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.	 21F00204a 21F00204b 21F00204c	**Program Elective – I** Software Testing Methodologies Data Mining and Business Intelligence Managerial Economics and Financial Accountancy	4	0	0	3
5.	 21F00205a 21F00205b 21F00205c	**Open Elective – I** Operations Research Digital Marketing 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.	 21F00209	**Skill Oriented Course – I** 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

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, 7thEdition, 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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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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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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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. Case Studies: Linux, Microsoft Windows.
Text Books:
1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016. 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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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. • Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007. • Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016 • Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009. • 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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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.

R21 Regulations

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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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ANANTHAPURAMU – 515 002 (A.P) INDIA

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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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