# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
## (Established by Govt. of A.P., ACT No.30 of 2008)
## ANANTHAPURAMU – 515 002 (A.P) INDIA

## MASTER OF COMPUTER APPLICATIONS

### SEMESTER - I

| S.No. | Course code | Course Name | Hours per week | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | 21F00101 | Mathematical Foundations of Computer Science | 4 | 0 | 0 | 4 |
| 2. | 21F00102 | Software Engineering | 4 | 0 | 0 | 4 |
| 3. | 21F00103 | Computer Organization & Architecture | 4 | 0 | 0 | 4 |
| 4. | 21F00104 | Data Structures | 4 | 0 | 0 | 4 |
| 5. | 21F00105 | Database Management Systems | 4 | 0 | 0 | 4 |
| 7. | 21F00106 | Software Engineering Laboratory | 0 | 1 | 2 | 2 |
| 8. | 21F00107 | Data Structures using C Laboratory | 0 | 1 | 2 | 2 |
| 9. | 21F00108 | Database ManagementSystems Laboratory | 0 | 1 | 2 | 2 |
| 10 | 21F00109 | Research Methodology and IPR | 2 | 0 | 0 | 2 |
| | | **TOTAL** | **22** | **3** | **8** | **28** |

### SEEMSTER - II

| S.No. | Course code | Course Name | Hours per | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | 21F00201 | Operating Systems | 4 | 0 | 0 | 4 |
| 2. | 21F00202 | Data Science with Python | 4 | 0 | 0 | 4 |
| 3. | 21F00203 | Computer Networks | 4 | 0 | 0 | 4 |
| 4. | <br>21F00204a<br>21F00204b<br>21F00204c | **Program Elective – I**<br>Software Testing Methodologies<br>Data Mining and Business Intelligence<br>Managerial Economics and Financial Accountancy | 4 | 0 | 0 | 3 |
| 5. | <br>21F00205a<br>21F00205b<br>21F00205c | **Open Elective – I**<br>Operations Research<br>Digital Marketing<br>Cloud Computing | 3 | 0 | 0 | 3 |
| 6. | 21F00206 | Operating Systems Laboratory | 0 | 1 | 2 | 2 |
| 7. | 21F00207 | Data Science Laboratory | 0 | 1 | 2 | 2 |
| 8. | 21F00208 | Computer Networks Laboratory | 0 | 1 | 2 | 2 |
| 9. | <br>21F00209 | **Skill Oriented Course – I**<br>Exploratory Data Analytics with Python | 1 | 0 | 2 | 2 |
| 10. | 21F00210 | **Seminar** | 0 | 0 | 4 | 2 |
| | | **Total** | **20** | **3** | **10** | **28** |

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## MASTER OF COMPUTER APPLICATIONS

### SEMESTER – III

| S.No. | Course code | Course Name | Hours per | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | 21F00301 | Web Technologies | 4 | 0 | 0 | 4 |
| 2. | 21F00302 | Big Data Technologies | 4 | 0 | 0 | 4 |
| 3. | 21F00303 | Dev Ops & Agile Programming | 4 | 0 | 0 | 4 |
| 5. | <br>21F00304a<br>21F00304b<br>21F00304c | **Program Elective – II**<br>Software Architecture & Design Patterns<br>Network Security<br>Machine Learning | 3 | 0 | 0 | 3 |
| 6. | <br>21F00305a<br>21F00305b<br>21F00305c | **Program Elective – III**<br>Mobile Application Development<br>Internet of things<br>Block chain Technologies | 3 | 0 | 0 | 3 |
| 7. | 21F00306 | Web Technologies Laboratory | 0 | 1 | 2 | 2 |
| 8. | 21F00307 | Big Data Technologies Laboratory | 0 | 1 | 2 | 2 |
| 9. | 21F00308 | Dev Ops& Agile Programming Laboratory | 0 | 1 | 2 | 2 |
| 10. | 21F00309 | Summer Internship / Industry Oriented Mini Project/ Skill Development Course (Minimum 6 weeks) | - | - | - | 2 |
| 11. | 21F00310 | **Skill oriented Course – II**<br>MEAN Stack Development | 1 | 0 | 2 | 2 |
| | | **TOTAL** | **18** | **4** | **8** | **28** |

### SEMESTER - IV

| S.No. | Course code | Course Name | Hours per | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | <br>21F00401a<br>21F00401b<br>21F00401c | **Program Elective– IV**<br>Deep Learning<br>Social Media Analysis<br>Multimedia Systems and Tools | 3 | 0 | 0 | 3 |
| 2. | <br>21F00402a<br>21F00402b<br>21F00402c | **Open Elective – II**<br>Cyber Laws<br>Entrepreneurship<br>NOSQL Databases | 3 | 0 | 0 | 3 |
| 3. | 21F00403 | Project Work | 0 | 0 | 20 | 10 |
| 4. | 21F00404 | Comprehensive Viva Voce | - | - | - | 2 |
| | | TOTAL | **6** | | **20** | **18** |

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| 21F00101 | | 4 | 0 | 0 | 4 |
| | **Semester** | **I** | | | |

**Course Objectives:**

- Introduces the elementary discrete mathematics for computer science and engineering.
- Topics include formal logic notation, methods of proof, induction, sets, relations, graph theory, permutations and combinations, counting principles; recurrence relations and generating functions

**Course Outcomes (CO):** Student will be able to

- Demonstrate the ability to understand and construct precise mathematical proofs
- Demonstrate the ability to use logic and set theory to formulate precise statements
- Acquire the knowledge to analyse and solve counting problems on finite and discrete structures
- Demonstrate the ability to describe and manipulate sequences
- Demonstrate the ability to apply graph theory in solving computing problems

**UNIT – I** Lecture Hrs:

The Foundations Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

**UNIT – II** Lecture Hrs:

Basic Structures, Sets, Functions, Sequences, Sums, Matrices and Relations: Sets, Functions, Sequences & Summations, Cardinality of Sets and Matrices Relations, Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

**UNIT - III** Lecture Hrs:

Algorithms, Induction and Recursion: Algorithms, The Growth of Functions, Complexity of Algorithms. Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness

**UNIT – IV** Lecture Hrs:

Discrete Probability and Advanced Counting Techniques: An Introduction to Discrete Probability, Probability Theory, Bayes' Theorem, Expected Value and Variance.
Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

**UNIT – V**

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

**TEXTBOOKS**

1. Discrete Mathematics and Its Applications with Combinatorics and Graph Theory- Kenneth H Rosen, 7$^{th}$Edition, TMH.

**REFERENCES**


1. Discrete Mathematical Structures with Applications to Computer Science-J.P. Tremblay and R. Manohar, TMH,
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe L. Mott, Abraham Kandel, Teodore P. Baker, 2nd ed., Pearson Education.
3. Discrete Mathematics- Richard Johnsonbaugh, 7th ed., Pearson Education.
4. Discrete Mathematics with Graph Theory- Edgar G. Goodaire, Michael M. Parmenter.
5. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, 5th edition, Pearson Education.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | SOFTWARE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00102 | | 4 | 0 | 0 | 4 |
| | **Semester** | **I** | | | |

**Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRSdocuments for software development problems
- To elucidate the basic concepts of software design and enable to carry out proceduraland objectoriented design of software development problems
- To understand the basic concepts of black box and white box software testing andenable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

**Course Outcomes (CO):** Student will be able to

- Ability to apply software engineering principles and techniques.
- Ability to develop, maintain and evaluate large-scale software systems.
- To produce efficient, reliable, robust and cost-effective software solutions.
- Ability to work as an effective member or leader of software engineering teams.
- Ability to understand and meet ethical standards and legal responsibilities.

**UNIT – I** Lecture Hrs:

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

**UNIT – II** Lecture Hrs:

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques. Axiomatic specification, algebraic specification.

**UNIT - III** Lecture Hrs:

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based Vs. Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

**UNIT – IV** Lecture Hrs:

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

**UNIT – V**

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

**Text Books:**

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**MASTER OF COMPUTER APPLICATIONS**

1. RajibMall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2.Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | COMPUTER ORGANIZATION & ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| 21F00103 | | 4 | 0 | 0 | 4 |
| | Semester | I | | | |

**Course Objectives:**

- Learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design
- Understand the structure and behavior of various functional modules of a computer.
- Discuss the techniques that computers use to communicate with I/O devices
- Study the concepts of pipelining and the way it can speed up processing.
- Describe the basic characteristics of multiprocessors

**Course Outcomes (CO):** Student will be able to

- Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os
- Able to explore the hardware requirements for cache memory and virtual memory
- Ability to design algorithms to exploit pipelining and multiprocessors
- Ability to use memory and I/O devices effectively
- Detect pipeline hazards and identify possible solutions to those hazards

**UNIT – I** Lecture Hrs:

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.
Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations
INTEL-8086: CPU architecture, Addressing modes - generation of physical address- code segment registers, Zero, one, two, and three address instructions. INTEL 8086 ASSEMBLY LANGUAGE INSTRUCTIONS-Data transfer instructions, input- output instructions, arithmetic, logical, shift, and rotate instructions, Conditional and unconditional transfer.

**UNIT – II** Lecture Hrs:

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating- Point Numbers and Operations.
Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, Multi-programmed Control.

**UNIT - III** Lecture Hrs:

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

**UNIT – IV** Lecture Hrs:

Input/output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

**UNIT – V**

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.
Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

**TEXT BOOKS:**

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill Education, 5th Edition, 2013.
2. Microprocessors and Interfacing, Douglas Hall, Tata McGraw-Hill.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATA STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00104 | | 4 | 0 | 0 | 4 |
| | **Semester** | **I** | | | |

**Course Objectives:**

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn the different types of searching and sorting techniques.

**Course Outcomes (CO):** Student will be able to

- Use C basic concepts to write simple C programs
- Explain the different notations of arithmetic express
- Analyze various operations on linked list
- Develop the representation of Tress
- Design the different sorting technique

**UNIT – I** Lecture Hrs:

Introduction to C Language - C Language Elements, Variable Declarations and Data Types, Operators and Expressions, Decision Statements - If and Switch Statements, Loop Control Statements -while, for, do-while Statements.
Introduction to Functions, Storage classes, Arrays, Structures, Unions, Pointers, Strings and Command line arguments.

**UNIT – II** Lecture Hrs:

Data Structures, Stacks and Queues- Overview of Data Structure, Representation of a Stack, Stack Related Terms, Operations on a Stack, Implementation of a Stack, Evaluation of Arithmetic Expressions, Infix, Prefix, and Postfix Notations, Evaluation of Postfix Expression, Conversion of Expression from Infix to Postfix, Recursion, Queues - Various Positions of Queue, Representation of Queue, Insertion, Deletion, Searching Operations.

**UNIT - III** Lecture Hrs:

Linked Lists–Pointers, Singly Linked List, Dynamically Linked Stacks and Queues, Polynomials Using Singly Linked Lists, Using Circularly Linked Lists, Insertion, Deletion and Searching Operations, Doubly linked lists and its operations, Circular linked lists and its operations.

**UNIT – IV** Lecture Hrs:

Trees- Tree terminology, representation, Binary tress, representation, Binary tree traversals. Binary Tree Operations, Graphs- Graph terminology, Graph representation, Elementary Graph Operations, Breadth first search (BFS) and Depth first search (DFS), Connected Components, Spanning Trees.

**UNIT – V**

Searching and Sorting–Sequential, Binary, Exchange (Bubble) Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort. Searching- Linear and Binary Search Methods.

**Text Books:**


1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A.Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg&Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00105 | | 4 | 0 | 0 | 4 |
| | **Semester** | I | | | |

**Course Objectives:**

- Train in the fundamental concepts of database management systems, database modeling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

**Course Outcomes (CO):** Student will be able to

- Design a database for a real world information system
- Define transactions which preserve the integrity of the database
- Generate tables for a database
- Organize the data to prevent redundancy
- Pose queries to retrieve the information from database

**UNIT – I** Lecture Hrs:

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Database Users and Administrators.
Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Algebra

**UNIT – II** Lecture Hrs:

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL: Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Index Definition in SQL, Authorization.
Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features.

**UNIT – III** Lecture Hrs:

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Complex Attributes, Mapping Cardinalities, Primary Key, Removing Redundant Attributes in Entity Sets, Reducing E-R Diagrams to Relational Schemas, Extended E-R Features, Entity- Relationship Design Issues, Alternative Notations for Modelling Data, Other Aspects of Database Design.
Relational Database Design:
Features of Good Relational Designs, Decomposition Using Functional Dependencies, Normal Forms, Functional-Dependency Theory, Algorithms for Decomposition using Functional Dependencies, Decomposition Using Multivalued Dependencies, More Normal Forms, Atomic Domains and First Normal Form, Database–Design Process, Modelling Temporal Data, Indexing.

**UNIT – IV** Lecture Hrs:

Query Processing: Overview, Measures of Query cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Processing in Memory.
Query optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

**UNIT – V**

Transaction Management:
Transactions: Transaction Concept, A Simple Transactional Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity,



Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.
Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Insert Operations. Delete Operations and Predicate Reads, Timestamp-Based Protocols, Validation- Based Protocols, Multiversion Schemes, Snapshot Isolation, Weak Levels of Consistency in Practice, Advanced Topics in Concurrency.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-Volatile Storage, High Availability Using Remote Backup Systems, Early Lock Release and Logical Undo Operations, ARIES, Recovery in Main- Memory Databases.

**TEXT BOOKS:**

1. A.Silberschatz, H.F.Korth, S.Sudarshan, “Database System Concepts”, 7/e, TMH 2020

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | SOFTWARE ENGINEERING LAB | L | T | P | C |
|---|---|---|---|---|---|
| 21F00106 | | 0 | 1 | 2 | 2 |
| | Semester | I | | | |

**Course Objectives:**

- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

**Course Outcomes (CO):**

- Ability to translate end-user requirements into system and software requirements
- Ability to generate a high-level design of the system from the software requirements
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

**List of Experiments**:

1) Development of problem statement.
2) Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.
3) Preparation of Software Configuration Management and Risk Management related documents.
4) Study and usage of any Design phase CASE tool
5) Performing the Design by using any Design phase CASE tools.
6) Develop test cases for unit testing and integration testing
7) Develop test cases for various white box and black box testing techniques.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATA STRUCTURES USING C LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00107 | | 0 | 1 | 2 | 2 |
| Semester | | I | | | |

**Course Objectives:**

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate the Binary tree traversal techniques.
- To design searching and sorting techniques

**Course Outcomes (CO):**

- Develop C programs for computing and real life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
- Implement searching and sorting algorithms

**List of Experiments**:

Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.
ii) To find the GCD (greatest common divisor) of two given integers.
iii) To solve Towers of Hanoi problem.

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices

a) Write a C program that uses functions to perform the following operations:
i) To insert a sub-string in to a given main string from a given position.
ii) To delete n Characters from a given position in a given string.

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn‘t contain T.
b) Write a C program to count the lines, words and characters in a given text.

a) Write a C Program to perform various arithmetic operations on pointer variables.
b) Write a C Program to demonstrate the following parameter passing mechanisms:
i) call-by-value ii) call-by-reference.

Write a C program that uses functions to perform the following operations:
i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers (Note: represent complex number using a structure.)

Write C programs that implement stack (its operations) using

i) Arrays
ii) Pointers

Write C programs that implement Queue (its operations) using
i) Arrays
ii) Pointers

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression
ii) Evaluating the postfix expression

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Write a C program that uses functions to perform the following operations on Circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers
ii) Traversing the above binary tree in preorder, inorder and postorder.

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers:
i) Linear search
ii) Binary search

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
i) Bubble sort
ii) Selection sort

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
i) Insertion sort
ii) Merge sort
iii) Quick sort

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATABASE MANAGEMENT SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00108 | | 0 | 1 | 2 | 2 |
| | **Semester** | I | | | |

**Course Objectives:**

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

**Course Outcomes (CO):**

- Design database for any real world problem
- Implement PL/SQL programs
- Define SQL queries
- Decide the constraints
- Investigate for data inconsistency

**List of Experiments**:

1. Create a table called Employee with the following structure.

| Name | Type |
|---|---|
| Empno | Number |
| Ename | Varchar2(20) |
| Job | Varchar2(20) |
| Mgr | Number |
| Sal | Number |

a. Add a column commission with domain to the Employee table.
b. Insert any five records into the table.
c. Update the column details of job
d. Rename the column of Employ table using alter command.
e. Delete the employee whose empno is19.

1. Createdepartmenttablewiththefollowingstructure.

| Name | Type |
|---|---|
| Deptno | Number |

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| | |
|---|---|
| Deptname | Varchar2(20) |
| Location | Varchar2(20) |

a. Add column designation to the department table.
b. Insert values into the table.
c. List the records of emp table grouped by dept no.
d. Update the record where dept no is9.
e. Delete any column data from the table

QUERIES USING DDL AND DML

1. a. Create a user and grant all permissions to the user.
b. Insert the any three records in the employee table and use rollback. Check the result.
c. Add primary key constraint and not null constraint to the employee table.
d. Insert null values to the employee table and verify the result.
2. a. Create a user and grant all permissions to the user.
b. Insert values in the department table and use commit.
c. Add constraints like unique and not null to the department table.
d. Insert repeated values and null values into the table.
3. a. Create a user and grant all permissions to the user.
b. Insert values into the table and use commit.
c. Delete any three records in the department table and use rollback.
d. Add constraint primary key and foreign key to the table.
4. a. Create a user and grant all permissions to the user.
b. Insert records in the sailor table and use commit.
c. Add save point after insertion of records and verify save point.
d. Add constraints not null and primary key to the sailor table.
5. a. Create a user and grant all permissions to the user.
b. Use revoke command to remove user permissions.
c. Change password of the user created.
d. Add constraint foreign key and notnull.
6. a. Create a user and grant all permissions to the user.
b. Update the table reserves and use save point and rollback.
c. Add constraint primary key , foreign key and not null to the reserves table
d. Delete constraint not null to the table column.

QUERIES USING AGGREGATE FUNCTIONS

1. a. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
b. Display lowest paid employee details under each department.
c. Display number of employees working in each department and their department number.
d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert dept name to dept table and insert dept name for each row, do the required thing specified above.
e. List all employees which start with either B or C.
f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.
2. a. Calculate the average salary for each different job.
b. Show the average salary of each job excluding manager.
c. Show the average salary for all departments employing more than three people.
d. Display employees who earn more than thelowest salary in department 30
e. Show that value returned by sign (n)function.

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f. How many days between day of birth to current date
3. a. Show that two substring as single string.
b. List all employee names, salary and 15% rise in salary.
c. Display lowest paid emp details under each manager
d. Display the average monthly salary bill for each deptno.
e. Show the average salary for all departments employing more than two people.
f. By using the group by clause, display the eid who belongs to dept no 05 along with average salary.
4. a. Count the number of employees in department20
b. Find the minimum salary earned by clerk.
c. Find minimum, maximum, average salary of all employees.
d. List the minimum and maximum salaries for each job type.
e. List the employee names in descending order.
f. List the employee id, names in ascending order by empid.
5. a. Find the sids ,names of sailors who have reserved all boats called "INTERLAKE
Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors.
b. Find the sname , bid and reservation date for each reservation.
c. Find the ages of sailors whose name begin and end with B and has at least 3characters.
d. List in alphabetic order all sailors who have reserved red boat.
e. Find the age of youngest sailor for each rating level.

6 a. List the Vendors who have delivered products within 6 months.
b. Display the Vendor details who have supplied both Assembled and Subparts.
c. Display the Sub parts by grouping the Vendor type (Local or Non Local).

PROGRAMS ON PL/SQL

1. a. Write a PL/SQL program to swaptwonumbers.
b. Write a PL/SQL program to find the largest of three numbers.
2. a. Write a PL/SQL program to find the total and average of 6 subjects and display thegrade.
b. Write a PL/SQL program to find the sum of digits in a given umber.
3. a. Write a PL/SQL program to display the number in reverse order.
b. Writea PL/SQLprogramtocheckwhetherthegivennumberisprimeornot.
4. a. Write a PL/SQL program to find the factorial of a givennumber.
b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius andarea.
5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When 'hello' passed to the program it should display 'Hll' removing e and o from the worldHello).
b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainderin words.

PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a given year.
3. Create a function to find the factorial of a given number and hence find NCR.
4. Write a PL/SQL block o pint prime Fibonacci series using local functions.
5. Create a procedure to find the lucky number of a given birth date.
6. Create function to the reverse of given number

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PROCEDURES

1. Create the procedure for palindrome of given number.
2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD isfound.
3. Write the PL/SQL programs to create the procedure for factorial of givennumber.
4. Write the PL/SQL programs to create the procedure to find sum of N naturalnumber.
5. Write the PL/SQL programs to create the procedure to find Fibonacciseries.
6. Write the PL/SQL programs to create the procedure to check the given number is perfect ornot

CASE STUDY: BOOK PUBLISHING COMPANY

A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.
A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following:
1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams

CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM

A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programmes have compulsory modules. The database is also to contain some information about studentsincludingtheirnumbers,names,addresses,degreestheyreadfor,andtheirpastperformance
i.e. modules taken and examination results. For the above case study, do the following:
1. Analyze the datarequired.
2. Normalize theattributes.
3. Create the logical data model i.e., ERdiagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys whereverrequired.
5. Insert values into the tables created (Be vigilant about Master- Slavetables).
6. Display the Students who have taken M.Sccourse
7. Display the Module code and Number of Modules taught by eachLecturer.
8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers ‘English’module.



10. Retrieve the Prerequisite Courses offered by every Department (with Departmentnames).
11. Present the Lecturer ID and Name who teaches‘Mathematics’.
12. Discover the number of years a Module istaught.
13. List out all the Faculties who work for ‘Statistics’Department.
14. List out the number of Modules taught by each ModuleLeader.
15. List out the number of Modules taught by a particularLecturer.
16. Create a view which contains the fields of both Department and Module tables. (Hint- The fields like Module code, title, credit, Department code and itsname).
17. Update the credits of all the prerequisite courses to 5. Delete the Module ‘History’ from the Module table.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | RESEARCH METHODOLOGY AND IPR | L | T | P | C |
|---|---|---|---|---|---|
| 21F00109 | | 2 | 0 | 0 | 2 |
| | **Semester** | **I** | | | |

**Course Objectives:**

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Understand the Adequate knowledge on IPR

**Course Outcomes (CO):** Student will be able to

- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow w world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

| **UNIT - I** | Lecture Hrs: |
|---|---|

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

| **UNIT - II** | Lecture Hrs: |
|---|---|

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

| **UNIT - III** | Lecture Hrs: |
|---|---|

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

| **UNIT - IV** | Lecture Hrs: |
|---|---|

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

| **UNIT - V** | |
|---|---|

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Text Books:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00201 | | 4 | 0 | 0 | 4 |
| | Semester | II | | | |

**Course Objectives:**

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

**Course Outcomes (CO):** Student will be able to

- Realize how applications interact with the operating system
- Analyze the functioning of a kernel in an Operating system.
- Summarize resource management in operating systems
- Analyze various scheduling algorithms
- Examine concurrency mechanism in Operating Systems

**UNIT - I** — Lecture Hrs:

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems
System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

**UNIT - II** — Lecture Hrs:

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems.
Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.
Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

**UNIT - III** — Lecture Hrs:

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples.
Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

**UNIT - IV** — Lecture Hrs:

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention.
File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

**UNIT - V**

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.
System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks,



| |
|---|
| Computer security classification.<br>Case Studies: Linux, Microsoft Windows. |
| **Text Books:** |
| 1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.<br>2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.) |

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATA SCIENCE WITH PYTHON | L | T | P | C |
|---|---|---|---|---|---|
| 21F00202 | | 4 | 0 | 0 | 4 |
| | **Semester** | **II** | | | |

**Course Objectives:**

Ideally for a student to understand Data Science, he/she should have exposure to the following. This will give a basic feel about Data Science. In the following, the topics highlighted in light blue is minimum needed and those highlighted in yellow will help to get a feel about the subject.

Overall it covers the following:

- Basics of probability
- Basics of statistics
- Pattern Recognition
- Machine Learning
- Introduction on Deep Neural Networks.

**Course Outcomes (CO):** Student will be able to

- Obtain, clean/process, and transform data
- Analyze and interpret data using an ethically responsible approach
- Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues
- Apply computing theory, languages, and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses
- Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges
- Perform well in a group

| **UNIT – I** | | Lecture Hrs: |
|---|---|---|

Descriptive Statistics: Measures of central tendency—mean, median, mode, harmonic mean and geometric mean; Measures of dispersion – mean deviation from mean, standard deviation and variance. Central moments. Linear and rank correlation. Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations Definition of random variable and probability, (problems depending on counting –taught in MFCS), discrete probability distributions: Bernoulli, Binomial, Poisson; Continuous probability distributions: Gaussian, Exponential, Chisquare. Definition of Bayesian probability.

| **UNIT - II** | | Lecture Hrs: |
|---|---|---|

Exploratory Data Analysis (EDA), Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.

Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps etc.

| **UNIT - III** | | Lecture Hrs: |
|---|---|---|

Patterns, features, patter representation, curse of dimensionality, dimensionality reduction. Supervised and Unsupervised learning. Classification—linear and non-linear. Bayesian, Perceptron, Nearest neighbour classifier, Support vector machine, use of kernels, Logistic regression, Naïve-bayes, decision trees and random forests; boosting and bagging. Clustering---partitional and hierarchical; k-means clustering.

Regression. Least squares. Evaluation metrics: RMSE, MAE and Coefficient of Determination (R- square) Cost functions, training and testing a classifier. Cross-validation. Class-imbalance – ways of handling, Exploratory data analysis (EDA), evaluation metrics— Precision, Recall, RoC, AUC; Confusion matrix, Classification accuracy

| **UNIT - IV** | | Lecture Hrs: |
|---|---|---|

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## MASTER OF COMPUTER APPLICATIONS

| | | |
|---|---|---|
| Multilayer perceptron. Back propagation. Loss functions. Epochs and Batch sizes. Hyper parameter tuning. Applications to classification, regression and unsupervised learning. Overview(introduction to the terms) of RNN, CNN and LSTM. | | |
| **UNIT - V** | | |
| Applications to text, images, videos: recommender systems, image classification, Social network graphs | | |
| **Textbooks:** | | |
| • Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline. O'Reilly, 2013.<br>• Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.<br>• Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016<br>• Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009.<br>• Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,2011. | | |

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | COMPUTER NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00203 | | 4 | 0 | 0 | 4 |
| Semester | | II | | | |

**Course Objectives:**

- Introduce the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

**Course Outcomes (CO):** Student will be able to

- Identify the software and hardware components of a Computer network (L1)
- Design software for a Computer network (L6)
- Develop new routing, and congestion control algorithms (L3)
- Critique the existing routing protocols (L5)
- Explain the functionality of each layer of a computer network (L2)
- Employ the appropriate transport protocol based on the application requirements (L3)

| **UNIT – I** | Lecture Hrs: |
|---|---|
| What is the Internet, The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet | |
| **UNIT – II** | Lecture Hrs: |
| Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications | |
| **UNIT – III** | Lecture Hrs: |
| Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control | |
| **UNIT – IV** | Lecture Hrs: |
| Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol(IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing | |
| **UNIT – V** | |
| Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Centre Networking, Retrospective: A Day in the Life of a Web Page Request | |

**Text Books:**

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | SOFTWARE TESTING METHODOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00204a | | 4 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:**

- To provide knowledge of the concepts in software testing such as testing process, criteria,strategies, and methodologies.
- To develop skills in software test automation and management using latest tools.

**Course Outcomes (CO):** Student will be able to

- Have an ability to apply software testing knowledge and engineering methods.
- Have an ability to design and conduct a software test process for a software testing project.
- Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.
- Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
- Have an ability to use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects

**UNIT - I** — Lecture Hrs:

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs
Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and Achievable paths, path sensitizing, path instrumentation, application of path testing..

**UNIT - II** — Lecture Hrs:

Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice & ugly domains, domain
testing, domains and interfaces testing, domain and interface testing, domains and testability

**UNIT - III** — Lecture Hrs:

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

**UNIT - IV** — Lecture Hrs:

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

**UNIT - V**

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

**Text Books:**

1. Software Testing techniques - BarisBeizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATA MINING AND BUSINESS INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| 21F00204b | | 4 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:**

The student will define the importance of business intelligence by:

- Describing key business intelligence terms.
- Determining the relevance of data to business
- Aligning business intelligence to organizational strategy.

**Course Outcomes (CO):** Student will be able to

- Demonstrate an understanding of the importance of data mining and the principles of business intelligence
- Organize and Prepare the data needed for data mining using pre preprocessing techniques
- Perform exploratory analysis of the data to be used for mining.
- Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
- Define and apply metrics to measure the performance of various data mining algorithms.
- Apply BI to solve practical problems : Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

| **UNIT - I** | Overview and concepts Data Warehousing and Business Intelligence | Lecture Hrs: |
|---|---|---|

Why reporting and Analysing data, Raw data to valuable information-Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing

| **UNIT - II** | The Architecture of BI and DW | Lecture Hrs: |
|---|---|---|

BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations

| **UNIT - III** | Introduction to data mining (DM) | Lecture Hrs: |
|---|---|---|

Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process

| **UNIT - IV** | Data Pre-processing | Lecture Hrs: |
|---|---|---|

Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

| **UNIT - V** | Concept Description and Association Rule Mining | |
|---|---|---|

What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – IncrementalARM – Associative Classification – Rule Mining

**Text Books:**

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.



3. PaulrajPonnian, "Data Warehousing Fundamentals", John Willey.
4. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
5. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00204c | | 4 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:**

- To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations namely: demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting and financial accounting and financial analysis.

**Course Outcomes (CO):** Student will be able to

- Prepare balance sheets of budget.
- Get the skill to manage finances of a firm/company

| **UNIT - I** | Lecture Hrs: |
|---|---|

.Introduction & Demand Analysis
Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

| **UNIT - II** | Lecture Hrs: |
|---|---|

Production Function- Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) – Managerial Significance.

| **UNIT - III** | Lecture Hrs: |
|---|---|

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.
Objectives and Policies of Pricing- Methods of Pricing: Cost Plus Pricing. Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing. Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

| **UNIT - IV** | Lecture Hrs: |
|---|---|

Business & New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership. Joint Stock Company. Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.

| **UNIT - V** | |
|---|---|

Introduction to Financial Accounting: Double-Entry Book Keeping, Journal. Ledger. Trial Balance- Final Accounts (Trading Account. Profit and Loss Account and Balance Sheet with simple adjustments).
Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio). Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio).

**Text Books:**

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
2. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2009.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | OPERATIONS RESEARCH | L | T | P | C |
|---|---|---|---|---|---|
| 21F00205a | | 3 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:**

- To impart knowledge in concepts and tools of Operations Research
- To understand mathematical models used in Operations Research
- To apply these techniques constructively to make effective business decisions

**Course Outcomes (CO):** Student will be able to

- Solve Linear Programming Problems
- Solve Transportation and Assignment Problems
- Understand the usage of game theory and Simulation for Solving Business Problems

**UNIT - I** — Lecture Hrs:

Linear programming problems - Mathematical formulation, graphical method of solution, simplex method

**UNIT - II** — Lecture Hrs:

Duality in linear programming problems, dual simplex method, sensitivity analysis, transportation and assignment problems, Traveling salesman Problem.

**UNIT - III** — Lecture Hrs:

Game theory Introduction, two-person zero-sum games, some basic terms, the maxmin principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property.
CPM & PERT- project scheduling, critical path calculations, Crashing.

**UNIT - IV** — Lecture Hrs:

Queuing theory -basic structure of queuing systems, roles of the Poisson and exponential distributions, classification of queues basic results of M/M/1: FIFO systems, Extension to multi-server queues.

**UNIT - V**

Simulation: simulation concepts, simulation of a queuing system using event list, pseudorandom numbers, multiplication congruential algorithm, inverse transformation method, basic ideas of Monte-Carlo simulation.

**Text Books:**


- Taha.H.A ,operation Research : An Introduction, McMilan publishing Co., 1982. 7th ed.
- Ravindran A, Philips D.T &Solbery.J.J, Operations Research: Principles and practice, John Wiley & Sons, New York, 1987.
- Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book seller, Delhi.
- Gillet.B.E., Introduction to Operations Research - A Computer oriented algorithmic approach, McGraw Hill, 1987.
- Joseph.G.Ecker& Michael KupperSchimd, Introduction to operations Research, John Wiley & Sons, 1988.
- Hillier.F.S&Liberman.G.J, operation Research, Second Edition, Holden Day Inc, 1974.
- KantiSwarup, Gupta.P.K. & Man Mohan, operations Research, S.Chand& Sons.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DIGITAL MARKETING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00205b | | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:**

- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can measured.

**Course Outcomes (CO):** Student will be able to

- To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- To focuses on how digital marketing can be utilized by organizations and how its effectiveness can measured.
- To know the key elements of a digital marketing strategy
- To study how the effectiveness of a digital marketing campaign can be measured
- To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

**UNIT - I** — Lecture Hrs:

Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand- Website - Planning and Creation- Content Marketing.

**UNIT - II** — Lecture Hrs:

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors - On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

**UNIT - III** — Lecture Hrs:

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximising email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

**UNIT - IV** — Lecture Hrs:

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing-Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

**UNIT - V**

.Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

**Text Books:**

1. Fundamentals of Digital Marketing by Puneet Singh BhatiaPublisher: Pearson Education; First edition ( July 2017)
2. Digital Marketing by VandanaAhuja ;Publisher: Oxford University Press ( April 2015)

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | CLOUD COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00205c | | 3 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:**

- To understand the need of Cloud Computing.
- To develop cloud applications.
- To demonstrate design the architecture for new cloud application.
- To teach how to re-architect the existing application for the cloud.

**Course Outcomes (CO):** Student will be able to

- Outline the procedure for Cloud deployment (L4)
- Investigate different cloud service models and deployment models (L4)
- Compare different cloud services. (L4)
- Design applications for an organization which use cloud environment. ( L6)
- Understand the concept and challenge of big data and why existing technology is inadequate to analyze the big data. (L2)

**UNIT – I** Lecture Hrs:

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.

Cloud Services and Platforms : Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity & and Access Management services, Open Source Private Cloud software

**UNIT – II** Lecture Hrs:

Hadoop&MapReduce: Apache Hadoop, HadoopMapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics : Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

**UNIT – III** Lecture Hrs:

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP,Document Storage App, MapReduce App, Social Media Analytics App.

**UNIT – IV** Lecture Hrs:

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data, Recommendation of Systems.

Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.

Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

**UNIT – V**

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity & Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare &Education:Cloud Computing for Healthcare, Cloud computing for

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## MASTER OF COMPUTER APPLICATIONS

Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven –step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age :Introduction, Basic concepts of Organizational Readiness, Drivers for changes : A frame work to comprehend the competitive environment , common change management models, change management maturity models, Organizational readiness self – assessment.

**Text Books:**

1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj kumarBuyya, James Broberg, AndrzejGoscinski, wiley, 2016

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | OPERATING SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00206 | | 0 | 0 | 4 | 2 |
| | Semester | II | | | |

**Course Objectives:**

- To understand the functionalities of various layers of OSI model
- To explain the difference between hardware, software; operating systems, programs
- and files.
- Identify the purpose of different software applications.

**Course Outcomes (CO):**

- Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.
- Able to implement C programs using Unix system calls

**List of Experiments**:

Week 1: Simulate the following CPU scheduling algorithms.
a) FCFS b) SJF c) Round Robin d) Priority.
Week 2: Write a C program to simulate producer-consumer problem using Semaphores
Week 3: Write a C program to simulate the concept of Dining-philosophers problem.
Week 4: Simulate MVT and MFT.
Week 5: Write a C program to simulate the following contiguous memory allocation Techniques
a) Worst fit b) Best fit c) First fit.
Week 6: Simulate all page replacement algorithms
a)FIFO b) LRU c) OPTIMAL
Week 7: Simulate all File Organization Techniques
a) Single level directory b) Two level directory
Week 8: Simulate all file allocation strategies
a) Sequential b) Indexed c) Linked.
Week 9: Simulate Bankers Algorithm for Dead Lock Avoidance.
Week 10: Simulate Bankers Algorithm for Dead Lock Prevention.
Week 11: Write a C program to simulate disk scheduling algorithms.
a) FCFS b) SCAN c) C-SCAN

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DATASCIENCE LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00207 | | 0 | 1 | 2 | 2 |
| | Semester | II | | | |

**Course Objectives:**

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its
- applications.
- Practical understanding of building different types of models and their evaluation

**Course Outcomes (CO):**

- Read, write, execute simple Python programs
- Decompose a Python program into functions
- Manipulate with 1-d,2-d and multidimensional data using Python
- Read and write data from/to files in Python programs

**List of Experiments**:

1. Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.
2. Write a program to create, append, and remove lists in Python.
3. Write a program to demonstrate working with tuples in Python.
4. Write a program to demonstrate working with dictionaries in Python.
5. Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.
8. Write a program to demonstrateRegression analysis with residual plots on a given data set.
9. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
10. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
11. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions using Java/Python ML library classes.
12. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in CSV file. Compare the results of various “k” values for the quality of clustering.
13. Write a program to build Artificial Neural Network and test the same using appropriate data sets.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | COMPUTER NETWORKS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00208 | | 0 | 0 | 4 | 2 |
| | Semester | II | | | |

**Course Objectives:**

- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and observe its performance
- To analyze the traffic flow and the contents of protocol frames

**Course Outcomes (CO):**

- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and observe its performance
- To analyze the traffic flow and the contents of protocol frames

**List of Experiments**:

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijsktra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting technique used in buffers.
10. Wireshark
i. Packet Capture Using Wire shark
ii. Starting Wire shark
iii. Viewing Captured Traffic
iv. Analysis and Statistics & Filters.
11. How to run Nmap scan
12. Operating System Detection using Nmap
13. Do the following using NS2 Simulator
i. NS2 Simulator-Introduction
ii. Simulate to Find the Number of Packets Dropped
iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
iv. Simulate to Find the Number of Packets Dropped due to Congestion
v. Simulate to Compare Data Rate& Throughput.
vi. Simulate to Plot Congestion for Different Source/Destination
vii. Simulate to Determine the Performance with respect to Transmission of Packets

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | EXPLORATORY DATA ANALYTICS WITH PYTHON | L | T | P | C |
|---|---|---|---|---|---|
| 21F00209 | | 1 | 0 | 2 | 2 |
| | **Semester** | **II** | | | |

**Course Objectives:**

- This course is designed to teach students how to analyse different types of data using Python.
- Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.

**Course Outcomes (CO):** Student will be able to

- Understanding basics of python for performing data analysis
- Understanding the data, performing preprocessing, processing and data visualization to get insights from data.
- Use different python packages for mathematical, scientific applications and for web data analysis.
- Develop the model for data analysis and evaluate the model performance.

| **UNIT - I** | Lecture Hrs: |
|---|---|

Python Fundamentals for Data Analysis Python data structures, Control statements, Functions, Object Oriented programming concepts using classes, objects and methods, Exception handling, Implementation of user-defined Modules and Package, File handling in python.

| **UNIT - II** | Lecture Hrs: |
|---|---|

Introduction to Data Understanding and Preprocessing Knowledge domains of Data Analysis, Understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

| **UNIT - III** | Lecture Hrs: |
|---|---|

Data Processing and Visualization Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using Pandas. Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps

| **UNIT - IV** | Lecture Hrs: |
|---|---|

Mathematical and Scientific applications for Data Analysis Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays.

| **UNIT - V** | |
|---|---|

Analysing Web Data wrangling, Web scrapping, Combing and merging data sets, Reshaping and pivoting, Data transformation, String Manipulation, case study for web scrapping

**Text Books:**

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. ReemaThareja, "Python Programming using Problem Solving approach",Oxford University press 3. Wes Mckinney "Python for Data Analysis", First edition, Publisher O'Reilly Media.

Reference Books

1. Allen Downey ,Jeffrey Elkner ,Chris Meyers,: Learning with Python, Dreamtech Press
2. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | WEB TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00301 | | 4 | 0 | 0 | 4 |
| | Semester | III | | | |

**Course Objectives:**

- To introduce PHP language for server-side scripting
- To introduce XML and processing of XML Data with Java
- To introduce Server-side programming with Java Servlets and JSP
- To introduce Client-side scripting with Javascript and AJAX.

**Course Outcomes (CO):** Student will be able to

- Gain knowledge of client-side scripting, validation of forms and AJAX programming
- Understand server-side scripting with PHP language
- Understand what is XML and how to parse and use XML Data with Java
- To introduce Server-side programming with Java Servlets and JSP

**UNIT - I** — Lecture Hrs:

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies
File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories

**UNIT - II** — Lecture Hrs:

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;
XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

**UNIT - III** — Lecture Hrs:

Introduction to Servlets: Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

**UNIT - IV** — Lecture Hrs:

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

**UNIT - V**

Client-side Scripting: Introduction to JavaScript, JavaScript language – declaring variables, scope of variables, functions. event handlers (on click, on submit etc.), Document Object Model, Form validation.

**Text Books:**

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hil

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | BIG DATA TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00302 | | 4 | 0 | 0 | 4 |
| | **Semester** | **III** | | | |

**Course Objectives:**

- To understand the specialized aspects of big data including big data application, and big data analytics.
- To study different types Case studies on the current research and applications of the Hadoop and big data in industry.

**Course Outcomes (CO):** Student will be able to

- Discuss the challenges and their solutions in Big Data
- Understand and work on Hadoop Framework and eco systems.
- Explain and Analyze the Big Data using Map-reduce programming in Both Hadoop and Spark framework.
- Demonstrate spark programming with different programming languages.
- Demonstrate the graph algorithms and live streaming data in Spark

| **UNIT – I** | Lecture Hrs: |
|---|---|

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

| **UNIT – II** | Lecture Hrs: |
|---|---|

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing mapreduce calculations

| **UNIT – III** | Lecture Hrs: |
|---|---|

Data format, analysing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

| **UNIT – IV** | Lecture Hrs: |
|---|---|

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

| **UNIT – V** | |
|---|---|

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

**Text Books:**

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, PreetiSaxena, McGraw Hill, 2018.
2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DEVOPS & AGILE PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00303 | | 4 | 0 | 0 | 4 |
| Semester | | III | | | |

**Course Objectives:**

- To give strong knowledge of Agile practices
- To give strong foundation of applications of DevOps
- To give strong foundation of development and its operations
- To give strong foundation of the source code management

**Course Outcomes (CO):** Student will be able to

- Understand the traditional software development.
- Learn the rise of agile methodologies.
- Define and design purpose of DevOps
- Understand applied DevOps.
- Learn real world applications of DevOps.
- Understand its practical examples.

**UNIT - I** — Lecture Hrs:

Why Agile? , How to be Agile, Understanding XP, Values and Principles, Improve the Process, Eliminate Waste, Deliver Value.
Practicing XP-Thinking, Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.

**UNIT - II** — Lecture Hrs:

Releasing-Done Done, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation.
Planning-Vision, Release Planning, Risk Management, Iteration Planning, Stories, Estimating.

**UNIT - III** — Lecture Hrs:

Developing-Incremental Requirements, Customer Tests, Test- Driven Development, Refactoring, Incremental Design and Architecture, Spike Solutions, Performance Optimization.

**UNIT - IV** — Lecture Hrs:

DEIFINITION & PURPOSE OF DEVOPS: Introduction to DevOps - DevOps and Agile, Minimum Viable Product - Application Deployment - Continuous Integration - Continuous Delivery

**UNIT - V**

CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING): CAMS – Culture -
CAMS – Automation - CAMS – Measurement - CAMS – Sharing - Test-Driven Development - Configuration Management - Infrastructure Automation - Root Cause Analysis – Blamelessness - Organizational Learning.

**Text Books:**


1. James Shore and Shane Warden, " The Art of Agile Development", O'REILLY, 2007.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices" , PHI, 2002.
3. The DevOps Handbook - by Gene Kim, Jez Humble, Patrick Debois, and Willis Willis
4. What is DevOps? - by Mike Loukides
5. The DevOps Handbook - by John Willis, Patrick Debois, Jez Humble, Gene Kim.
6. DevOps: A Software Architect's Perspective - by Len Bass, Ingo Weber, Liming Zhu.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | SOFTWARE ARCHITECTURE AND DESIGN PATTERNS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00304a | | 3 | 0 | 0 | 3 |
| | **Semester** | **III** | | | |

**Course Objectives:**

- Learn How to add functionality to designs while minimizing complexity.
- What code qualities are required to maintain to keep code flexible?
- To Understand the common design patterns.
- To explore the appropriate patterns for design problems

**Course Outcomes (CO):** Student will be able to

- Design and implement codes with higher performance and lower complexity
- Experience core design principles and be able to assess the quality of a design with respect to these principles.
- Capable of applying these principles in the design of object oriented systems.
- Demonstrate an understanding of a range of design patterns. Be capable ofcomprehending a design presented using this vocabulary.
- Be able to select and apply suitable patterns in specific contexts

**UNIT – I** — Lecture Hrs:

Envisioning Architecture The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.
Creating an Architecture Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

**UNIT – II** — Lecture Hrs:

Analyzing Architectures Architecture Evaluation, Architecture design decision making, ATAM, CBAM Moving from One System to Many Software Product Lines, Building systems from off the shelf components, Software architecture in future

**UNIT – III** — Lecture Hrs:

Patterns Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational and Structural Patterns Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

**UNIT – IV** — Lecture Hrs:

Behavioral Patterns Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

**UNIT – V**

Case Studies A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development. A Case Study (Designing a Document Editor): Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

**TEXT BOOKS:**

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

**REFERENCE BOOKS:**

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001 3.



3.Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.
8. Pattern Oriented Software Architecture, F.Buschmann& others, John Wiley & Sons.

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ANANTHAPURAMU – 515 002 (A.P) INDIA

## MASTER OF COMPUTER APPLICATIONS

| Course Code | NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00304b | | 3 | 0 | 0 | 3 |
| Semester | | III | | | |

**Course Objectives:**

- Network security using various cryptographic algorithms.
- Underlying network security applications. It also focuses on the practical applications that have been implemented and are in use to provide email and websecurity.

**Course Outcomes (CO):** Student will be able to

- Understand the most common type of cryptographic algorithm
- Understand the Public-Key Infrastructure
- Understand security protocols for protecting data on networks
- Be able to digitally sign emails and files
- Understand vulnerability assessments and the weakness of using passwords for authentication
- Be able to perform simple vulnerability assessments and password audits

**UNIT - I** — Lecture Hrs:

Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms.

**UNIT - II** — Lecture Hrs:

Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES

**UNIT - III** — Lecture Hrs:

Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages. Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS,
Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

**UNIT - IV** — Lecture Hrs:

Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

**UNIT - V**

What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

**Text Books:**


1. AtulKahate, Cryptography and Network Security, McGraw Hill.
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice HallPTR., 2002.
3. Stallings W.Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003
4. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000.
5. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.
6. Information Security Intelligence Cryptographic Principles and App. CalabresThomson.
7. Securing A Wireless Network Chris Hurley SPD.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | MACHINE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00304c | | 3 | 0 | 0 | 3 |
| | **Semester** | **III** | | | |

**Course Objectives:**

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

**Course Outcomes (CO):** Student will be able to

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

**UNIT - I** — Lecture Hrs:

.Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning

**UNIT - II** — Lecture Hrs:

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

**UNIT - III** — Lecture Hrs:

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning

**UNIT - IV** — Lecture Hrs:

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

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## MASTER OF COMPUTER APPLICATIONS

| **UNIT - V** | | |
|---|---|---|
| Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.<br>Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.<br>Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis | | |
| **Text Books:** | | |
| 1.Machine Learning – Tom M. Mitchell, - MGH | | |

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## ANANTHAPURAMU – 515 002 (A.P) INDIA

## MASTER OF COMPUTER APPLICATIONS

| Course Code | MOBILE APPLICATION DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| 21F00305a | | 3 | 0 | 0 | 3 |
| Semester | | III | | | |

**Course Objectives:**

- To demonstrate their understanding of the fundamentals of Android operating systems
- To improves their skills of using Android software development tools
- To demonstrate their ability to develop software with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

**Course Outcomes (CO):** Student will be able to

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications.

**UNIT – I** Lecture Hrs:

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes
Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

**UNIT – II** Lecture Hrs:

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts
User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

**UNIT – III** Lecture Hrs:

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts

**UNIT – IV** Lecture Hrs:

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving andretrieving data using Shared Preference

**UNIT – V**

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

**Text Books:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox)2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | INTERNET OF THINGS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00305b | | 3 | 0 | 0 | 3 |
| | Semester | III | | | |

**Course Objectives:**

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

**Course Outcomes (CO):** Student will be able to

- Choose the sensors and actuators for an IoT application
- Select protocols for a specific IoT application
- Utilize the cloud platform and APIs for IoT applications
- Experiment with embedded boards for creating IoT prototypes
- Design a solution for a given IoT application
- Establish a startup

**UNIT – I** Lecture Hrs:

.Overview of IoT:
The Internet of Things: An Overview, The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?
Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.
Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

**UNIT – II** Lecture Hrs:

Embedded Devices:
Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things

**UNIT – III** Lecture Hrs:

Communication in the IoT:
Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols
Prototyping Online Components:
Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

**UNIT – IV** Lecture Hrs:

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups.
Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

**UNIT – V**

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software.
Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

**Text Books:**

Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | BLOCK CHAIN TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00305c | | 3 | 0 | 0 | 3 |
| | **Semester** | **III** | | | |

**Course Objectives:**

- This course is intended to study the basics of Block chain technology. During this course learner will explore various aspects of Block chain technology like application in various domains. By implementing learner will have idea about private and public Block chain, and smart contract

**Course Outcomes (CO):** Student will be able to

- Understand and explore the working of Block chain technology (Understanding)
- Analyze the working of Smart Contracts (Analyze)
- Understand and analyze the working of Hyper ledger (Analyze).
- Apply the learning of solidity and de-centralized apps on Ethereum (Apply).

**UNIT - I** — Lecture Hrs:

Introduction of Cryptography and Block chain: What is Block chain, Block chain Technology Mechanisms &Networks, Block chain Origins, Objective of Block chain, Block chain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Block chain

**UNIT - II** — Lecture Hrs:

Bit Coin and Crypto currency: What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Block chain Technology On Crypto currency.

**UNIT - III** — Lecture Hrs:

Introduction to Ethereum: What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts.

**UNIT - IV** — Lecture Hrs:

Introduction to Hyper ledger: What is Hyper ledger? Distributed Ledger Technology & its Challenges, Hyper ledger & Distributed Ledger Technology, Hyper ledger Fabric, Hyper ledger Composer.

**UNIT - V**

Block chain Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Block chain, Alt Coins

**Text Books:**


1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven
2. Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive
3. Introduction, Princeton University Press (July 19, 2016).
4. Antonopoulos, Mastering Bitcoin.
5. Antonopoulos and G. Wood, Mastering Ethereum.
6. D. Drescher, Blockchain Basics. Apress, 2017.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | WEB TECHNOLOGIES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00306 | | 0 | 0 | 4 | 2 |
| Semester | | III | | | |

**Course Objectives:**

- Understand the web technologies to create adaptive web pages for web application.
- Use CSS to implement a variety of presentation effects to the web application
- Know the concept and implementation of cookies as well as related privacy concerns
- Develop a sophisticated web application that employs the MVC architecture.

**Course Outcomes (CO):**

- Integrate frontend and backend web technologies in distributed systems.
- Facilitate interface between frontend and backend of a web application.
- Debug, test and deploy web applications in different web servers.
- Migrate the web applications to the other platforms like .Net

**List of Experiments**:

1. Write a PHP script to print prime numbers between 1-50.
2. PHP script to
a. Find the length of a string.
b. Count no of words in a string.
c. Reverse a string.
d. Search for a specific string.

3. Write a PHP script to merge two arrays and sort them as numbers, in descending order.
4. Write a PHP script that reads data from one file and write into another file.
5. Develop static pages (using Only HTML) of an online book store. The pages should resemble: www.amazon.com. The website should consist the following pages.
a) Home page
b) Registration and user Login
c) User Profile Page
d) Books catalog
e) Shopping Cart
f) Payment By credit card
g) Order Conformation
6. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
7. Create and save an XML document on the server, which contains 10 users information. Write a program, which takes User Id as an input and returns the user details by taking the user information from the XML document.
8. Install TOMCAT web server. Convert the static web pages of assignments 2 into dynamic web pages using servlets and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
9. Redo the previous task using JSP by converting the static web pages of assignments 2 into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. Follow the MVC architecture while doing the website

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | BIG DATA TECHNOLOGIES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00307 | | 0 | 1 | 2 | 2 |
| | Semester | III | | | |

**Course Objectives:**

- Apply quantitative modeling and data analysis techniques to the solution of real-world business problems, communicate findings, and effectively present results using data visualization techniques.
- Apply principles of Data Science to the analysis of business problems.

**Course Outcomes (CO):**

- Understand and implement the basics of data structures like Linked list, stack, queue, set and map in Java.
- Demonstrate the knowledge of big data analytics and implement different file management task in Hadoop.
- Understand Map Reduce Paradigm and develop data applications using variety of systems.
- Analyze and perform different operations on data using Pig Latin scripts.
- Illustrate and apply different operations on relations and databases using Hive.

**List of Experiments**:

**Week 1:**Hadoop Installation on a)Single Node and SPARK Installation, Launch a cloud instance for AWS instance on Centos 7

**Week 2:** Design a distributed application using MapReduce which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform.

**Week 3:**Design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.

**Week 4:** Write an application using HBase and HiveQL for flight information system which will include 1) Creating, Dropping, and altering Database tables, 2) Creating an external Hive table to connect to the HBase for Customer Information Table, 3) Load table with data, insert new values and field in the table, Join tables with Hive, 4) Create index on Flight information Table, and 5) Find the average departure delay per day in 2008.

**Week 5:** Display the hierarchical structure of your data by generating Trees, graphs and network visualization. Install and Run Pig then write Pig Latin scripts to sort, group, join, project and filter the data. Install and Run Hive then use Hive to Create, alter and drop databases, tables, views, functions and Indexes.

**Week 6:** Input file contains a series of tweets made by few people. Do a word count on the text object value Hint: Json Parsing in python – this sample snippet can be used within Map to read the JSON

**Week 7:** Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location. And Reading Excel,XML data sheets in R. Using with and without R objects on console, mathematical functions on console create R objects for calculator application and save in a specified location in disk.

Write an R script to find basic descriptive statistics using summary,str, quartile unction on mtcars& cars datasets and to find subset of dataset by using subset (),aggregate () functions on dataset.

**Week 8:**

Implementing data visualization using R : Find the data distributions using box and scatter plot, Find the outliers using plot and Plot the histogram, bar chart and pie chart on sample data.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DEV OPS & AGILE PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21F00308 | | 0 | 0 | 4 | 2 |
| | Semester | III | | | |

**Course Objectives:**

To understand the concept of DevOps with associated technologies and

- methodologies.
- To be familiarized with Jenkins, which is used to build & test software Applications
- & Continuous integration in Devops environment. To understand different Version
- Control tools like GIT, CVS or Mercurial
- To understand Docker to build, ship and run containerized images
- To use Docker to deploy and manage Software applications running on Container.
- To be familiarized with concept of Software Configuration Management &
- provisioning using toolslikePuppet,Chef, Ansible or Saltstack.

**Course Outcomes (CO):**

- Understand and Implement the Integration and Continuous deployment.
- Can implement anatomy of continuous delivery pipeline.
- Understands and implement static code analysis.

**List of Experiments**:

Agile Laboratory Programs:

1. Understand the background and driving forces fortaking an Agile Approach to Software Development.
2. Understand the business value of adopting agileapproach.
3. Understand agile development practices
4. Drive Development with Unit Test using Test Driven development.
5. Apply Design principle and Refactoring to achieve agility
6. To study automated build tool.
7. To study version control tool.
8. To study Continuous Integration tool.
9. Perform Testing activities within an agile project.

Dev Ops Laboratory Programs:

1. Build & TestApplicationswithContinuousIntegration - To Install and Configure Jenkins to test, anddeploy Java or Web Applications usingNetBeans or eclipse.
2. VersionControl - To Perform Version Control on websites/Software's using different Version control toolslike RCS/ CVS/GIT/Mercurial (Any two)
3. Virtualization&Containerization - To Install and Configure Docker for creatingContainers of different Operating SystemImages
4. Virtualization&Containerization - To Build, deploy and manage web orJava application on Docker
5. SoftwareConfigurationManagement - To install and configure Software ConfigurationManagement using Chef/Puppet/Ansible orSaltstack.
6. Provisioning - To Perform Software ConfigurationManagement and provisioning usingChef/Puppet/Ansible or Saltstack.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | MEAN STACK DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| 21F00310 | | 1 | 0 | 2 | 2 |
| | Semester | III | | | |

**Course Objectives:**

- To understand basic concepts of JAVASCRIPT.
- To implement concepts of HTML,CSS, and REACT in developing various websites.
- To design solutions to real world scenarios using NODE and EXPRESS JS.
- To Analyze concepts of MONGODB.
- To implement socket programming in MERN stack.

**Course Outcomes (CO):** Student will be able to

- Understand basic concepts of JAVASCRIPT.
- Implement concepts of HTML,CSS, and REACT in developing various websites.
- Design solutions to real world scenarios using NODE and EXPRESS JS.
- Analyze concepts of MONGODB.
- Implement socket programming in MERN stack.

**UNIT – I** — Lecture Hrs:10

Introduction: data types ,logical operations, functions, object and classes, promise async& await, modules and npm packages, error handling, Document Object module,
J Query.

**UNIT – II** — Lecture Hrs:10

**HTML CSS and REACT :** Basic structure of a webpage, Different types of tags , HTML text fundamentals, Creating hyperlinks, Insertion of images and multimedia, Introduction CSS, CSS-selector –internal- external , CSS- inline class background font text colour, CSS-padding margin border, Installation of react , REACT- virtual DOM, REACT-JSX, REACT-components, REACT-prop and state , REACT – lifecycles.

**UNIT – III** — Lecture Hrs:10

**Node and Express JS :** Introduction of Node JS (Run time environment), Node JS installation, Node JS web based example (import required modules ,create server,read request and return response), Node JS – npm ,errors, crypto, Node JS – child process ,buffer, string, Node JS- string decoder ,query string , Node JS- callbacks , events, web modules, Introduction of APIs, Express JS – introduction , Express JS- installation, Express JS – GET, POST, REQUEST, RESPONSE, Express JS- Routing ,file upload, cookies, middleware .

**UNIT – IV** — Lecture Hrs:10

**MongoDB:** Introduction of MongoDB, Difference between SQL and NoSQL, MongoDB data types, MongoDB installation, Data modelling in MongoDB, Create database, Drop Database, Create collection, Insert document, Select document, Queries in MongoDB, Sorting data in document, Remove document.

**UNIT - V** — Lecture Hrs:10

**Socket programming in MERN stack :**Connect the react to node by axiom, Import required module, Create server in node, Connect the Node JS to MongoDB, Create request , Read Response, Full Stack Project.

**Textbooks:**

1. Getting MEAN with MONGO, Express angular and node by Simon Holmes, Dreamtech Publishers
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node Paperback – 1 April 2017 by Vasan Subramanian (Author)
3. Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App by Greg Lim (Author)

4. Full Stack JavaScript Development with MEAN by COLIN J Ihrig and Adam J bretz.Sitepoint publishers.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | DEEP LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| 21F00401a | | 3 | 0 | 0 | 3 |
| | Semester | IV | | | |

**Course Objectives:**

- To present the mathematical, statistical and computational challenges of building neural networks.
- To teach the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To enable the students to know deep learning techniques to support real-time applications.
- To explain the case studies of deep learning techniques.

**Course Outcomes (CO):** Student will be able to

- Identify Convolutional Neural Networks models to solve Supervised Learning Problems
- Design Autoencoders to solve Unsupervised Learning problems
- Apply Long Shot Term Memory (LSTM) Networks for time series analysis classification problems.
- Apply Classical Supervised Tasks for Image Denoising, Segmentation and Object detection problems.

| **UNIT - I** | | Lecture Hrs: |
|---|---|---|

Introduction: Introduction to machine learning- Linear models (SVMs and Perceptron, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

| **UNIT - II** | | Lecture Hrs: |
|---|---|---|

Deep Networks: History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks - Generative Adversarial Networks (GAN), Semi- supervised Learning .

| **UNIT - III** | | Lecture Hrs: |
|---|---|---|

Dimensionality Reduction: Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

| **UNIT - IV** | | Lecture Hrs: |
|---|---|---|

Optimization and Generalization: Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

| **UNIT - V** | | |
|---|---|---|

Case Study and Applications: Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

**Text Books:**

1. Deep Learning", Ian Goodfellow, YoshuaBengio , Aaron Courville, MIT Press 2016.
2. "Neural Networks and Deep Learning A Text Book", Charu C Aggarwal, Springer International Publishing AG, Part of Springer Nature 2018.

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**ANANTHAPURAMU – 515 002 (A.P) INDIA**

## MASTER OF COMPUTER APPLICATIONS

| Course Code | SOCIAL MEDIA ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00401b | | 3 | 0 | 0 | 3 |
| | Semester | IV | | | |

**Course Objectives:**

- To inspire the students with interest, excitement, and urge to learn the subject of Social network
- analysis .
- To understand the fundamental concepts of Social network analysis .
- To introduce the purpose of learning important aspects in Social network analysis .

**Course Outcomes (CO):** Student will be able to

- explain basic concepts and theories of network analysis in the social sciences, and understand how these concepts and theories can help explain different actors' micro behaviours as wellasmacro outcomes;
- critically examine the ways in which networks can contribute to the explanation of social, political, economic and cultural phenomena;
- use statistical software to visualize networks and analyse their properties, connecting these to network concepts and theories;
- explain principles underlying statistical models for social networks;
- use software to implement statistical models of social networks to analyse network formation and evolution;
- use software to simulate the dynamics of networks based on social network models.

| UNIT - I | Lecture Hrs:10 |
|---|---|

Introduction to Web - Limitations of current Web – Development ofSemantic Web – Emergence of the Social Web - Network analysis -Development of Social Network Analysis - Key concepts andmeasures in network analysis - Electronic sources for network analysis -Electronic discussion networks, Blogs and onlinecommunities, Web-based networks - Applications of SocialNetwork Analysis

| UNIT - II | Lecture Hrs:10 |
|---|---|

Ontology and their role in the Semantic Web - Ontology-basedKnowledge Representation - Ontology languages for the SemanticWeb -RDF and OWL - Modelling and aggregating social networkdata – State-of-the-art in network data representation, Ontologicalrepresentation of social individuals - Ontological representation ofsocial relationships, Aggregating and reasoning with social networkdata, Advanced Representations

| UNIT - III | Lecture Hrs:10 |
|---|---|

Extracting evolution of Web Community from a Series of WebArchive - Detecting Communities in Social Networks - Definition ofCommunity - Evaluating Communities –Methods for CommunityDetection & Mining -Applications of Community Mining Algorithms- Tools for Detecting Communities Social Network Infrastructuresand Communities-Applications - Case Studies - Real Time SentimentAnalysis, Stock Market Predictions

| UNIT - IV | Lecture Hrs:9 |
|---|---|

Understanding and Predicting Human Behavior for SocialCommunities - User Data Management, Inference and Distribution- Enabling New Human Experiences - Reality Mining - Context-Awareness - Privacy in Online Social Networks

| UNIT - V | Lecture Hrs:9 |
|---|---|

Trust in Online Environment - Trust Models Based on SubjectiveLogic - Trust Network Analysis - Trust Transitivity Analysis -Combining Trust and Reputation - Trust Derivation Based on TrustComparisons - Attack Spectrum and Countermeasures

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## MASTER OF COMPUTER APPLICATIONS

**Textbooks:**

1. Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2011.
2. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, first edition, 2011.

**Reference Books:**

1. Peter Mika, "Social networks and the Semantic Web", Springer, first edition 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, first edition, 2010.
3. Dion Goh and Schubert Foo, "Social information retrieval systems: emerging technologies and applications for searching the Web effectively", IGI Global snippet, 2008. 133
4. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and social information retrieval and access: techniques for improved user modelling", IGI Global snippet, 2004 .

**Online Learning Resources:**

1. www.utdallas.edu
2. ibook.ics.uci.edu
3. www.ebmtools.org

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | MULTIMEDIA SYSTEMS & TOOLS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00401c | | 3 | 0 | 0 | 3 |
| | **Semester** | **IV** | | | |

**Course Objectives:**

- Formulate a working definition of interactive multimedia
- Demonstrate competence in using the authoring program Hyper Studio
- Outline the use of animation, digitized sound, video control, and scanned images
- Illustrate the use of Netscape to access the Course Home Page and Tips and Tricks;

**Course Outcomes (CO):** Student will be able to

- Create a well-designed, interactive Web site with respect to current standards and practices
- Demonstrate in-depth knowledge in an industry-standard multimedia development tool and its associated scripting language
- Determine the appropriate use of interactive verses standalone Web applications
- Create time-based and interactive multimedia components
- Identify issues and obstacles encountered by Web authors in deploying Web-based Applications

**UNIT – I** Lecture Hrs:

Unit-I: Multimedia Overview, Definition Applications and Design, Authoring (HyperStudio), Introduction to HyperStudio, The Metaphor, The Basics (Cards, Buttons, Text), HyperStudio, Resources.
Multimedia Authoring- Multimedia Authoring Metaphors, Multimedia Production, Multimedia Presentation, Automatic Authoring, Some Useful Editing and Authoring Tools, Adobe Premiere, Macromedia Director, Macromedia Flash, Dreamweaver.

**UNIT – II** Lecture Hrs:

Unit-II: Instructional Design, Objectives, Content (print, graphics, sounds, etc.), Interaction, Assessment, Closure, Screen Design: Metaphors and Themes, Colors and Backgrounds, Text (size, color, placement), Navigation, Consistency.

**UNIT – III** Lecture Hrs:

Unit-III: Transitions and Links, Use of Sound, HyperStudio Sounds, Recording Your Own, Internet Resources, Graphics, Integrating Web documents, HyperStudio Tips and Tricks, Animation, Launching other applications and documents

**UNIT – IV** Lecture Hrs:

Unit-IV: Multimedia Portfolios, Designing a template, Adding elements, Choosing materials, Advanced Button Features, Hyperlinks,Drag-n-Drop, Advanced NBA's, Using Actions with other Objects.

**UNIT – V**

Incorporating Digital Media, QuickTime Movies, Laserdisc and CD-ROM control, scanning.

**Text Books:**

1. Marcia Kuperberg, A Guide to Computer Animation: for TV, games, multimedia and web,Focal Press (Taylor and Francis Group), 2002.
2. Z. N. Li and M. S. Drew, “Fundamentals of Multimedia”, Pearson Prentice Hall

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | CYBER LAWS | L | T | P | C |
|---|---|---|---|---|---|
| 21F00402a | | 3 | 0 | 0 | 3 |
| | **Semester** | **IV** | | | |

**Course Objectives:**

- The objectives of this course are to enable the learner to understand, explore, and acquire a critical understanding of cyber laws.
- Equip the learner with competencies for dealing with frauds and deceptions, and other cybercrimes that take place via the Internet

**Course Outcomes:**

- Understand the social and intellectual property issues emerging from cyberspace.
- Understand the policy regulations of cyber space employed by various countries
- Understand the relationship between commerce and cyberspace.
- Gain the knowledge of Information Technology Act

**UNIT - I**

Conceptual and theoretical perspective of Cyber Law, Computer and Web Technology, Development of Cyber Law, National and International Perspective Cyber Law, Legal issues and challenges in India, USA, Data Protection, Cyber Security.

**UNIT - II**

Jurisdiction issues in Transactional Crimes Cyber Law, International Perspective, Budapest Convention on Cybercrime. Hacking and Legal Issues, Privacy legal issues

**UNIT - III**

Cyber Law and IPR, Understanding Copyright in Information Technology, Software Copyrights Copyright in Internet & Multimedia, Software Piracy, Trademarks in Internet Domain Name registration, Domain Name disputes, Icann’s core principles and domain names, Net Neutrality, Databases in IT, Protection of databases, Position in USA, EU and India.

**UNIT - IV**

E-Commerce, UNCITRAL Model, Legal Aspects of E-Commerce, E-Taxation, E-Banking, Online Publishing and online credit card payment, Employment Contracts, Non-Disclosure Agreements.

**UNIT - V**

Information Technology Act 2000, Aims and Objectives, Overview of the Act, Jurisdiction, Electronic Governance, Electronic Evidence, Digital Signature Certificates, Digital Signatures, Duties of Subscribers, Role of Certifying Authorities, Regulations Appellate Tribunal, Internet Service Providers and their liabilities, Social Networking Sites.

**Text Books:**

1. Law Relating to Computer, Internet and E-Commerce by KamathNandan, 5th Edition,Universal Law Publishing.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | ENTREPRENEURSHIP | L | T | P | C |
|---|---|---|---|---|---|
| 21F00402b | | 3 | 0 | 0 | 3 |
| | **Semester** | **IV** | | | |

**Course Objectives:**

- The aim of this course is to have a comprehensive perspective of inclusive learning, ability tolearn and implement the fundamentals of Entrepreneurship.

Course Outcomes:

- Learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

**UNIT - I**

Entrepreneurial Perspectives
Introduction to Entrepreneurship – Evolution - Concept of Entrepreneurship - Types of Entrepreneurs - Entrepreneurial Competencies,Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods
- Entrepreneurial Motivations - Models for Entrepreneurial Development - The process of Entrepreneurial Development

**UNIT - II**

New Venture Creation
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**UNIT - III**

Management of MSMEs and Sick Enterprises
Challenges of MSME s, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units

**UNIT - IV**

Managing Marketing and Growth of Enterprises
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**UNIT - V**

Strategic perspectives in Entrepreneurship
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

**Text Books:**

1. Entrepreneurship Development and Small Business Enterprises, Poornima M.Charantimath, 2nd edition, Pearson, 2014.
2. Entrepreneurship, a South – Asian Perspective, D.F.Kuratko and T.V.Rao, 3rd edition, Cengage, 2012.
3. Entrepreneurship, Arya Kumar, 4th edition, Pearson 2015.

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## MASTER OF COMPUTER APPLICATIONS

| Course Code | NOSQL DATABASES | L | T | P | C |
|---|---|---|---|---|---|
| 21F00402c | | 3 | 0 | 0 | 3 |
| Semester | | IV | | | |

**Course Objectives:**

- Distinguish the different types of NoSQL databases. Understand the impact of the cluster on database design. State the CAP theorem and explain it main points

**Course Outcomes:**

- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

**UNIT – I**

Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
• Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
• Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

**UNIT – II**

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases

**UNIT – III**

Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.NoSQL Key/Value databases using MongoDB, Document Databases, What Is a Document Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

**UNIT – IV**

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, When Not to Use.

**UNIT – V**

NoSQL Key/Value databases using Riak, Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

**Text Books:**

1.NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence
Sadalage, P. &FowlerPearson Education