and network security techniques.

UNIT I

12

INTRODUCTION: Uses of Computer Networks, Network Topologies, Network Hardware, Network Software, and Reference Models- The OSI Reference model, The TCP/IP Reference Model. **THE PHYSICAL LAYER:** Multiplexing- Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Code Division Multiplexing, Switching-Packet Switching, Circuit Switching.

UNIT II

11

THE DATA LINK LAYER: Data Link layer design issues-Framing, Error Control, Flow Control, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols. **THE MEDIUM ACCESS CONTROL SUB-LAYER:** The Channel Allocation Problem, Multiple Access Protocols-ALOHA, Carrier Sense Multiple Access Protocols (CSMA), Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols.

UNIT III

10

THE NETWORK LAYER : Network layer design issues; Routing Algorithms-The Optimality Principle, Shortest path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcasting routing. Internetworking-How Networks Differ, Tunneling, Internetwork Routing, Packet Fragmentation.

UNIT IV**10**

THE TRANSPORT LAYER: The Transport Service, The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP. **THE APPLICATION LAYER:** The Domain Name System(DNS), Electronic Mail.

UNIT V**10**

NETWORK SECURITY: Cryptography, Symmetric-Key Cryptography algorithms- Data Encryption Standard (DES), Advanced Encryption Standard (AES); Asymmetric-Key Cryptography algorithms- Rivest, Shamir, and Adleman (RSA); Digital Signature, Entity Authentication.

Prescribed Textbooks:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Pearson Education, 6th Edition, 2022.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw-Hill. 6th Edition, 2022.
2. James F. Kurose, Keith W. Rose. Computer Networks- A Top-Down Approach Featuring the internet, Pearson Education., Standard Edition, 2023
3. 3.Larry L. Peterson, Computer Networks: A Systems Approach, Morgan Kaufmann, 6th Edition 2021.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA24T.1	2	2	1	-	-	-	-	-
24FMCA24T.2	3	2	1	-	-	-	-	-
24FMCA24T.3	3	2	1	-	-	-	-	-
24FMCA24T.4	3	3	2	-	-	-	-	-
24FMCA24T.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Data Science
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2AT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To Understand the fundamentals and concepts of data science.
- The course gives you a set of practical skills for handling data that comes in a variety of formats and sizes, such as texts, spatial and time series data.
- These skills cover the data analysis lifecycle from initial access and acquisition, modelling, transformation, integration, querying, application of statistical learning and data mining methods, and presentation of results.
- This includes data wrangling, the process of converting raw data into a more useful form that can be subsequently analysed.
- To implement applications with Bokeh(Python), recent trends and techniques in data science.

COURSE OUTCOMES:

The Student will be able to

1. Summarize the fundamentals of data science.
2. Explain how data is collected, managed and stored for data science.
3. Analyze the data by applying various techniques.
4. Explain data visualization techniques.
5. Describe several applications in data science.

UNIT I FUNDAMENTALS OF DATA SCIENCE

10

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data. Supervised Versus Unsupervised Learning, Regression Versus Classification Problems, Assessing Model Accuracy, Measuring the Quality of Fit, The Bias-Variance Trade-of, The Classification Setting.

UNIT II MAINTENANCE OF DATA, DATA COLLECTION AND MANAGEMENT

10

Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

UNIT III DATA ANALYSIS

10

Classification, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods, Logistic Regression, LDA, QDA, and KNN, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT IV DATA VISUALIZATION**10**

Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Data Wrangling: Data Acquisition, Data Formats, Imputation, The split-apply-combine paradigm.

UNIT V DATA SCIENCE-APPLICATIONS**9**

Applications of Data Science, Bokeh (Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

PRESCRIBED TEXTBOOKS:

1. Alberto Boschetti, Luca Massaron, “Python Data Science Essentials”, Packt Publications, 2nd Edition.
2. Davy Cielen, Arno Meysman, Mohamed Ali, “ Introducing Data Science: Big Data, Machine Learning, and more, using Python tools”, Manning Publications: 1st Edition.

REFERENCE BOOKS:

1. Sinan Ozdemir, Principles of Data Science, Packt Publishing Ltd Dec, 2016.
2. Joel Grus, Data Science from Scratch, Oreilly media, 1st Edition, 2015.
3. Mark Gardener, Beginning R The Statistical Programming Language, Wiley.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2AT.1	2	2	1	-	-	-	-	-
24FMCA2AT.2	2	2	1	-	-	-	-	-
24FMCA2AT.3	3	3	2	-	-	-	-	-
24FMCA2AT4	2	2	1	-	-	-	-	-
24FMCA2AT.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Object Oriented Analysis and Design
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2BT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To know the importance of modeling in the software development life cycle.
- Explain OOAD concepts and various UML diagrams.
- Specify, analyze and design the use case driven requirements for a particular system.
- Model the event driven state of object and transform them into implementation specific layouts.
- Identify, analyze the subsystems, various components and collaborate them interchangeably.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend conceptual model of UML.
2. Apply structural modeling of the system.
3. Analyze behavioral modeling of the system.
4. Apply advanced behavioral modeling of the system.
5. Apply architectural modeling of the system.

UNIT I 10

INTRODUCTION: Why We Model : Importance of modeling, principles of modeling, Object-Oriented Modeling, **Introducing the UML**: An Overview of the UML, Conceptual model of UML, UML architecture and Software Development Life Cycle

UNIT II 10

STRUCTURAL MODELING: Classes, Relationships, Common Mechanisms, Advanced classes, Interfaces, Packages, modeling Class and Object Diagrams.

UNIT III 10

BEHAVIORAL MODELING: Interaction diagrams, Use cases, Use case Diagrams and Activity Diagrams.

UNIT IV 10

ADVANCED BEHAVIORAL MODELING: Events and signals, state machines, processes and Threads, time and space, state chart diagrams

UNIT V 10

ARCHITECTURAL MODELING: Component, Deployment, Component diagrams and Deployment diagrams

PRESCRIBED TEXTBOOK:

1. GradyBooch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide. Pearson Education, 9th Edition, 2009.

REFERENCE BOOKS:

1. Craig Larman. Applying UML and Patterns: An introduction to Object - Oriented Analysis and Design and Unified Process. Pearson Education, 2nd Edition.
2. Bernd Oestereich. Developing software with UML- Addison-Wesley, 1st Edition, 1999.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado. UML 2 Toolkit, WILEY- Dreamtech India Pvt.Ltd, 2nd Edition, 2003.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2BT.1	3	3	2	-	-	-	-	1
24FMCA2BT.2	2	2	1	-	-	-	-	1
24FMCA2BT.3	3	3	2	-	-	-	-	1
24FMCA2BT.4	2	2	1	-	-	-	-	1
24FMCA2BT.5	3	3	2	-	-	-	-	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Cloud Computing
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2CT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to establish the definition of cloud computing.
- Describing the various service delivery models of a cloud computing architecture, and the ways in which clouds can be deployed as public, private, hybrid, and community clouds.
- Able to understand the advantages and Risks exists in Cloud Computing.
- Understand the concept of Virtual Storage paradigms exists in Cloud computing.
- Understand the Azure concepts.

COURSE OUTCOMES:

The Student will be able to

1. Summarize cloud computing services, uses and applications.
2. Analyze various cloud collaboration services.
3. Apply cloud services for various types of applications.
4. Analyze exploring cloud services based on category.
5. Comprehend different industrial cloud platforms.

UNIT I

8

CLOUD COMPUTING: Introduction, History of Cloud Computing, uses, services, types of cloud computing. Applications of Cloud Computing, feature perspective and developments of cloud computing.

UNIT II

10

CLOUD COMPUTING FOR EVERY ONE: Working of cloud computing and Collaboration of Cloud computing, Centralizing email communication, cloud computing for community, collaboration on schedules, collaborating on group projects and events, cloud computing for corporation and mapping scheduling & managing projects.

UNIT III

10

USING CLOUD SERVICES-I: Collaborating on calendars, schedulers and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets and databases ,Evaluating web mail services, evaluating instant messaging, evaluating web conference tools, Creating groups on social networks, evaluating on line groupware, collaborating via blogs and wikis.

UNIT IV**10**

USING CLOUD SERVICES-II: Understanding Cloud Storage, evaluating on-line file storage, exploring on-line book marking services, exploring on-line photo editing applications, exploring photo sharing communities, controlling it with web bases desktops.

UNIT V**12**

INDUSTRIAL PLATFORMS AND NEW DEVELOPMENTS: Cloud Platforms in Industry, Amazon web services, Compute services Storage services, Communication services, Additional services, GoogleAppEngine ,Architecture and core concepts, Application life cycle, Cost model, Observations ,Microsoft Azure, Azure core concepts 9.3.2 SQL AzureWindows, Azure platform appliance , observations.

PRESCRIBED TEXTBOOK:

1. Michael Miller, Cloud computing, Pearson Education India, 1st Edition, 2008..

REFERENCE BOOKS:

1. Thomas Erl, Eric Barcelo Monroy, Cloud Computing Concepts, Technology and Architecture, Pearson Education , 2nd Edition, 2024.
2. Dan C. Marinescu, Cloud Computing: Theory and Practice, Morgan Kaufmann Publishers In, 3rd Edition 2022.
3. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing Foundations and Applications Programming- , Morgan Kaufmann Publishers In, Illustrated Edition 2013.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2CT.1	2	2	1	-	-	-	-	-
24FMCA2CT.2	3	3	2	-	-	-	-	-
24FMCA2CT.3	3	2	1	-	-	-	-	-
24FMCA2CT.4	3	3	2	-	-	-	-	-
24FMCA2CT.5	2	2	1	-	-	-	-	-



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(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Mobile Computing
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2DT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Learning about the Fundamentals of Mobile Computing.
- Learning about mobile internet protocol and transport layer.
- Learning about mobile telecommunication systems.
- Learning about importance of routing ad-hoc networks.
- Learning about for mobile application development.

COURSE OUTCOMES:

The Student will be able to

1. Summarize the Fundamentals of Mobile Computing.
2. Explain mobile internet protocol and transport layer.
3. Describe the role of GSM in the evolution of mobile telecommunications.
4. Explain various applications of ad-hoc networks.
5. Apply Mobile Device Operating Systems.

UNIT I

12

INTRODUCTION: Mobile Computing – Mobile Computing Vs wireless, Networking – Mobile Computing Applications – Characteristics of Mobile computing-Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed, Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II

12

MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER: Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

UNIT III

10

MOBILE TELECOMMUNICATION SYSTEM: Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT IV**10**

MOBILE AD-HOC NETWORKS: Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

UNIT V**12**

MOBILE PLATFORMS AND APPLICATIONS: Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

PRESCRIBED TEXTBOOK:

1. Jochen H. Schller , Mobile Communications, Pearson Education India, 2nd Edition , 2008.

REFERENCE BOOKS:

1. . Raj Kamal, Mobile Computing, Oxford University Press, 3rd Edition, 2018.
2. Dharma Prakash Agarval, Qing - An Zeng, Introduction to Wireless and Mobile systems, Cengage Learning Inc, 3rd Edition 2010.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2DT.1	2	2	1	-	-	-	-	-
24FMCA2DT.2	2	2	1	-	-	-	-	-
24FMCA2DT.3	2	2	1	-	-	-	-	-
24FMCA2DT.4	2	2	1	-	-	-	-	-
24FMCA2DT.5	3	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Social Network Analysis
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2ET
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To Describing the levels of SNA and network measures.
- To learn various network growth models and different rank methods.
- To learn different community structures and link prediction models.
- Understand the cascade behaviour in networks.
- To learn graph representation.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend the basic concepts of Social Network Analysis.
2. Analyze the network models and link analysis.
3. Comprehend the communities in network.
4. Describe various community detection methods.
5. Comprehend representation learning in graphs.

UNIT I

13

INTRODUCTION: Introduction, Applications, Preliminaries, Three Levels of SNA, Historical Development, Graph Visualization Tools

NETWORK MEASURES: Network Basics, Node Centrality, Assortativity, Transitive and Reciprocity, Similarity, Degeneracy.

UNIT II

12

NETWORK GROWTH MODELS: Properties of real world networks, Random network model, Ring Lattice Network Model, Watts Strogatz model. Preferential Attachment model, Price's model, Local -world network growth model.

LINK ANALYSIS: Applications, Signed networks, Strong and weak Ties, Link analysis and algorithms, Page Rank, Personalized Page Rank, Divrank, Simrank, PathSim.

UNIT III

10

COMMUNITY STRUCTURE IN NETWORKS: Applications, Types of communities, Community detection methods, Disjoint community detection, overlapping community detection, local community detection, community detection vs community search, evaluation.

LINK PREDICTION: Applications, temporal changes in a network, Problem definition, Evaluating link prediction networks, Heuristic Models, probabilistic Models, Supervised, Random walk, Information- theoretic model.

UNIT IV**11**

CASCADE BEHAVIOR AND NETWORK EFFECTS: Preliminaries, Cascade model, Probabilistic cascades, epidemic models, Independent cascade models, Cascade prediction.

ANOMALY DETECTION IN STATIC NETWORKS: Outliers vs Network-based anomalies, challenges, Anomaly detection in static and dynamic networks.

UNIT V**10**

GRAPH REPRESENTATION LEARNING: Machine learning pipelines, Intuition behind representation learning, benefits, criteria of GRL, GRL pipelines, representation learning methods.

APPLICATIONS: Malicious activities on OSNs, Sockpuppets in OSNs.

PRESCRIBED TEXTBOOK:

1. Tanmoy Chakraborty, Social Network Analysis, Wiley Publications, 2021

REFERENCE BOOKS

1. Albert-Laszlo Barabasi ,Network Science, Cambridge University Press, 1st Edition, 2016.
2. Stanley Wasserman, Katherine Faust, Social Network Analysis: Methods and Applications, Cambridge University Press, 1994.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2ET.1	2	2	1	-	-	-	-	-
24FMCA2ET.2	3	3	2	-	-	-	-	-
24FMCA2ET.3	2	2	1	-	-	-	-	-
24FMCA2ET.4	2	2	1	-	-	-	-	-
24FMCA2ET.5	2	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Data Warehousing and Data Mining
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2FT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To introduce students the basic concepts and techniques of Data Warehousing.
- To understand OLAP functions and tools, including OLAP server types.
- To explore the multi-dimensional data model, data cubes and concept hierarchy.
- To gain insights into mining association rules using the Apriority algorithm.
- To explore classification and prediction methods.

COURSE OUTCOMES:

The Student will be able to

1. Explain data concepts in data ware housing.
2. Analyze the query facilities, OLAP functionalities and types.
3. Explain the data classification in data mining.
4. Apply the data mining techniques like classification and regression.
5. Apply the data mining predictions and clustering's to the data processing.

UNIT I

12

DATA WAREHOUSING: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

UNIT II

12

DATAWAREHOUSE AND OLAP TECHNOLOGY: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

UNIT III

12

DATA MINING: Overview, Motivation, Data Mining-Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

UNIT IV

14

CONCEPT DESCRIPTION:- Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, **Association Analysis-**

Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases.

UNIT V

14

CLASSIFICATION AND PREDICTIONS: What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K- nearest neighbor classifiers, Genetic Algorithm. **CLUSTER ANALYSIS:** Data types in cluster analysis, Categories of clustering methods, Partitioning methods. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis.

PRESCRIBED TEXTBOOK:

1. M.H.Dunham, "DataMining: Introductory and Advanced Topics", Pearson Education, 1st Edition 2006.

REFERENCE BOOKS:

1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems, ", Pearson Education, 1st Edition 1997.
2. Mallach, "Data Warehousing System", McGraw –Hill, 4th Edition 2001.
3. Jiawei Han, MichelineKamber, "Data Mining Concepts & Techniques" , Elsevier, 4th Edition 2023.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2FT.1	3	3	2	-	-	-	-	1
24FMCA2FT.2	2	2	1	-	-	-	-	1
24FMCA2FT.3	3	3	2	-	-	-	-	1
24FMCA2FT.4	2	2	1	-	-	-	-	1
24FMCA2FT.5	3	3	2	-	-	-	-	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Big Data Analytics
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2GT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To know the fundamentals and need of Big Data.
- To learn various big data technologies.
- To know holistic view of big data analytics and gain the knowledge for decision making.
- To learn advanced analytics platform of big data.
- To gain knowledge about Hadoop Map Reduce and parallel processing patterns.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend the fundamental concepts of big data.
2. Describe various big data technologies.
3. Apply decision making concepts in big data analytics.
4. Describe the advanced analytic platforms of big data.
5. Analyze the processing of big data using Hadoop Map Reduce.

UNIT I

11

INTRODUCTION TO BIG DATA : What is Big Data and why is it important?, Four V's of Big Data, Drivers for Big Data, Building the big data team, Big data sources, Big Data Analytics applications

UNIT II

10

BIG DATA TECHNOLOGIES: Hadoop's Parallel World, Data discovery, Open-source technology for Big Data Analytics, The cloud and Big Data, Predictive Analytics, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics, Information Management.

UNIT III

10

THE PEOPLE PART OF THE EQUATION: Rise of the data scientist, Using deep math, science, and computer science, Holistic view of analytics, Creating talent for decision sciences, Setting up the right organizational structure for institutionalizing analytics, Best practices for big data analytics.

UNIT IV

9

ADVANCED ANALYTICS PLATFORM: Real-Time Architecture for conversations, Orchestration and Synthesis Using Analytics Engines, Discovery using Data at Rest, Implementation of Big Data Analytics: Big Data Governance, Analytics Business Maturity Model.

UNIT V

10

PROCESSING BIG DATA USING HADOOP: What is Hadoop Map Reduce?, Hadoop Map Reduce components, Advantages of Hadoop Map Reduce, Hadoop Map Reduce Example, Building blocks of Hadoop Map Reduce, Design of HDFS, HDFS Concepts, Data flow. Anatomy of a Map Reduce job run.

PRESCRIBED TEXTBOOKS:

1. Michael Minelli, Michehe Chambers, Ambiga Dhiraj “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Businesses”, Wiley, 1st Edition, 2013.
2. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, MC Press LLC, 1st Edition, 2012.

REFERENCE BOOKS:

1. Frank J. Ohlhorst, “Big data analytics: Turning big data into big money”, Wiley, 1st Edition, 2012
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 1st Edition. 2012.
3. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, Shroff/O’reilly, 4th Edition, 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2GT.1	2	2	1	-	-	-	-	1
24FMCA2GT.2	2	2	1	-	-	-	-	-
24FMCA2GT.3	3	2	1	-	-	-	-	-
24FMCA2GT.4	2	2	1	-	-	-	-	-
24FMCA2GT.5	3	3	2	-	-	-	-	-



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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Cyber Security
Category : PE
Year : I
Semester : II
Course Code : 24FMCA2HT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To understand the policies and security evolution.
- To learn cyber offenses Categories of Cyber Crime.
- To study cybercrime in mobile and wireless devices.
- To learn techniques and tools for cracking passwords and their effectiveness.
- To analyze the dangers and risks posed by web-based threats.

COURSE OUTCOMES:

The Student will be able to

1. Analyze how cyber security affects productivity, internet use, and e-commerce.
2. Explain the Identify and classify different types of cybercrimes.
3. Analyze credit card frauds within the mobile and wireless computing context.
4. Explain various methods and tools used for password cracking.
5. Evaluate cost of cybercrimes and intellectual property rights issues on organizations.

UNIT I History of Cyber Security and Security Evolution 14

Introduction - Cyber Security -Definition-Key terms-cyber Attacks and Security tools-Security Threats-Vulnerability assessments-roles in Security-Cyber Security-today- Critical Thinking in Cyber Security

Cyber Security Evolution - Enterprise Policy, Technology Operations, Technology Configuration, Strategy Versus, Policy, Cyber Security Evolution, Productivity, Internet, E-Commerce, Counter Measures, Challenges.

UNIT II CYBER OFFENSES 13

Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyber stalking, Cyber cafe and cybercrimes, Botnets, Attack vector, Cloud computing, Phishing – Methods, Techniques, Spear phishing, Phishing scams, Phishing toolkits, Spy phishing, Countermeasures; Identity Theft – Personally identifiable information, Types, Techniques, Effacing online identity.

UNIT III CYBERCRIME IN MOBILE AND WIRELESS DEVICES 14

Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT IV TOOLS AND METHODS USED IN CYBERCRIME 12

Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

UNIT V ORGANIZATIONAL IMPLICATIONS**12**

Cost of cybercrimes and IPR issues, **Web threats for Organizations:** The evils and Perils-Social media marketing, Security and privacy Implications- Digital Forensic- Protecting people privacy in the organizations, Forensic best practices for organizations.

PRESCRIBED TEXTBOOK:

1. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 1st Edition, 2011.

REFERENCE BOOKS:

1. Nilakshi Jain, Ramesh Menon, Cyber Security and Cyber Laws, Wiley, 1st Edition, 2020.
2. Harish Chander, "cyber laws & IT protection", PHI learning Pvt. Ltd, 1st Edition, 2012.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA2HT.1	3	3	2	-	-	-	-	1
24FMCA2HT.2	2	2	1	-	-	-	-	1
24FMCA2HT.3	3	3	2	-	-	-	-	1
24FMCA2HT.4	2	2	1	-	-	-	-	1
24FMCA2HT.5	3	3	2	-	-	-	-	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Operating Systems Laboratory
Category : PC
Year : I
Semester : II
Course Code : 24FMCA21L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- To implement the Types of system calls.
- To implement CPU Scheduling Algorithms.
- To implement Bankers Algorithm used for deadlock and prevention.
- To implement Memory Management & Page Replacement Algorithms.
- To implement Read and Write Permissions in Security and Protection Concepts.

COURSE OUTCOMES:

The Student will be able to

1. Analyze the types of system calls.
2. Analyze CPU scheduling algorithms.
3. Apply Bankers algorithm for deadlock avoidance and prevention.
4. Analyze memory management and page replacement algorithms.
5. Apply read and write permission in security and protection concepts.

List of programs

1. Evolution of Operating Systems
 - a. Simple Systems
 - b. Batch Systems
 - c. Multi-Programmed Systems
 - d. Time-Shared Systems
2. Simulating Types of System Calls
3. Simulate the following CPU scheduling algorithms
 - a) FCFS
 - b) SJF
 - c) priority
4. Producer-consumer problem using semaphores
5. Simulate Bankers algorithm for Deadlock Avoidance.
6. Dead lock prevention
7. Simulate the following file allocation strategies
 - a) Sequential
 - b) indexed
8. Simulate MVT and MFT
9. Simulate FIFO and optimal page replacement algorithms
10. Simulate Paging Technique of Memory Management.
11. Implementing an Access Control Matrix
12. Buffer Overflow Prevention



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Python Programming Laboratory
Category : PC
Year : I
Semester : II
Course Code : 24FMCA22L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- To understand the concepts of Python.
- To develop the programming skills in Python for control structures.
- To develop the programming skills in Python for functions and graphic design.
- To understand the text files, dictionaries and exception handling concepts of Python.
- To understand the principles of object oriented programming concepts of Python.

COURSE OUTCOMES:

The Student will be able to

1. Apply python fundamental programs using operators.
2. Apply control statements using python.
3. Analyze functions, turtle graphics using python.
4. Analyze text-file, manipulate dictionary data types and exception handling.
5. Apply object oriented programs using class, constructors, polymorphism and inheritance.

List of programs

Implement the following in Python

1. Programs using basic concepts.
2. Programs using various control structures.
3. Programs using Lists and tuples.
4. Programs using functions.
5. Programs using objects
6. Programs using turtle.
7. Programs using Recursion.
8. Programs using modules.
9. Programs using text files.
10. Programs using Exception Handling.
11. Programs using Dictionaries.
12. Programs using object oriented concepts.

PRESCRIBED TEXTBOOK:

1. Dr. R. Nageswar Rao, Core Python Programming, Dreamtech Press, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2nd Edition, 2012.
2. Wesley J Chun, "Core Python Applications Programming", Prentice Hall, 3rd Edition, 2015.
3. James Payne, Beginning Python: Using Python 2.6 and Python 3, Wiley India, 2nd Edition 2013.

4. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2nd Edition, 2010.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA22L.1	-	-	-	-	-	1	-	-
24FMCA22L.2	-	-	-	1	-	1	-	1
24FMCA22L.3	-	-	-	-	-	1	-	-
24FMCA22L.4	-	-	-	-	-	1	-	-
24FMCA22L.5	-	-	-	-	-	1	-	1



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RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course : Software Engineering Laboratory
Category : PC
Year : I
Semester : II
Course Code : 24FMCA23L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- To Apply software engineering principles to real world scenarios and projects.
- To Enable students to understand and document both functional and non-functional requirements various system modeling techniques effectively.
- To Develop skills in making critical architectural decisions that influence the overall system structure.
- To Apply verification, validation, and testing concepts to real-world software projects through hands-on exercises and projects.
- To Apply project management, planning, scheduling, risk management, and cost estimation concepts to real-world software projects.

COURSE OUTCOMES:

The Student will be able to

1. Summarize Software Requirements Specification (SRS) by using software engineering concepts for a given business application.
2. Develop a conceptual model for a given applications by using process and data models.
3. Implement operational model for a given applications.
4. Apply and execute the test case of a given applications.
5. Evaluate the results for effectiveness, system usability and quality.

Design and Develop following applications:

1. Online Railway Reservation System
2. Payroll processing application
3. Inventory system
4. Automating the banking process
5. Software for game
6. Library management system
7. Create a dictionary
8. Text editor
9. Telephone directory
10. Create an E-Book of your choice

PRESCRIBED TEXTBOOK:

1. Roger S. Pressman. Software Engineering - A Practitioners approach. McGraw-Hill, 9th Edition 2020.

REFERENCE BOOKS:

1. Shari Lawrence Pfleeger, Joanne M. Atlee. Software Engineering Theory and Practice. Pearson Education, 4th Edition, 2010.
2. Waman S Jawadekar. Software Engineering Principles and Practice, Tata McGraw Hill, 2012.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA23L.1	-	-	-	1	1	1	1	1
24FMCA23L.2	-	-	-	1	1	1	1	1
24FMCA23L.3	-	-	-	1	1	1	1	1
24FMCA23L.4	-	-	-	1	1	1	1	1
24FMCA23L.5	-	-	-	1	1	1	1	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Universal Human Values
Category : AU
Year : I
Semester : II
Course Code : 24FAUD2AT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	0

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature / existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.
- Development of ethical values.

COURSE OUTCOMES:

The Student will be able to

1. Analyze more aware of themselves and their surroundings (family,society,nature) for value education.
2. Comprehend more responsible in life and handling problems with sustainable solutions in life.
3. Describe harmony in the family and society, trust and respect of the human relationship.
4. Analyze human values, human relationship and self regulations in nature.
5. Apply what they have learn to day to day activities in real life and we have learnt to their own self harmony on professional ethics.

UNIT I

6

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

UNIT II

6

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
- Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility
- Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of ‘I’ and harmony in ‘I’

UNIT III**6****Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

UNIT IV**6****Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature.
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space.

UNIT V**7****Implications of the above Holistic Understanding of Harmony on Professional Ethics**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

PRESCRIBED TEXTBOOK:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 3rd Edition, 2023.

REFERENCE BOOK:

1. A. N. Tripathi, "Human Values", New Age International, 3rd Edition 2023.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FAUD2AT.1	3	3	2	-	-	-	-	1
24FAUD2AT.2	2	2	1	-	-	-	-	1
24FAUD2AT.3	2	2	1	-	-	-	-	1
24FAUD2AT.4	3	3	2	-	-	-	-	1
24FAUD2AT.5	3	2	1	-	-	-	-	1



ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Full Stack Development
Category : PC
Year : II
Semester : I
Course Code : 24FMCA31T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Develop strong foundation in object oriented programming principles.
- Provide strong foundation in web development including HTML,CSS and XML Technologies.
- Understand basic concepts of Java Script.
- Understand Node JS Concepts and introduction of Express JS.
- Build on foundational knowledge of Mongo Data base connections.

COURSE OUTCOMES:

The Student will be able to

1. Apply exception handling mechanism using Java for developing applications.
2. Apply HTML, CSS and XML features for developing web pages.
3. Apply Java Script features for developing web pages.
4. Apply NODE JS for developing various web applications.
5. Apply Mongo DB for storing data in database.

UNIT I

12

CLASSES AND OBJECTS: Concepts of classes, objects, methods, access control, this keyword, simple java program, constructors, parameter passing, recursion, Enumeration, String Handling, Inheritance, Polymorphism, Packages and Interfaces, Exception Handling.

UNIT II

12

HTML COMMON TAGS: Introduction, HTML Basics- Text, Colors, Links, Images, Lists, Forms, Frames, Tables, Web Page Design, HTML5, Cascading Style Sheets, Introduction to CSS, Types of CSS.

XML: Introduction, Document Type Definition, XML Schema, Document Object Model, Presenting XML(XSL), XML Parsers: DOM and SAX.

UNIT III

12

JAVA SCRIPT: Introduction to JavaScript, Declaring Java Script Variables, Basics of JavaScript, Control Structures, Pop Up Boxes, Functions, Arrays, Events, Objects.

UNIT IV

10

NODE JS: Introduction to Node JS, Installation of Nods JS, Node JS File System Modules, NODE JS npm, Errors, Crypto Module, NODE JS Callbacks, Events, Web Modules. Introduction to Express JS, Express JS Installation, Express JS- GET, POST, REQUEST, RESPONSE, Express JS- Cookies, Middleware Routing.

UNIT V**8**

Introduction to Mongo DB, Differences between SQL and NOSQL, Mongo DB datatypes, Mongo DB installation, Data Modeling in Mongo DB- Create Database, Insert Mongo DB, Update Mongo DB, find Mongo DB, Update Mongo DB, Delete Mongo Db, Queries in Mongo DB.

PRESCRIBED TEXTBOOKS:

1. Herbert Schildt, Java. The Complete Reference, 12th Edition, 2022
2. Uttam K Roy, Web Technologies , Oxford University Press, 1st Edition, 2010.
3. Nabendu Biswas, Full Stack Web Development with MERN, Orange Education Pvt Ltd, 1st Edition 2023.

REFERENCE BOOKS:

1. Y. Daniel Liang. Introduction to Java Programming, Pearson Education, 12th Edition, 2024.
2. Colin J Ihrig, Full Stack JavaScript Development with MEAN , Sitepoint Publishers,1st Edition, 2015.
3. Philip Ackermann, Full Stack Development(The Comprehensive Guide), Shroff/ Rheinwerk Computing, Gray Scale Edition, 2023.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA31T.1	2	2	1	-	-	-	-	-
24FMCA31T.2	3	2	1	-	-	-	-	-
24FMCA31T.3	3	2	1	-	-	-	-	-
24FMCA31T.4	3	2	1	-	-	-	-	-
24FMCA31T.5	3	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Machine Learning
Category : PC
Year : II
Semester : I
Course Code : 24FMCA32T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES

- Understand the fundamentals of machine learning.
- Learn how to select, train, evaluate, and improve machine learning models.
- Grasp the concepts of Bayesian learning and common supervised classification algorithms.
- Develop a solid understanding of various supervised regression algorithms.
- Explore and implement unsupervised learning techniques.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend the fundamental concepts of Machine Learning.
2. Describe the process of model selection and evaluation of process model.
3. Apply the concepts of Bayes' theorem and supervised classification algorithms.
4. Analyze various supervised regression algorithms.
5. Analyze various unsupervised algorithms including clustering.

UNIT I

11

INTRODUCTION TO MACHINE LEARNING: Introduction, What is Human Learning?, Types of Human Learning, What is Machine Learning?, Types of Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning.

PREPARING TO MODEL: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.

UNIT II

11

MODELING AND EVALUATION: Introduction, Selecting a Model, Training a Model (for Supervised Learning): Hold-out Method, k-fold Cross-validation Method, Model Representation and Interpretability, Evaluating Performance of a Model: Supervised Learning—Classification, Supervised Learning – Regression, Unsupervised Learning— Clustering, Improving Performance of a Model

BASICS OF FEATURE ENGINEERING: Introduction, Feature Transformation: Feature Construction, Feature Extraction, Feature Subset Selection: Issues in High-Dimensional Data, Key Drivers of Feature Selection – Feature Relevance and Redundancy, Measures of Feature Relevance and Redundancy, Overall Feature Selection Process, Feature Selection Approaches.

UNIT III**10**

BAYESIAN CONCEPT LEARNING: Introduction, Bayes' Theorem: Prior, Posterior, Likelihood, Bayes' Theorem and Concept Learning: Concept of Consistent Learners, Bayes Optimal Classifier, Naïve Bayes Classifier, Applications of Naïve Bayes Classifier.

SUPERVISED LEARNING: CLASSIFICATION: Introduction, Classification Model, Classification Learning Steps, Common Classification Algorithms: k-Nearest Neighbor (k-NN), Decision Tree, Random Forest Model.

UNIT IV**10**

SUPERVISED LEARNING: REGRESSION: Introduction, Example of Regression, Common Regression Algorithms: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression Model, Logistic Regression.

UNIT V**9**

UNSUPERVISED LEARNING: Introduction, Clustering: Clustering as a Machine Learning Task, Different Types of Clustering Techniques, Partitioning Methods, Hierarchical Clustering, Finding Pattern using Association Rule: Definition of Common Terms, Association Rule, The Apriority Algorithm for Association Rule Learning.

PRESCRIBED TEXTBOOK:

- 1.Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson Education, 2019.

REFERENCE BOOKS:

- 1.Tom M.Mitchell, Machine Learning, McGraw Hill Education, Indian Edition, 2019.
2. Ethern Alpaydin, Introduction to Machine Learning, PHI,3rd Edition, 2015
- 3.Stephen Marsland, Machine Learning-An Algorithmic Perspective, CRC Press, 2nd Edition 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA32T.1	2	2	1	-	-	-	-	1
24FMCA32T.2	2	2	1	-	-	-	-	-
24FMCA32T.3	3	2	1	-	-	-	-	-
24FMCA32T.4	3	3	2	-	-	-	-	-
24FMCA32T.5	3	3	2	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : DevOps
Category : PC
Year : II
Semester : I
Course Code : 24FMCA33T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To give basic knowledge of AWS practices and Linux commands.
- To give strong knowledge of AWS practices.
- To give strong foundation of Version control system.
- To give strong foundation of Jenkins CI/CD methodologies.
- To give foundation of the Docker containerization tool.

COURSE OUTCOMES:

The Student will be able to

1. Summarize cloud computing components and AWS cloud.
2. Apply AWS services.
3. Analyze version control system.
4. Analyze continuous integration frame work.
5. Apply Docker containerization.

UNIT I

13

AWS INTRODUCTION: Introduction to cloud computing, Service Models in cloud computing, Deployment models in Cloud Computing, Introduction to AWS, AWS account creation and free tier limitations and overview. Ec2 Service, Launching an EC2 instance, Elastic Load Balancer and types of ELB, introduction to Linux, Linux architecture, File types, Directories, File permissions

UNIT II

12

AWS SERVICES: S3 Bucket- bucket creation, storage classes, S3 versioning, Bucket policies, Replication Rules in S3, IAM service-Groups, Users, Policies & Roles, AWS-CLI Commands, RDS, VPC, Route53, Monitoring tools

UNIT III

10

Git&GitHub: introduction to Version control system, types of VCS, GIT life cycle, basic commands, git branches, create a remote repository

UNIT IV

11

JENKINS: Why continuous integration, Introduction to Continuous Integration, Release and relation with Devops, Jenkins Introduction and setup, Jenkins projects/jobs, Master/Slave concept, Jenkins poll scm, build periodically, web hooks, Jenkins pipeline, Jenkins plugins, Jenkins CLI and Jenkins administration

UNIT V**10**

DOCKER: Introduction to docker, Virtualization an Docker cli and Containerization differences, Docker Installation, Docker cli, Docker File, Docker Volumes, Docker-compose, Docker Network.

PRESCRIBED TEXTBOOKS:

1. Mark Wilkins, Learning Amazon Web Servicse(AWS) Pearson Publications, 1st Edition, 2019.
2. Sandeep Rawat, CI/ CD Pipeline with Docker and Jenkins, BPB Publications, 3rd Edition, 2023

REFERENCE BOOK:

- 1.Len Bass, Ingo Weber, LimingZhu- DevOps: A Software Architect’s Perspective, 1st Edition, 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA33T.1	2	2	1	-	-	-	-	-
24FMCA33T.2	3	2	1	-	-	-	-	-
24FMCA33T.3	3	3	2	-	-	-	-	-
24FMCA33T.4	3	3	2	-	-	-	-	-
24FMCA33T.5	3	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Artificial Intelligence
Category : PC
Year : II
Semester : I
Course Code : 24FMCA34T
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Introduce the fundamental concepts and history of Artificial Intelligence.
- Understand and apply techniques in constraint satisfaction problems, adversarial search, and logical reasoning.
- Develop a deep understanding of First-Order Logic.
- Explore knowledge representation techniques and automated planning methods.
- Learn to handle uncertainty in AI through probabilistic reasoning.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend the fundamental concepts of Artificial Intelligence.
2. Describe the constraint satisfaction problems.
3. Apply the concepts of First-Order Logic.
4. Summarize the knowledge Representation and develop automated planning solutions.
5. Analyze uncertainty using probabilistic methods.

UNIT I

11

INTRODUCTION: What is Artificial Intelligence? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Risks and Benefits of Artificial Intelligence.

INTELLIGENT AGENTS: Agents and Environments, The Nature of Environments.

SOLVING PROBLEMS BY SEARCHING: Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies.

UNIT II

11

CONSTRAINT SATISFACTION PROBLEMS: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems.

ADVERSARIAL SEARCH AND GAMES: Game Theory, Optimal Decisions in Games, Heuristic Alpha- Beta Tree Search.

LOGICAL AGENTS: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking.

UNIT III

10

FIRST-ORDER LOGIC: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

INFERENCE IN FIRST-ORDER LOGIC: Propositional vs. First-Order Inference, Unification and First- Order Inference, Forward Chaining, Backward Chaining.

UNIT IV

10

KNOWLEDGE REPRESENTATION: Onto logical Engineering, Categories and Objects, Events, Reasoning Systems for Categories, Reasoning with Default Information.

AUTOMATED PLANNING: Definition of Classical Planning, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Time, Schedules, and Resources.

UNIT V

10

QUANTIFY UNCERTAINTY: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes’ Rule and Its Use.

PROBABILISTIC REASONING: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Exact Inference in Bayesian Networks.

PRESCRIBED TEXTBOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson Education, 4th Edition 2022.

REFERENCE BOOKS:

1. Kevin Knight, Elaine Rich, Shivashankar B Nair, Artificial Intelligence, Mc Graw Hill Education., 3rd Edition, 2017.
2. Shivani Goel. Artificial Intelligence. Pearson Education, 1st Edition, 2013.
3. Patrick Henry Winston. Artificial Intelligence, Pearson Education, 3rd Edition 1992 .

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA34T.1	2	2	1	-	-	-	-	1
24FMCA34T.2	2	2	1	-	-	-	-	-
24FMCA34T.3	3	2	1	-	-	-	-	-
24FMCA34T.4	2	2	1	-	-	-	-	-
24FMCA34T.5	3	3	2	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Industry 4.0
Category : PE
Year : II
Semester : I
Course Code : 24FMCA3AT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Understand the Foundations of Industry 4.0.
- Understand the Role of Computerization in Modern Industry.
- Summarize the Key Communication Protocols in Industry 4.0.
- Explain the Importance of Communication Protocols in Industry 4.0.
- Describe the Application of Industry 4.0 Across Various Domains.

COURSE OUTCOMES:

The Student will be able to

1. Understand the core concepts of Industry 4.0.
2. Explain the role of PLCs in industrial automation and their specifications.
3. Describe the functionalities and applications of critical communication protocols.
4. Apply the importance of communication protocols in Industry 4.0.
5. Apply the application of Industry 4.0 across various domains.

UNIT I Introduction to Industry 4.0

10

Concepts of Industry 4.0, Globalization and emerging issues, The Fourth Revolution, LEAN manufacturing, Smart and connected business perspectives, Smart factories, Comparison of Industry 4.0, Supportive Technologies, Collaborative platform, Product lifecycle management

UNIT II Computerization of Industry

11

Programmable Logic Controller (PLC) and its specifications, Communication of different devices with PLC, Sensor, Smart Sensor, HMI design, Cyber Physical System – key components, ISA-95 architecture, CPS-5C architecture, Concept of Digital Twins

UNIT III Connections of Industry 4.0

12

Protocols – MQTT, OPC UA, EtherNet/IP, Profinet, EtherCAT; MQTT – History, MQTT broker, Message types, Quality of Service (QoS), Application, Role of Augmented Reality: Introduction, AR Hardware and Software Technology, Industrial Applications of AR, Virtual reality

UNIT IV Industrial IoT**10**

Industrial IoT Introduction, Industrial Internet Systems, Sensing & Actuation, Processing, Communication, Business models, Architecture, Analytics & Data management, Cloud computing, Fog computing

Unit 5 : Industry Application Domains**10**

Application Domains (Health care, Power plants, oil, chemical and pharmaceutical) , Inventory Management & Quality Control, Plant Safety and Security, Facility Management, Industrial applications through UAVs, Obstacles of Digital Strategy, Data Security, Financing conditions

PRESCRIBED TEXTBOOKS:

1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing the Digital Transformation", 2018.
2. Alasdair Gilchrist, "Industry 4.0 – The Industrial Internet of Things", Springer Link, 2017.

REFERENCE BOOKS:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Willy Publications, 2nd Edition, 2020.
2. P. Juahs, K. Molnar, "Key Components of the Architecture of Cyber-physical manufacturing systems", International Scientific Journal "Industry 4.0", 2017.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA3AT.1	2	2	1	-	-	-	-	-
24FMCA3AT.2	2	2	1	-	-	-	-	-
24FMCA3AT.3	2	2	1	-	-	-	-	-
24FMCA3AT.4	3	2	1	-	-	-	-	-
24FMCA3AT.5	3	2	1	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Neural Networks
Category : PE
Year : II
Semester : I
Course Code : 24FMCA3BT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Develop the skill in basic understanding on neural network.
- Apply linear associative networks for pattern association tasks.
- Explore the Advanced methods of representing information in ANN.
- Understand Fundamentals of Genetic Algorithms.
- Exposure to many real-world control problems.

COURSE OUTCOMES:

The Student will be able to

1. Summarize Neural Network Fundamentals.
2. Develop and Evaluate Feed forward Neural Networks.
3. Implement Feedback Neural Networks.
4. Create and Analyze Competitive Learning Networks.
5. Integrate ANN, Genetic Algorithms, and Fuzzy Logic.

UNIT I

12

Fundamentals of neural networks – model of artificial neuron – neural network architectures, Learning methods – Taxonomy of Neural network architectures, Standard back propagation algorithms, selection of various parameters, variations Applications of back propagation algorithms

UNIT II

11

Analysis of Feed forward Neural Networks: Linear associative networks for pattern association; Single layer and Multilayer Perception network for pattern classification; Multilayer feed forward neural networks for pattern mapping.

UNIT III

10

Analysis of Feedback Neural Networks: Linear auto associative networks; Hopfield model for pattern storage; stochastic networks; Boltzmann machine for pattern environment storage

UNIT IV

10

Competitive Learning Neural Networks: Basic competitive learning laws; Analysis of pattern clustering networks; Analysis of self-organizing feature mapping networks

Applications of ANN: Pattern classification problems; Optimization; Control. Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms

PRESCRIBED TEXTBOOKS:

1. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, 2003, Addison Wesley, 1st Edition, 2003
2. Laurance Fausett, Fundamentals of Neural Networks, Prenticehall , 1st Edition, 1992.

REFERENCE BOOKS:

1. J.A. Anderson, An Introduction to Neural Networks, MIT, 2nd Edition, 2014.
2. Hagen Demuth Beale, Neural Network Design, Cengage Learning, 1st Edition, 1994.
3. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson India, 1st Edition, 1994.
4. Kosko, Neural Network and Fuzzy Sets, PHI, 1st Edition, 1992.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA3BT.1	2	2	2	-	-	-	-	-
24FMCA3BT.2	3	2	2	-	-	-	-	-
24FMCA3BT.3	3	3	3	-	-	-	-	-
24FMCA3BT.4	3	2	2	-	-	-	-	-
24FMCA3BT.5	3	2	2	-	-	-	-	-



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Block Chain Technologies
Category : PE
Year : II
Semester : I
Course Code : 24FMCA3CT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- Understand how block chain systems (mainly Bitcoin and Ethereum) work.
- Introduce key vocabulary and concepts related to block chain and Bitcoin in business situations.
- Discuss the current state of the Block chain landscape.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from blockchain technology into their own projects.

COURSE OUTCOMES:

The Student will be able to

1. Explain advantages, limitations and decentralize currency using block chain technology.
2. Apply Cryptography for Block chain technology.
3. Analyze Bitcoin crypto currency and alternate to bitcoin technology.
4. Describe the smart contracts to add and investigate the challenges and security issues of ethereum.
5. Analyze the Hyperledger project and open source ledger framework.

UNIT I BLOCKCHAIN & DECENTRALIZATION 10

Block Chain : Distributed systems, the history of block chain, introduction to block chain, CAP theorem and block chain, Benefits and limitations of block chain.

Decentralization: Decentralization using block chain, Methods of decentralization, Routes to decentralization, Block chain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for decentralization.

UNIT II CRYPTOGRAPHY AND TECHNICAL FOUNDATIONS 9

Introduction, Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, Financial markets and trading.

UNIT III BITCOIN & ALTERNATIVE COINS 9

Bitcoin: Bitcoin Transactions, Blockchain, Bitcoin payments, Bitcoin programming and the command- line interface, Bitcoin improvement proposals (BIPs).

Alternative Coins: Theoretical foundations, Bitcoin limitations, Name coin, Litecoin

UNIT IV SMART CONTRACTS & ETHEREUM 8

Smart Contracts: History, Definition, Ricardian contracts

Ethereum: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled

contracts, Accounts, code Block.

UNIY V LEDGER

10

Hyper Ledger: Projects, Hyperledger as a protocol, Fabric, Hyper ledger Fabric, Sawtoothlake, Corda.

PRESCRIBED TEXTBOOK:

1. Imran Bashir, “Mastering Block chain” Packt Publishing Ltd, 2017.

REFERENCE BOOKS:

1. Josh Thompson, “Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming”, Create Space Independent Publishing Platform,2017.
2. Melanie swan, “Blok chain blueprint for a new economy”, O’REILLY, 1st Edition, 2015.
3. Paul Vigna & Michael J. Casey, The age of crypto currency, Picador Publishers, 1st Edition 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA3CT.1	2	1	2	-	-	-	-	-
24FMCA3CT.2	3	1	2	-	-	-	-	-
24FMCA3CT.3	3	1	3	-	-	-	-	-
24FMCA3CT.4	2	1	2	-	-	-	-	-
24FMCA3CT.5	3	1	3	-	-	-	-	-



ANNAMACHARYA UNIVERSITY

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course : Deep Learning
Category : PE
Year : II
Semester : I
Course Code : 24FMCA3DT
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge on the basics of neural networks.
- To implement neural networks using computational tools for variety of problems.
- To explore various deep learning algorithms.
- To present the mathematical, statistical and computational challenges of buildings table representations for high-dimensional data, such as images, text and data.
- To explore advanced topics such as deep generative models, Boltzmann machines and its applications.

COURSE OUTCOMES:

The Student will be able to

1. Comprehend introduction to deep learning.
2. Analyze the feed forward networks.
3. Analyze convolutional networks using efficient algorithms.
4. Analyze the recurrent neural networks.
5. Apply deep generative models in natural language processing.

UNIT I

12

INTRODUCTON TO DEEP LEARNING: History of Deep Learning: Basics: Biological Neuron, Idea of computational units, McCulloch– Pitts unit and Thresholding logic, Optimizing logistic classifier using gradient descent, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

UNIT II

11

FEED FOR WARD NETWORKS: Feed forward Networks: Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders.

UNIT III

12

CONVOLUTIONAL NETWORKS: Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features-LeNet, AlexNet

UNIT IV

11

RECURRENT NEURAL NETWORKS: Recurrent Neural Networks: Unfolding computational graphs Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks-The Long Short-Term Memory and Other Gated RNNs.

DEEP GENERATIVE MODELS: Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling- gradient computations in RBMs - Deep Belief Networks-Deep Boltzmann Machines.

AUTO ENCODERS: Under complete auto encoders, regularized auto encoders, sparse auto encoders, denoising auto encoders, stochastic encoders and decoders.

PRESCRIBED TEXTBOOK:

1. M. Gopal, Deep Learning Core Concepts, Methods and Applications, Pearson Education, 1st Edition 2022.

REFERENCE BOOKS:

1. Nikhil Buduma , Fundamentals of Deep Learning, O’Reilly Publications, 2nd Edition 2022.
2. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly Publications, 2nd Edition 2017.
3. Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti , Deep Learning, Pearson Education, 1st Edition, 2025.

CO-POMAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA3DT.1	2	2	1	-	-	-	-	-
24FMCA3DT.2	3	3	2	-	-	-	-	-
24FMCA3DT.3	3	3	2	-	-	-	-	-
24FMCA3DT.4	3	3	2	-	-	-	-	-
24FMCA3DT.5	3	2	1	-	-	-	1	-



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RAJAMPET, Annamaya District, AP – 516126, INDIA

Title of the Course : Full Stack Laboratory
Category : PC
Year : II
Semester : I
Course Code : 24FMCA31L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- Develop strong foundation in object oriented programming principles.
- Understand how packages improve code organization and modularity, and exception hierarchy in java.
- Provide strong foundation in web development including HTML,CSS, Java script and XML. Technologies.
- Understand the lifecycle of servlets and how to manage their execution, how to design scalable and maintainable web applications using JSP.
- Build on foundational knowledge of JSP to create dynamic and database-driven web applications.

COURSE OUTCOMES:

The Student will be able to

1. Apply exception handling mechanism using Java for developing applications.
2. Apply HTML, CSS and XML features for developing web pages.
3. Apply Java Script features for developing web pages.
4. Apply NODE JS for developing various web applications.
5. Apply Mongo DB for storing data in database.

List of programs

1. Write a Java Program for creation of classes and use of different types of functions.
2. Write a Java Program using constructor.
3. Write a Java Program on a) interfaces and b) packages
4. Write a Java Program using a) function overloading and overriding b) inheritance.
5. Write a Java Program using exception handling mechanism.
6. Develop static pages of an online Bookstore. The pages should resemble www.amazon.com. The website should consist the following pages
 - Home Page
 - Registration Page
 - Login Page
 - Books Catalogue
 - Shopping Cart
 - Payment By Credit Card
 - Order Confirmation
7. Design a web page using Cascading Style Sheet.
8. Validate the Registration Page using Java Script.



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : Machine Learning Laboratory
Category : PC
Year : II
Semester : I
Course Code : 24FMCA32L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- Learn to import and export data using Python's Pandas library.
- Understand and apply various data preprocessing techniques using Python.
- Implement dimensionality reduction using Principal Component Analysis (PCA).
- Master the creation of data visualization techniques for effective data analysis.
- Develop skills in implementing various machine learning models, including classification, regression, and clustering.

COURSE OUTCOMES:

The Student will be able to

1. Apply the import and export data using Python's Pandas library.
2. Apply various data preprocessing techniques using Python.
3. Apply dimensionality reduction using Principal Component Analysis.
4. Apply data visualization techniques for effective data analysis.
5. Apply various machine learning models classification, regression, and clustering.

List of programs

1. Write a python program to import and export data using Pandas library functions.
2. Write a Python program to demonstrate various data pre-processing techniques using a given dataset.
3. Write a Python program to implement dimensionality reduction using Principle Component Analysis (PCA) method for a given data set.
4. Write a Python program to demonstrate various data visualization techniques for a given dataset.
5. Write a Python program to implement Naïve Bayes classification model for a given dataset.
6. Write a Python program to build KNN Classification model for a given data set.
7. Write a Python program to develop decision tree classification model for a given dataset.
8. Write a Python program to implement random forest ensemble method for a given dataset.
9. Write a Python program to implement simple linear regression model for a given dataset.
10. Write a Python program to implement multiple linear regression models for a given dataset.
11. Write a Python program to implement logistic regression model for a given dataset.
12. Write a Python program to implement K-Means clustering algorithm for a given dataset.

PRESCRIBED TEXTBOOK:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson Education, 2019.

REFERENCE BOOKS:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, Indian Edition, 2019.
2. Ethern Alpayd in, Introduction to Machine Learning, MIT Press, 3rd Edition, 2014.
3. Stephen Marsland, Machine Learning-An Algorithmic Perspective, CRC Press, 2nd Edition 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA32L.1	-	-	-	1	-	-	-	-
24FMCA32L.2	-	-	-	1	-	-	1	1
24FMCA32L.3	-	-	-	-	-	-	1	1
24FMCA32L.4	-	-	-	1	-	-	1	1
24FMCA32L.5	-	-	-	1	-	-	1	1



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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course : DevOps Laboratory
Category : PC
Year : II
Semester : I
Course Code : 24FMCA33L
Branch : MCA

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

COURSE OBJECTIVES:

- To understand Load balancer.
- To understand the s3 bucket policies and cloud network communications.
- To understand version control system and git branches issues.
- To understand CI/CD methodologies through Jenkins.
- To understand Docker to build, ship and run containerized images.

COURSE OUTCOMES:

The Student will be able to

1. Analyze Amazon web service load balancing and Linux commands.
2. Apply html project live on AWS cloud using S3.
3. Analyze version control system life cycle and branches.
4. Analyze simple Dev.Ops project for CI/CD through Jenkins.
5. Apply Dockerfile to build our own Docker image.

List of programs

1. Creating Application Load balancer and attach to two EC2 machines
2. Make HTML project live in AWS cloud using S3 Bucket
3. How do you configure route tables to enable traffic between two peered VPCs?
4. How to use AWS-CLI to create s3 buckets, upload files, and establish IAM users and groups
5. How to resolve merge conflicts in Git command line
6. Simple DevOps project for CI/CD through Jenkins freestyle job
7. Simple DevOps project for CI/CD through Jenkins pipeline
8. Building Our Own image in Docker through DockerFile
9. How do you build our own Docker image through Jenkins Pipeline?

PRESCRIBED TEXTBOOKS:

1. Mark Wilkins, Learning Amazon Web Services(AWS) Pearson Publications, 1st Edition, 2019.
2. Sandeep Rawat, CI/ CD Pipeline with Docker and Jenkins, BPB Publications, 3rd Edition, 2023

REFERENCE BOOK:

- 1.Len Bass, Ingo Weber, LimingZhu- DevOps: A Software Architect's Perspective, 1st Edition, 2015.

CO-PO MAPPING:

Course Outcomes	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project Management and Finance	Ethics	Life-long Learning
24FMCA33L.1	-	-	-	-	-	1	-	-
24FMCA33L.2	-	-	-	-	-	-	-	-
24FMCA33L.3	-	-	-	-	-	-	1	1
24FMCA33L.4	-	-	-	-	1	1	-	1
24FMCA33L.5	-	-	-	-	1	-	1	1