JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

MASTER OF COMPUTER APPLICATIONS (MCA)
(For Two-Year PG Programme)

COURSE STRUCTURE AND SYLLABUS
For PG – R20

MASTER OF COMPUTER APPLICATIONS (MCA)
(For Two-Year PG Programme)

(Applicable for batches admitted from 2020-21)

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COURSE STRUCTURE

I Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	MCA1101	Business Communication	BS&H	2	0	0	2
2	MCA1102	Mathematical and Statistical Foundations	BS&H	3	0	0	3
3	MCA1103	Computer Organization & Operating Systems	PC	3	1	0	4
4	MCA1104	Data Structures	PC	3	0	0	3
5	MCA1105	Object Oriented Programming with JAVA	PC	3	0	0	3
6	MCA1106	Operating Systems and Linux Lab	PC	0	0	3	1.5
7	MCA1107	Data Structures Lab	PC	0	0	3	1.5
8	MCA1108	JAVA Programming Lab	PC	0	0	3	1.5
9	MCA1109	Socially Relevant Project using Design Thinking	MC	0	0	1	0.5
			Total	15	1	10	20

II Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	MCA2101	Database Management Systems	PC	3	0	0	3
2	MCA2102	Computer Networks	PC	3	0	0	3
3	MCA2103	Software Engineering and Design Patterns	PC	3	0	0	3
4	MCA2104	Data Warehousing and Mining	PC	3	0	0	3
5	MCA2105	**Elective-I** • No SQL Databases • Design and Analysis of Algorithms • Mobile Application Development • Artificial Intelligence • Accounting for Managers	PE	3	0	0	3
6	MCA2106	DBMS Lab	PC	0	0	3	1.5
7	MCA2107	Computer Networks Lab	PC	0	0	3	1.5
8	MCA2108	Software Engineering and Design Patterns Lab	PC	0	0	3	1.5
9	MCA2109	Employability Skills	MC	0	0	1	0.5
10	MCA2110	Bridge Course (Python Programming to be taken through MOOCs)	MC	0	0	0	0
			Total	15	0	10	20

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III Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	MCA3101	Machine Learning with Python	PC	3	0	0	3
2	MCA3102	Internet of Things	PC	3	0	0	3
3	MCA3103	Web Technologies	PC	3	0	0	3
4	MCA3104	Cryptography and Network Security	PC	3	0	0	3
5	MCA3105	**Elective-II** • Soft Computing • Software Project Management • Cloud Computing • Optimization Techniques • Cyber Security	PE	3	0	0	3
6	MCA3106	Machine Learning with Python Lab	PC	0	0	3	1.5
7	MCA3107	IoT Lab	PC	0	0	3	1.5
8	MCA3108	Web Technologies Lab	PC	0	0	4	2
9	MCA3109	Internship / Industry Oriented Mini Project/ Skill Development Course (Minimum 6-weeks)	PR	0	0	0	2
			Total	15	0	10	22

IV Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	MCA4101	Elective-III * • Digital Marketing • Human Resource Management • Deep Learning • Ad-hoc and Sensor Networks • MOOCs-1 (NPTEL/SWAYAM) - Full Stack Technologies - Any recommended course	PE	3	0	0	3
2	MCA4102	Elective-IV * • Network Programming • Block Chain technologies • Software Testing Methodologies • Big Data Analytics • MOOCs-2 (NPTEL/SWAYAM) -Data Science -Any recommended course	PE	3	0	0	3
3	MCA4103	Project Work/ Dissertation	PR	0	0	0	12
			Total	6	0	0	18

***Students going for Industrial Project/Thesis will complete these courses through MOOCs (even in earlier semester)**

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I Semester		**L**	**T**	**P**	**C**
		2	0	0	2
BUSINESS COMMUNICATION (MCA1101)					

Course Objectives:

To acquaint the students with fundamentals of communication, help them honing oral, written and non-verbal communication skills and to transform them as effective communicators.

UNIT I:

Purpose and process of communication: Objectives of Communication-Process of Communication-Types of communication; noise, listening skills, Types of listening, essentials of good listening and tips.

UNIT II:

Managing Organizational Communication: Formal and Informal Communication- Interpersonal and Intrapersonal communication- Role of Emotion in Interpersonal Communication- Barriers to Interpersonal Communication- Exchange Theory-Gateways for Effective Interpersonal Communication.

UNIT III:

Non-verbal communication and Body Language: Kinesics, Proxemics, Paralanguage, Haptics, handshakes, appropriate body language and mannerisms for interviews: business etiquettes- across different cultures.

UNIT IV:

Written communication: mechanics of writing, report writing- business correspondence-business letter format- Meetings and managing meetings- Resume writing-Formats and Skills.

UNIT V:

Presentation skills: prerequisites of effective presentation, format of presentation; Assertiveness – strategies of assertive behavior; Communication skills for group discussion and interviews, Interview Techniques.

Note: Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

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Reference Books:

1) Mallika Nawal: "Business Communication", Cengage Learning, New Delhi, 2012.
2) Edwin A. Gerloff, Jerry C. Wofford, Robert Cummins Organisational Communication: The key stone to managerialeffectiveness.
3) Meenakshi Rama: "*Business Communication*", Oxford University Press, NewDelhi
4) C.S.G. Krishnamacharyulu and Dr. Lalitha Ramakrishnan, Business Communication, Himalaya Publishing House,Mumbai
5) Paul Turner: "*Organisational Communication*", JAICO Publishing House, New Delhi.
6) Sathya Swaroop Debasish, Bhagaban Das" "*Business Communication*", PHI Private Limited, New Delhi, 2009.
7) R.K.Madhukar: "Business Communication", Vikas Publishing House, New Delhi,2012.
8) Kelly M Quintanilla, Shawn T.Wahl:"Business and Professional Communication", SAGE, New Delhi,2012.
9) Sangita Mehta, Neety Kaushish: "Business Communication", University Science Press, New Delhi,2010.
10) Anjali Ghanekar: "Business Communication Skills", Everest Publishing House, NewDelhi,2011

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I Semester		**L**	**T**	**P**	**C**
		3	0	0	3
MATHEMATICAL AND STATISTICAL FOUNDATIONS (MCA1102)					

Course Objectives: This course is aimed at enabling the students to

- Understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- Develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
- Study various sampling and classification problems.

Course Outcomes:

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

- Apply the basic rules and theorems of probability theory such as Baye's Theorem, determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.
- Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.
- Learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.
- Design various ciphers using number theory.
- Apply graph theory for real time problems like network routing problem.

UNIT I:

Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT II:

Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point

Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT III:

Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT IV:

Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT V:

Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1) Foundation Mathematics for Computer Science, 1st Edition, John Vince, Springer,2015
2) Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers, 2018
3) Probability and Statistics with Reliability,2nd Edition, K. Trivedi, Wiley, 2011
4) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

1) Probability and Computing: Randomized Algorithms and Probabilistic Analysis,1st Edition, M. Mitzenmacher and E. Upfal,2005
2) Applied Combinatorics, 6th Edition, Alan Tucker, Wiley,2012

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		3	1	0	4
COMPUTER ORGANIZATION & OPERATING SYSTEMS (MCA1103)					

Course Objectives:

The objectives of this course are to

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computer.

Course Outcomes (COs): At the end of the course, student will be able to

- Understand the basic organization of computer and different instruction formats and addressing modes
- Analyze the concept of pipelining, segment registers and pin diagram of CPU.
- Understand and analyze various issues related to memory hierarchy
- Evaluate various modes of data transfer between CPU and I/O devices
- Examine various inter connection structures of multi processors

UNIT I:

Introduction: Basic Structure Of Computers: Computer Types, Functional units, Basic Operational concepts, Bus structures, Software, Performance, multiprocessor and multi computers, Historical perspective.

Machine Instructions and Programs: Numbers, Arithmetic Operations, and c Characters, Memory locations and addresses, Memory operations, Instructions and Instruction sequencing, Addressing Modes, Assembly Languages, stacks and Queues Basic Input/output Operations, role of Stacks and Queues Additional Instructions

UNIT II:

Processing Unit: Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control, **Micro Programmed Control:** Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field

UNIT III:

Introduction to Operating System Concept: Types of Operating Systems, Operating Systems Concepts, Operating System Operations. Operating Systems Structures- Operating System Services, User Operating-System Interface, Introduction to System calls, Types of System Calls.

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Process Management: Process concept, Process State Diagram, Process control block, Process Scheduling, Inter process Communication, Threads- Threading Issues, Scheduling- Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT IV:

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, **Principles of deadlock:** System Model, Deadlock characterization, Deadlock handling, Deadlock Prevention, Detection and Avoidance, Recovery Starvation, Critical Regions form Deadlock

UNIT V:

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation Virtual Memory Management- Demand Paging, Page-Replacement Algorithms, Thrashing. **File-System Interface:** File Concept, Access Methods, Directory structure, File-System mounting, Files Sharing, Protection. File-System implementation- File-System Structure, Allocation Methods, Free-Space Management, Disk Structure, Disk Scheduling

Text Books:

1) Computer Organization, Carl Hamacher, Zvonks Vranesic, Safea Zaky, 5th ed, McGraw Hill.
2) Operating System concepts, 7th ed, Abraham Siliberschatz, Galvin, John Wiley & Sons, Inc
3) Advanced Programming in the Unix environment by W. Richard Stevens

Reference Books:

1) Computer Architecture and Organization , John P. Hayes ,3rd Edition, McGraw Hill
2) Computer Organization and Architecture, William Stallings 6th Edition, Pearson/PHI
3) Operating Systems, 6th Edition, William Stallings, PHI/Pearson
4) Unix and Shell Programming by B.M. Harwani, OXFORD University Press

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I Semester		L	T	P	C
		3	0	0	3
DATA STRUCTURES (MCA1104)					

Course Objectives:

The objective of this course is to explore basic data structures such as stacks and queues, introduce a variety of data structures such as hash tables, search trees, tries, heaps, graphs, sorting and pattern matching algorithms

Course Outcomes (CO): *At the end of the course, student will be able to*

- Implement basic programs by using C concepts.
- Select the data structures that efficiently model the information in a problem
- Assess efficiency trade-offs among different data structure implementations or combinations
- Implement and know the application of algorithms for sorting and pattern matching.

UNIT I:

Introduction to C: Constants and variables, Operators and Expressions, Managing Input and Output operators, Decision making-branching and looping, Arrays,

UNIT II:

Functions, Structures and Unions, Pointers, File handling in C.

UNIT III:

Data structure: Definition, types of data structures Recursion Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion. Preliminaries of algorithms, analysis and complexity .**Linear list** – singly linked list, Double linked list and circular linked list - implementation, insertion, deletion and searching operations on linear list.

UNIT IV:

Stacks-Operations, array and linked representations of stacks, stack applications, **Queues**-operations, array and linked representations. **Hash Table Representation:** hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing and rehashing, extendible hashing.

UNIT V:

Sorting Techniques: Insertion sort, selection sort, exchange-bubble sort, quick sort and merge sort Algorithms. **Trees:** Binary Trees, terminology, representation and traversals- pre, post & in order traversals. **Search Trees:** Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion

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Text Books:

1) Let Us C: Authentic Guide to C Programming Language, 17th ed., Yashavant Kanetkar, BPB Publications.
2) Data Structures Using C. 2nd Edition, Reema Thareja, Oxford
3) Data Structures and Algorithm Analysis in C, 2nd ed, Mark Allen Weiss

Reference Books:

1) Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning.
2) Programming in ANSI C, 5th ed, E. Balaguruswamy, TMH

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I Semester		L	T	P	C
		3	0	0	3
OBJECT ORIENTED PROGRAMMING WITH JAVA (MCA1105)					

Course Objectives:

- To understand the basic concepts of object oriented programming concepts.
- To introduce the principles of inheritance and polymorphism and demonstrate how they are related to the design of abstract classes
- To understand the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To learn and understand the design of Graphical User Interface using applets and swing controls

Course Outcomes (COs): At the end of the course, student will be able to

- Describe the uses OOP concepts
- Apply OOP concepts to solve real world problems
- Distinguish the concept of packages and interfaces
- Demonstrate the exception handing, multithread applications with synchronization
- Design the GUI based applications using AWT and Swings
- Discuss the Collection Framework

UNIT I:

Basics of Object Oriented Programming (OOP): Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms. **Java Basics:** Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT II:

Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes. **Packages and Interfaces:** Defining, Creating and Accessing a package, Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.

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UNIT III:

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT IV:

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy , user-interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, list panes- scroll pane, dialogs, menu bar, graphics, layout manager- layout manager types- boarder, grid, flow, card and grid bag.

UNIT V:

Applets: Concepts of Applets, differences between applets and applications, lifecycle of an applet, types of applets, creating applets, passing parameters to applets, **Swings:** Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Text Books:

1) Java-The complete reference,7/e, Herbert Schildt, TMH
2) JAVA: How to program, 8/e, Dietal , Dietal,PHI
3) Introduction of programming with JAVA, S.Dean,TMH
4) Introduction to Java programming, 6/e, Y.Daniel Liang, Pearson

Reference Books:

1) Core Java 2, Vol 1(Vol 2) Fundamentals(Advanced), 7/e, Cay.S.Horstmann, Gary Cornell, Pearson
2) Big Java2, 3/e, Cay.S. Horstmann, Wiley
3) Object Oriented Programming through Java, P.Radha Krishna, University Press
4) JAVA& Object Orientation an Introduction, 2/e, John Hunt, Springer
5) Introduction to JAVA Programming, 7/e, Y. Daniel Liang, Pearson. , TMH

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		0	0	3	1.5
OPERATING SYSTEMS AND LINUX LAB (MCA1106)					

Course Objectives:

This Course will enable students to implement CPU scheduling algorithms, Disk scheduling algorithms, Execute different types of Linux commands and Write shell scripts

Course Outcomes(COs): At the end of the course, student will be able to

- Implement various CPU scheduling algorithms and compare results
- Implement various disk scheduling algorithms and compare results
- Implement page replace algorithms
- Implement various memory management techniques.
- Execute basic Linux commands

List of Experiments:

UNIX Lab- Introduction to UNIX

1. Study of Unix/Linux general purpose utility commands
2. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.
3. Study of UNIX/LINUX File System(tree structure).
4. C program to emulate the UNIX ls –l command
5. C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort
6. Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

Operating Systems Lab

1. Simulate the Following CPU Scheduling Algorithms
   A) FCFS B) SJF C) Priority D) Round Robin
2. Multiprogramming-Memory Management- Implementation of fork(), wait(), exec() and exit()
3. Simulate The Following
   a. Multiprogramming with A Fixed Number Of Tasks (MFT)
   b. Multiprogramming with A Variable Number Of Tasks (MVT)
4. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
5. Simulate Bankers Algorithm for Dead Lock Avoidance

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6. Simulate Bankers Algorithm for Dead Lock Prevention.
7. Simulate The Following Page Replacement Algorithms.
   a) FIFO b) LRU c) LFU
8. Simulate the Following File Allocation Strategies
   a) Sequenced b) Indexed c) Linked

Linux Lab

1. Write a Shell program to check whether given number is prime or not.
2. Write a shell script which will display Fibonacci series up to the given range.
3. Write a shell script to check whether the given number is Armstrong or not.
4. Write a shell script to the calculate the value of
5. Write a shell script to accept student number, name, marks in 5 subjects.
6. Find total, average and grade using the following rules:
   Avg>=80 then grade A
   Avg<80&&Avg>=70 then grade B
   Avg<70&&Avg>=60 then grade C
   Avg<60&&Avg>=50 then grade D
   Avg<50&&Avg>=40 then grade E
7. Write a shell script to find minimum and maximum elements in the given list of elements.
8. Write a shell program to check whether the given string is palindrome or not.
9. Write an awk program to print sum, avg of students marks list
10. Write a shell script to compute no. of characters and words in each line of given file
11. Write a shell script to check whether the given input is a number or a string

Note: Fundamentals of UNIX and Linux to be taught in the lab.

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I Semester		L	T	P	C
		0	0	3	1.5
DATA STRUCTURES LAB (MCA1107)					

Course Objectives: This Course will enable students to

- Design and implement various data structures.
- Implement operations like searching, insertion, and deletion, traversing mechanism
- Develop applications using data structure algorithms.

Course Outcomes (COs): At the end of the course, student will be able to

- Implement various basic data structures and its operations.
- Apply sorting and searching algorithms to given numbers
- Implement various tree operations.
- Implement various graphs algorithms.
- Develop applications using various data structures.

Experiment 1:

a) Write a program in C to display the n terms of even natural number and their sum.
b) Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
c) Write a C program to check whether a given number is an Armstrong number or not.
d) Write a C program to calculate the factorial of a given number.

Experiment 2:

a) Write a program in C for multiplication of two square Matrices.
b) Write a program in C to find transpose of a given matrix.

Experiment 3:

a) Write a program in C to check whether a number is a prime number or not using the function.
b) Write recursive program which computes the n^{th} Fibonacci number, for appropriate values of n.
c) Write a program in C to add numbers using call by reference.

Experiment 4:

a) Write a program in C to append multiple lines at the end of a text file.
b) Write a program in C to copy a file in another name.

Experiment 5:

Write recursive program for the following

a) Write recursive and non recursive C program for calculation of Factorial of an integer.
b) Write recursive and non recursive C program for calculation of GCD (n, m)
c) Write recursive and non recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

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Experiment 6:

a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.
b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Experiment 7:

a) Write C program that implement stack (its operations) using arrays.
b) Write C program that implement stack (its operations) using Linked list.

Experiment 8:

a) Write a C program that uses Stack operations to convert infix expression into postfix expression.
a) Write C program that implement Queue (its operations) using arrays.
b) Write C program that implement Queue (its operations) using linked lists.

Experiment 9:

Write a C program that uses functions to create a singly linked list and perform various operations on it.

Experiment 10:

Write a C program to store a polynomial expression in memory using linked list and perform polynomial addition.

Experiment 11:

a) Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.
b) Write a non recursive C program for traversing a binary tree in preorder, inorder and postorder.

Experiment 12:

a) Write a C program to implement Prims' algorithm.
b) Write a C program to implement Kruskal's algorithm.

Experiment 13:

Implementation of Hash table using double hashing as collision resolution function.

Experiment 14:

Implementation of Binary Search trees- Insertion and deletion.

Experiment 15:

a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order.
b) Write C program that implement Quick sort, to sort a given list of integers in ascending order.
c) Write C program that implement merge sort, to sort a given list of integers in ascending order

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KAKINADA – 533 003, Andhra Pradesh, India

MASTER OF COMPUTER APPLICATIONS (MCA)

(For Two-Year PG Programme)

I Semester		L	T	P	C
		0	0	3	1.5
JAVA PROGRAMMING LAB (MCA1108)					

Course Objectives:

- To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.
- To understand the importance of Classes & objects along with constructors, Arrays and Vectors.
- Discuss the principles of inheritance, interface and packages and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.
- To understand importance of Multi-threading & different exception handling mechanisms.
- To learn experience of designing, implementing, testing, and debugging graphical user interfaces in Java using applet and AWT that respond to different user events.
- To understand Java Swings for designing GUI applications based on MVC architecture

Course Outcomes(COs): At the end of the course, student will be able to

- Apply OOP concepts to solve real world problems
- Implement different forms of inheritance
- Create packages and to reuse them.
- Implement multi threaded programs using synchronization concepts
- Create user defined exceptions
- Design GUI applications using AWT and SWINGS.

List of Experiments:

1) The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java Program that uses both recursive and non recursive functions to print the nth value of the Fibonacci sequence.
2) Write a Java Program that prompts the user for an integer and then prints out all the prime numbers up to that Integer.
3) Write a Java Program that checks whether a given string is a palindrome or not. Ex. MALAYALAM is a palindrome.
4) Write a Java Program for sorting a given list of names in ascending order.
5) Write a Java Program that illustrates how runtime polymorphism is achieved.
6) Write a Java Program to create and demonstrate packages.
7) Write a Java Program, using StringTokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.

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8) Write a Java Program that reads on file name form the user then displays information about whether the file exists, whether the file is readable/ writable, the type of file and the length of the file in bytes and display the content of the using FileInputStream class.
9) Write a Java Program that displays the number of characters, lines and words in a text/text file.
10) Write an Applet that displays the content of a file.
11) Write a Java Program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +-*?% operations. Add a text field to display the result.
12) Write a Java Program for handling mouse events.
13) Write a Java Program demonstrating the life cycle of a thread.
14) Write a Java Program that lets users create Pie charts. Design your own user interface (with Swings & AWT).
15) Write a Java Program to implement a Queue, using user defined Exception Handling (also make use of throw, throws).

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I Semester		L	T	P	C
		0	0	1	0.5
SOCIALLY RELEVANT PROJECT USING DESIGN THINKING (MCA1109)					

Course Objectives:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream 4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

How to Pursue The Project Work?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

Tasks to be done:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge

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- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

References:

1. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

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Other Useful Design Thinking Frameworks and Methodologies:

- Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
- Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/