Post Graduate Department of Computer Sciences,
The University of Kashmir,
Srinagar - 190006

Choice Based Credit System Curriculum for

Master of Computer Applications
(MCA) Programme
2021 – 2023

Eligibility for 2-year MCA degree Programme:
"Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree.
OR
Passed B.Sc./ B.Com./ B.A with Mathematics at 10+2 Level or at Graduation Level(with additional bridge Courses as per the norms of the concerned University).Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination"

Subject Code	Subject name	Subject Category	Hours / Week			Credits Units
			L	T	P	
Semester-I						
Core Courses (14 Credit Units)						
MCA21101CR	Programming with C++	Core	3	0	2	4
MCA21102CR	Database Systems	Core	3	0	2	4
MCA21103CR	Computer Networks	Core	3	0	2	4
MCA21104CR	Accounting and Management Control	Core	2	0	0	2
Discipline Centric Elective Courses (8 Credit Units)						
MCA21105DCE	Discrete Mathematics	DCE	3	1	0	4
MCA21106DCE	Numerical Techniques	DCE	3	1	0	4
MCA21107DCE	Computer Architecture and ALP	DCE	3	0	2	4
OE (2 Credit Units) For Students of Other Departments						
MCA21101OE	Fundamentals of Computers	OE	2	0	0	2

Semester I

Subject Code: MCA21101CR
Subject Name: Programming with C++

Unit I   [12 L]

Data Types, Identifiers, Variables Constants and Literals. Arithmetic Relational Logical and Bitwise. Basic input/output statements **[2L]**

Control structures: if-else statement, Nested if statement, Switch statement Loops: while loop, do while, for loop, Nested loops. **[3L]**

Arrays: Declaration; initialization; 2-dimensional and 3-dimensional array, passing array to function, Strings and String functions, and character arrays. **[3L]**

 Functions; prototype, passing parameters, storage classes, identifier visibility, Recursive functions[4L]

Unit II   [12L]

Command-line arguments. Variable scope, lifetime. Multi-file programming, Introduction to macros. File processing in C. [4L]

Structures and unions: syntax and use, members, structures as function arguments passing structures and their arrays as arguments [2L]

Pointers: variables, pointers and arrays, pointers to pointers, strings, pointer arithmetic, portability issues, pointers to functions, void pointers, pointer to structure. [4L]

Introduction to object oriented programming, Abstraction, Encapsulation [2L]

Unit III [8L]

Introduction to classes and objects; Access specifiers, Constructor; destructor; Function overloading; Operator overloading; friend functions; Use of call-by-reference for efficiency. Copy constructor. [4L]

Inheritance: Single, Multiple, and Multilevel Inheritance[2L]

 Virtual functions and Polymorphism/Dynamic binding vs Static binding; Virtual Destructors[2L]

Unit IV [8 L]

Pure virtual function; concrete implementation of virtual functions[2L]

Templates: Function Templates, Class Templates, Member Function Template and Template Arguments, namespaces, Exception Handling Concepts[4L]

Input and Output: Streams classes, Stream Errors, Disk File I/O with streams. [2L]

Reference Books:
1. FOSTER AND FOSTER "C by discovery"   RRI penram.
2. ROBERT LAFORE "Object orientation with C++ Programming" Waite Group.
3. YASHWANT KANETKAR "Let us C"   PHI.
4. E. BALAGURUSWAMI "Programming in ANSI C"   Tata McGraw Hill.
5. BJARNE STROUSTRUP "The C++ programming language" Pearson Education.
6. HERBERT SCHILD "C++ The complete Reference"   Tata McGraw Hill.

Course Code: MCA21101CR
Course Name: Programming with C++ Lab

Unit I

Lab Sheet 1

Q1. Write a program to demonstrate the use of Output statements that draws any object of your choice e.g. Christmas Tree using '*'

Q2. Write a program that reads in a month number and outputs the month name.

Q3. Write a program that demonstrate the use of various input statements like getchar(), getch(), scanf().

Q4. Write a program to demonstrate the overflow and underflow of various datatype and their resolution?

Lab Sheet 2

Q1. Write a program to demonstrate the precedence of various operators.

Q2. Write a program to generate a sequence of numbers in both ascending and descending order.

Q3. Write a program to generate pascals triangle.

Q4. Write a program to reverse the digits of a given number. For example, the number 9876 should be returned as 6789.

Lab Sheet 3

Q1. Write a program to convert an amount (upto billion) in figures to equivalent amount in words.

Q2. Write a program to find sum of all prime numbers between 100 and 500.

Q3. Create a one dimensional array of characters and store a string inside it by reading from standard input.

Q4. Write a program to input 20 arbitrary numbers in one-dimensional array. Calculate Frequency of each number. Print the number and its frequency in a tabular form.

Unit II

Lab Sheet 1

Q1. Write a C function to remove duplicates from an ordered array. For example, if input array contains 10,10,10,30,40,40,50,80,80,100 then output should be 10,30,40,50,80,100.

Q2. Write a program which will arrange the positive and negative numbers in a one-dimensional array in such a way that all positive numbers should come first and then all the negative numbers will come without changing original sequence of the numbers. Example: Original array contains: 10,-15,1,3,-2,0,-2,-3,2,-9 Modified array: 10,1,3,0,2,-15,-2,-2,-3,-9

Q3. Write a program to compute addition multiplication and transpose of a 2-D array.

Q4. Implement a program which uses multiple files for holding multiple functions which are compiled separately, linked together and called by main(). Use static and extern variables in these files.

Lab Sheet 2

Q1. Implement a function which receiver a pointer to a Student struct and sets the values of its fields.

Q2. Write a program which takes five arguments on command line, opens a file and writes one argument per line in that file and closes the file.

Q3. Write a program which creates Student (struct) objects using malloc and stores their pointers in an array. It must free the objects after printing their contents.

Q4. Write a function char* stuff(char* s1,char* s2,int sp, intrp) to stuff string s2 in string s1 at position sp, replacing rp number of characters (rp may be zero).

Lab Sheet 3

Q1. Write a program to input name, address and telephone number of 'n' persons (n<=20). Sort according to the name as a primary key and address as the secondary key. Print the sorted telephone directory.

Q2. Write a program to find the number of occurrences of a word in a sentence ?

Q3. Write a program to concatenate two strings without using the inbuilt function?

Q4. Write a program to check if two strings are same or not?
Q5. Write a program to check whether a string is a palindrome or not?
Q6. Write a program to find the number of vowels and consonants in a sentence?

Unit III
Lab Sheet 1
Q1. Write a program that reverse the contents of a string.
Q2. Write a program to demonstrate the array indexing using pointers.
Q3. Write a program to pass a pointer to a structure as a parameter to a function and return back a pointer to structure to the calling function after modifying the members of the structure?
Q4. Write a program to demonstrate the use of pointer to a pointer.
Q5. Write a program to demonstrate the use of pointer to a function.
Q6. Write a program to demonstrate the swapping the fields of two structures using pointers?

Lab Sheet 2
Q1. Write a program in C++ to define class complex which having two data members viz. real and imaginary part ?
Q2. Write a program in C++ to define class Person which having multiple data members for storing the different details of the person e.g. name,age, address, height etc.
Q3. Write a program to instantiate the objects of the class person and class complex ?
Q4. Write a C++ program to add member function that displays the contents of class person and class complex?
Q5. Write a C++ program to demonstrate the use of scope resolution operator?
Q6. Write a program in C++ which creates objects of Student class using default, overloaded and copy constructors.

Lab Sheet 3
Q1. Write a program to demonstrate the use of different access specifiers.
Q2. Write a C++ program to demonstrate the use of inline, friend functions and this keyword.
Q3. Write a C++ program to show the use of destructors.
Q4. Write a program in C++ demonstrates the use of function overloading.
Q5. Write a C++ program to overload the '+' operator so that it can add two matrices .
Q6. Write a C++ program to overload the assignment operator.
Q7. Write a C++ program to overload comparison operator operator== and operator!= .
Q8. Write a C++ program to overload the unary operator.

Unit IV
Lab Sheet 1
Q1. Write a program in C++ which creates a single-inheritance hierarchy of Person, Employee and Teacher classes and creates instances of each class using new and stores them in an array of Person * .
Q2. Write a program in C++ which creates a multiple-inheritance hierarchy of Teacher classes derived from both Person, Employee classes. Each class must implement a Show() member function and utilize scope-resolution operator
Q3. Write a program in C++ demonstrates the concept of function overriding?
Q4. Write a C++ program to show inheritance using different levels?
Q5. Write a C++ program to demonstrate the concepts of abstract class and inner class?

Lab Sheet 2
Q1. Write a C++ program to demonstrate the use of virtual functions and polymorphism?
Q2. Write a C++ program to demonstrate the use of pure virtual functions and virtual destructors?
Q3. Write a C++ program to swap data using function templates.

Q4. Write a C++ program to create a simple calculator which can add, subtract, multiply and divide two numbers using class template.

Lab Sheet 3

Q1. Write a C++ program to demonstrate the concept of exception handling.

Q2. Write a C++ program to create a custom exception.

Q3. Define a class with appropriate data members and member functions which opens an input and output file, checks each one for being open, and then reads name, age, salary of a person from the input file and stores the information in an object, increases the salary by a bonus of 10% and then writes the person object to the output file. It continues until the input stream is no longer good.

Subject Code: – MCA21102CR
Subject Name: Database Systems

Unit I

Introduction to Data, Information and Knowledge. Database basics – Need and evolution, Database and DBMS. Characteristics of Database Approach, Advantages and disadvantages of DBMS Approach. [3L]

Database System Concepts and Architecture – Data Models, Schemas, and Instances, Database Models and Comparison Three Schema Architecture and Data Independence. Database Languages and Interfaces. DBMS architectures. DBMS Classification. [5L]

Data Modeling: Overview of Data Modeling, Entity-Relationship (ER) Modeling. [2L]

UNIT II

Relational Data Model –Basic Concepts and Characteristics, Model Notation, Model Constraints and Database Schemas, Constraint Violations [3L].

Relational Algebra – basic concepts, Unary Relational Operations, Algebra Operations from Set Theory, Binary Operations, Additional Relational Operations [3L]

Criterion for Good Database Design. Database Design through Functional Dependencies & Normalization: Functional Dependencies, Lossless Join, Normal Forms: 1NF, 2NF, 3NF, BCNF. [4L]

UNIT III

Introduction to SQL, Data Types, Data Definition Language, Data Manipulation Language, Specifying Constraints in SQL, Transaction Control Language, SQL Functions, Set Operators and Joins, View, Synonym and Index, Sub Queries and Database Objects, Locks and SQL Formatting Commands. [10L]

UNIT IV

Transaction Processing –Transaction Processing Basics, Concurrency Control, Transaction and Systems Concepts, Desirable properties of Transactions. [4L]

Characterizing Schedules and Recoverability, Schedules and Serializability. Concurrency Control - Two Phase Locking, Timestamp Ordering. [3L]

Database Recovery – Concepts, Transaction Rollback, Recovery based on Deferred and Immediate Update, Shadow Paging [3L]

Text Book:
1. Elmasri and Navathe, Fundamentals of Database Systems, 7/e, Pearson, 2016

Reference Books:

1. Silberschatz, Korth, & Sudarshan, Database System Concepts, , McGraw-Hill, 7/e, 2011.
2. Bayross I. SQL, Pl/SQL: The Programming Language of Oracle, BPB Publications, 2009
3. Michael J. Hernandez ,Database Design for Mere Mortals®: A Hands-on Guide to Relational Database Design, Third Edition, Addison-Wesley Professional, 2013

Lab Manual for Database Systems (MCA21102CR)

UNIT I

Lab #1

a. List various users, functions and constraints of the database system for Library Management.

b. List various users, functions and constraints of the database system for Banking System.

Lab #2

a.   Identify the various tables and draw a diagrammatic schema to represent the database of Library management system.

b.   Identify the various tables and draw a diagrammatic schema to represent the database of University system.

Lab #3

a.   Draw ER Model for the database of Library management system.

b.   Draw ER Model for the database of University management system.

UNIT II

Lab #1

Consider the following schema:
    Suppliers (sid, sname, address)
    Parts (pid, pname, color)
    Catalog (sid, pid, cost)

Write relational algebra queries to
a.   Find the name of suppliers who supply some red parts.
b.   Find the sids of suppliers who supply some red or green parts.
c.   Find the sids of suppliers who supply some red part or are at Srinagar.
d.   Find the sids of suppliers who supply some red and some green part.
e.   Find the sids of suppliers who supply every part.
f.   Find the sids of suppliers who supply every red part.
g.   Find the sids of suppliers who supply every red or green part.

Lab #2

a.   Consider a schema R(A,B,C,D) and functional dependencies A->B and C->D. Check the decomposition of R into R1(AB) and R2(CD) for lossless join and dependency preservation.

b.   R(A,B,C,D) is a relation. Which of the following does not have a lossless join, dependency preserving BCNF decomposition?
  1. A->B, B->CD   2. A->B, B->C, C->D
  3. AB->C, C->AD   4. A ->BCD

Lab #3

a.   Using a sample schema and data, demonstrate the use of 1NF, 2NF, 3NF and BCNF.

UNIT III

Lab #1

a. CreatetableStudentwithfollowingattributesandperformthefollowingoperations?

AttributeName	ST_ROLLNO	ST_NAME	ST_ADDRESS	ST_TELNO
Date Type	Number	Varchar	Char	Varchar2
Size	6	30	35	15

i.   AddnewattributesCity,Street,CountrywithDatatypeVdischarandlength30?
ii.   Modifyfield ST_ROLLNOand change thesize to5?
iii. RemovecolumnST_ADDRESS?
iv.   DescribetheTableStudent?
v.   DropTableStudent?
vi.   CopyStructureof onetableto another

b.   CreateUsersuser1, user2,user3andperformthefollowingoperations

i.   Grant Session Privilege to the newly created users?
ii.   Grant privileges for creating and manipulation tables?
iii. Grant data manipulation privileges to various users on tables?
iv.   Grant privileges with grant option.
v.   Revoke privileges.

Lab #2

a.   CreateObject ADDRESSand usetheobjectinaTableDDL?

b.   CreatetableStudent withfollowingattributesandperformthefollowing operations.

Attribute Name	ST_ROLLNO	ST_NAME	ST_STREET	ST_CITY	ST_State	ST_Country	DTE_REG
DateType	Number	Varchar	Char	Char	Varchar2	Varchar2	Date
Size	6	30	35	30	30	30	

i.   Insert 10recordsinthetable.
ii.   PerformvariousProjectOperationsusingSelectQuery.
iii. PerformvariousrestrictoperationsusingSelectQuery.
iv.   Updaterecords inthetable.
v.   Deleterecordsinthetable.
vi.   Create another table with same structure as existing table without copying the data.
vii. Create another table along with the structure and data from existing table.

Lab #3

a.   Create table Student with ST_ADDRESS as Object Type with following attributes and

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS				DTE_REG
			ST_STREET	ST_CITY	ST_State	ST_Country	
DateType	Number	Varchar	Char	Char	Varchar2	Varchar2	Date
Size	6	30	35	30	30	30	

i)   Insert 10records.
ii)   PerformvariousProjectOperationsusingSelectQuery.

iii)   PerformvariousrestrictoperationsusingSelectQuery.
iv)   Updaterecords inthetable
v)   Delete records in the table

b.   CreatetableSTUDENT withfollowingattributesandperformthefollowingoperations?

Attribute Name	ST_ROLLNO	ST_NAME	ST_STREET	ST_CITY	ST_State	ST_Country	DTE_REG
Date Type	Number	Varchar	Char	Char	Varchar2	Varchar2	Date
Size	6	30	35	30	30	30	

i.   Insert 10recordsinthetable.
ii.   PerformvariousProjectOperationsusingSelectQuery.
iii.   PerformvariousrestrictoperationsusingSelectQueryusingvariousarithmeticand LogicalOperators like
a.   LessThan
b.   GreaterThan
c.   LessThan orEqualto
d.   GreaterThan orEqualTo
e.   Equalto
f.   Not EqualTo
iv.   Performrestrict operationsshownto(iii)usingvariousdatatypeslikenumeric,Characters,Date.
v.   PerformUpdateoperationsusingvariousArithmeticandLogicalOperatorsonTableSTUDENT
vi.   PerformDeleteoperationsusingvariousArithmeticandLogicalOperatorsonTableSTUDENT
vii.   UseInsertandSelectCommandstogetherwithArithmeticandLogicalOperators.

UNIT IV
Lab #1
a.   Perform followingTransaction ControlOperationsontheabove table

    ii.   Perform various data manipulation operations the table .
    iii. Create Five Savepoints from S1 to S5.
    iv. Rollback to Various savepoints and observe the changes in the table.
    v.   Perform various DDL operations the table and observe its effect on Savepoint and Rollback on the table.
    vi. Try to abnormally terminate the application to observe whether data is saved or not.
    vii. Use Commit and Commit Work commands to save the data permanently.

b.   CreatetableSTUDENTwithfollowingattributesandperformvariousDMLoperationst

overify domain constraint

AttributeName	ST_ROLLNO	ST_NAME	ST_ADDRESS
Date Type	Number	Varchar2	Varchar
Size	6	30	35
Constraint	NOTNull	NotNULL	NOTNULL

Lab #2
a. Create table STUDENT with following attributes and perform various DML operations to verify Validity Integrity.

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS
Date Type	Number	Varchar2	Varchar

Size	6	30	35
Constraint	CHECK (ROLLNO >20001 and ROLLNO < 30001	NotNULL	NOTNULL

b.   Create table STUDENT with following attributes and perform various DML operations to verify Entity Integrity using Primary and Unique Keys?

Lab #3

Attribut eName	ST_ROLLNO	ST_NAME	ST_ADDRSS
Date Type	Number	Varchar2	Varchar
Size	6	30	35
Constraint	Primary/UniqueKeys	NotNULL	NOTNULL

a.   Create table STUDENT with following attributes and perform various DML operations to verify Referential Integrity using given tables (employee and department)?

AttributeN ame	EMP_ID	EMP_NAME	ST_ADDRESS	DEPT_ID
Date Type	Number	Varchar2	Varchar	Number
Size	6	30	35	4
Constraint	PrimaryKey	NotNULL	NOTNULL	Foreign Key

AttributeN ame	DID	NAME	Address
Date Type	Number	Varchar2	Varchar
Size	4	30	100
Constraint	Primary Key	NotNULL	NOTNULL

b.   Write SQL queries to demonstrate use of Join and various SQL functions

Subject Code: MCA21103CR
Subject Name: Computer Networks

Unit I

Goals and applications of networks. LAN, MAN & WAN architectures. Concept of WAN subnet.**(3L)**
Overview of existing networks. OSI Reference Model Architecture, TCP/IP Model and their comparison. **(3L)**
Protocol layers and service models. OSI and Internet protocols.**(4L)**

Unit II

Internetworking concept and architectural model. Connection-oriented and connection-less approaches. Discuss ATM and Ethernet. Concept of Virtual Circuits, Concept of Autonomous systems and Internetwork Routing. Classful IP addresses. Subnetting, Subnet addressing, IP Multicasting.**(5L)**
Internet Protocol (IP): connectionless delivery of datagrams (MTU, fragmentation, reassembly). IP header structure. IP Addressing. Efficiency and consistency trade-offs. **(5L)**

Unit III

Internet control protocols: ICMP, ARP and RARP. Concepts of delay, security, and Quality of Service (QoS). Reliable data transfer. Stop-and-Go evaluation. TCP and UCP semantics and syntax. TCP RTT estimation.**(4L)**
Principles of congestion control. Principles of routing. Link-state and distance vector routing. Routing algorithms: Inter- and intra-domain routing. RIP, OSPF, BGP.CIDR. Transport Layer: UDP and TCP concepts. Socket API for Network Programming. **(6L)**

Unit IV

Client-Server application development using TCP & UDP sockets. Basic Server Architectures. Network Security: Overview of threats, cryptography, authentication, and firewalls their components. **(4L)**
Encryption techniques and examples of encryption standards. Network management including SNMP. Network troubleshooting.**(6L)**

Reference Books:
1. Andrew Tanenbaum, "Computer Networks", 4th Edition by Pearson.
2. Douglas Comer, "Internetworking with TCP/IP, Volume 1", Pearson.
3. W. Richard Stevens, "UNIX Network Programming", Pearson.
4. Maufer, "IP Fundamentals", Pearson.
5. Douglas Comer, "Client-Server Programming with TCP/IP, Volume 3", Pearson.

Subject Name: Computer Networks (Lab)

Lab Sheet 1

Unit I:

Q1. Network components such as Modem, Gateways, Routers, Switches, Cables etc.

Q2. Various network softwares, services and applications.

Lab Sheet 2

Unit I:

Q1. Network trouble shooting Techniques: Trouble shooting basic TCP/IP problems.

Q2. Commands like ipconfig, getmac, tracert, pathping, arp, ping, netstat, finger etc.

Lab Sheet 3

Unit I:

Q1. Straight cabling, Cross cabling, Signal testing, T568A and B wiring standards (including hands on practice)

Lab Sheet 1

Unit II:

Q1. Program that prints the address of www.bitmesra.ac.in

Q2. Program that prints all the addresses of www.indianrail.gov.in

Lab Sheet 2

Unit II:

Q1. Program that scans lower ports and prints them.

Q2. Program to list host names from command line, attempt to open socket to each one and print the remote host, the remote port, the local address and the local port.

Lab Sheet 3

Unit II:

Q1. Program for splitting the URLs entered into command line into component parts.

Lab Sheet 1

Unit III:

Q1. Program to list all the interfaces available on a workstation.

Q2. Basics of TCP/IP and UDP/IP socket Programming

Lab Sheet 2

Unit III:

Q1. Program for "echo" client. The Client enters data to the server, and the server echoes the data back to the clients.

Lab Sheet 3

Unit III:

Q1. Program for "echo" Server The Server listens at the port specified and reads from client and echoes back the result.

Lab Sheet 1

Unit IV:

Q1. Basics of Serial Port programming

Lab Sheet 2

Unit IV:

Q1. Program to write out "Hello World" to a serial port or to a USB to Serial Converter.

Lab Sheet 3

Unit IV:

Q1. Simple RPC Programming. (Introductory level)

Subject Code: MCA21104CR
Subject Name: Accounting and Management Control

Unit 1

Evolution of Management: - Contribution of Taylor, Mayo & Fayol, Different approaches of management, role of manager, tasks of a professional manager, Management & its functions. Level of Management, managerial skills at various levels. Planning & Decision making: - Definition, Nature for planning, importance, Process of planning, decision making, nature importance & process, types of plans

Unit 2

Accounting, meaning, definition, objectives, accounting principles, branches of accounting, uses & limitations of Accounting, Basic Accounting Procedure –, rules of debit & credit, Practical system of book keeping – Cashbook, types of cash book, Profit & loss Account – meaning, Need & preparation, Balance Sheet- Meaning, need & Preparation,

Reference:
Principles & Practice of Management – L. M. Prasad
Management – Theory & Practice – C. B. Gupta
Basics of Accounting – Jain & Narang
Basic of Accounting – T. S. Grewal

Discipline Centric Elective Courses

Subject Code: MCA21105DCE
Subject Name: Discrete Mathematics

UNIT I

Proposition, Logic, Truth tables, Propositional Equivalence, Logical Equivalence, Predicates and Quantifiers; Sets: operations on sets, Computer representation of sets, Cardinality of a Set (4L)

Functions: Domain, Range, One-to-One, Onto, Inverses and Composition, Sequences and summations, Growth of functions. (3L)

Methods of Proof: Direct Proof, Indirect Proof, Mathematical Induction for proving algorithms; Counting techniques – Permutations, Combinations, The Pigeonhole Principle. (3L)

UNIT II

Discrete Probability, Advanced Counting Techniques: Inclusion-Exclusion, Applications of Inclusion exclusion principle, recurrence relations, solving recurrence relation. (4L)

Relations: Relations and their properties, Binary Relations, Equivalence relations, Diagraphs, Matrix representation of relations and digraphs. (3L)

Computer representation of relations and digraphs; Transitive Closures, Warshall's Algorithm, Problem solving on Warshall's Algorithm. (3L)

UNIT III

Partially Ordered Sets (Posets), External elements of partially ordered sets, Hasse diagram of partially ordered set, isomorphic ordered set, Lattices: Properties of Lattices, complemented Lattices. (5L)

Graph theory: Introduction to graphs, Graph Terminology Weighted graphs, Representing Graphs, Connectivity of Graphs: Paths and Circuits, Eularian and Hamiltonian Paths, Matrix representation of graphs. Graph Coloring and its applications. (5L)

UNIT IV

Trees: Rooted trees, Application of trees: Binary Search Trees, Decision Trees, Prefix Codes, Tree traversal, trees and sorting, spanning trees, minimal spanning trees. (5L)

Finite Boolean algebra, Functions on Boolean algebra, Boolean functions as Boolean polynomials. Groups and applications: Subgroups, Semigroups, Monoids Isomorphism, Homomorphism. (5L)

Text Book:
KENNETH H. ROSEN "Discrete Mathematics and Its Applications" The Random House/Birkhauser Mathematics series

Reference Books:
1. LIU, "Elements of Discrete Mathematics", Tata McGraw Hill
2. SCHAUMS, "Discrete Mathematics", Tata McGraw Hill.
3. KOLMAN/REHMAN, "Discrete Mathematical Structures", Pearson Education
4. NICODEMI "Discrete Mathematics", CBS

Subject Name: Discrete Mathematics (Tutorials)

Unit 1
Tutorial Sheet #1

1. Find whether $(p \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg p)$ is a tautology or a contradiction?
2. Show that:
   $\neg (p \vee (\neg p \wedge q))$ and $(\neg p \wedge \neg q)$ are logically equivalent by using the propositional laws.
3. Let $P(x, y, z) :$ "$x + y = z$". Find the truth values of the following:
   A) $P(1, 2, 3)$
   B) $P(0, 0, 1)$
4. How many students must be in a class to guarantee that at least two students receive the same score in the final exam, if the exam is graded on a scale from 0 to 100 points?

Tutorial Sheet #2

1. Each user on a computer has a password, which is six to eight characters long, where each character is an uppercase letter or a digit. Each password must contain at least one digit. How many possible passwords are there?
2. A playoff between two teams consists of at most five games. The first team that wins three games wins the playoff. In how many different ways can the playoff occur? Use tree diagram.
3. A young pair of rabbits (one of each sex) is placed on an island. A pair of rabbits does not breed until they are two months old. After they are two months old, each pair of rabbits produces another pair each month. Find a recurrence relation for the number of pairs of rabbits on the island after n months, assuming that no rabbits ever die.
4. Conjecture a simple formula for a_n if the first 10 terms of the sequence $\{a_n\}$ are:
   1, 7, 25, 79, 241, 727, 2185, 6559, 19681, 59047.

Tutorial Sheet #3

1. Show that the set of all integers is countable.
2. Give a direct proof of the theorem
   "If n is an odd integer, then n^2 is odd."
3. Express the statement "Everyone has exactly one best friend" as a logical expression involving predicates, quantifiers with a domain consisting of all people, and logical connectives.
4. Use a membership table to show that
   $$A \cap (B \cup C) = (A \cap B) \cup (A \cap C).$$

Unit 2
Tutorial Sheet #1

1. How many onto functions are there from a set with six elements to a set with three elements?
2. Suppose there are seven coins, all with the same weight, and a counterfeit coin that weighs less than the others. How many weighing's are necessary using a balance scale to determine which of the eight coins is the counterfeit one? Give an algorithm for finding this coin.
3. Is the divides relation on the set of positive integers reflexive, symmetric, antisymmetric, and transitive?
4. What are the sets in the partition of the integers arising from congruence modulo 4?

Tutorial Sheet #2

1. What is the probability that when two dice are rolled, the sum of the numbers on the two dice is 7?
2. An urn contains four blue balls and five red balls. What is the probability that a ball chosen at random from the urn is blue?
3. How many ways are there to assign five different jobs to four different employees if every employee is assigned at least one job?

Tutorial Sheet #3

1. Draw the Hasse diagram of (D(75), divides), where the set D(75) represents the set of all positive divisors of 75.
2. Which elements of the poset ({2, 4, 5, 10, 12, 20, 25}, /)are maximal, and which are minimal?
3. Find a compatible total ordering for the poset ({1, 2, 4, 5, 12, 20}, /).
4. Draw the Hasse diagram for the partial ordering $\{(A,B) \mid A \subseteq B\}$ on the power set $P(S)$ where
   $$S = \{a, b, c\}.$$

Unit 3
Tutorial Sheet #1

1. Find out the transitive closure of any relation R using Warshall's Algorithm
2. Let R be the relation on the set of real numbers such that aRb if and only if $a - b$ is an integer. Is R an equivalence relation?
3. Let R be the relation on the set of people such that xRy if x and y are people and x is older than y. Show that R is not a partial ordering.

Tutorial Sheet #2

1. How many edges are there in a graph with 12 vertices, each of degree 4?
2. A connected graph has an Euler path but not an Euler circuit iff it has exactly two vertices of odd degree. Verify this theorem by drawing a graph of the said property.
3. What is the chromatic number of the graph Cn, where $n \geq 3$? (Cn is the cycle with n vertices.)

Tutorial Sheet #3

1. Show that $K_n$has a Hamilton circuit whenever $n \geq 3$.
2. Suppose that a connected planar simple graph has 20 vertices, each of degree 3. Into how many regions does a representation of this planar graph split the plane?
3. Use Dijkstra's algorithm to find the length of a shortest path between any two verticesin some weighted connected graph.

Unit 4
Tutorial Sheet #1

1. Use Prim's algorithm to find a minimum spanning tree of any graph.
2. Is the set Z (a set of integers) monoid under usual operation of +, - ?
3. Form a binary search tree for the following words in alphabetical order.
   mathematics, physics, geography, zoology, meteorology, geology, psychology, and *chemistry*

Tutorial Sheet #2

1. What is the chromatic number of the complete bipartite graph $K_{m,n}$, where m and n are positive integers?
2. How can we find out whether two graphs are isomorphic or not?
3. Show that C_6 is bipartite. Also show that K_3 is not bipartite.

Tutorial Sheet #3

1. What is the significance of Erdos number with regards to Paths in Collaboration Graphs?
2. How can backtracking be used to decide whether a graph can be colored using n colors?
3. What is the value of following prefix expression?

$$+ - * 2\ 3\ 5 / \uparrow 2\ 3\ 4$$

Subject Code: MCA21106DCE
Subject Name: Numerical Techniques

UNIT I: 10L

Computer Arithmetic: Introduction, Floating Point Representation and Arithmetic, Normalized Floating Point Representation of Numbers. (2L)

Approximations & Errors – Types of Programming Errors, Data Errors, Computer & Arithmetic Errors, Round off and Truncation Errors, Accuracy and Precision, Measures of Accuracy, Error Propagation (3L)

Iterative Methods - Non-Linear Equations, Types of Methods to find solutions to nonlinear equations, Algorithms to Compute Roots of Equation – Methods of Tabulation or Brute Force Method, Method of Bisection, Secant Method, Newton-Raphson Method, Method for False Position (5L)

Derivation of mathematical formulas and implementation of these methods

UNIT II: 10L

Solution of Simultaneous Algebraic Equations: Linear Equations, Types of Methods to find solutions to linear equations. Algorithms to Solve Linear Algebraic Equations: Gauss Elimination, Gauss Jordan, Gauss Seidel, L.U. Decomposition, Pivoting (10L)

Derivation of mathematical formulas and implementation of these methods

Unit III: 10L

Interpolation: Lagrange Interpolated Polynomial, Newton's Methods of Interpolation – Forward difference, Backward difference (4L)

Least Square Approximation of Functions: Linear Regression, Polynomial Regression (4L)

Taylor and Chebyshev Series (2L)

Derivation of mathematical formulas and implementation of these methods

UNIT IV: 10L

Differentiation and Integration: Simpsons Rule, Trapezoidal Rule (3L)

Numerical solution of Differential Equations using Taylor Series Method, Euler's Method, Modified Euler's Method, Runge-Kutta Methods, Predictor Corrector Formula, Higher order Differential Equations, Comparison of Runge-Kutta, Predictor and Correction Methods (7L)

Derivation of mathematical formulas and implementation of these methods

Text Books

1. S.C.Chapra&R.P.Canale: "Numerical methods for Engineering" Tata McGraw Hill.
2. Krishenmurty and Sen : "Numerical Algorithms"
3. V. Rajaraman "Computer oriented numerical methods." Prentice Hall of India
4. Grewal, B. S.: "Higher Engineering Mathematics", Hindustan Offset Problems Series.

Subject Code: MCA20106DCE
Subject Name: Numerical Techniques Tutorials

Tutorial Sheet 1
Unit I:

Q1. Define different types of errors.
Q2. Let X= 0.005998. Find relative error if x is truncated to 3 decimal digits
Q3. Let X= 0.005998. Find relative error if x is truncated to 3 decimal digits.

Tutorial Sheet 2
Unit I:

Q1. What do you mean by approximation and error?
Q1. Find the root of the equation $2x-x-3 = 0$ graphically.
Q2. Find the root of the equation correct to three decimal digits using False Position Method.
$$cos\ x - 3x + 1 = 0$$

Tutorial Sheet 3
Unit I:

Q1. What is the difference between accuracy and precision? Define the two ways for measuring accuracy.
Q2. Find the root of the equation correct to three decimal digits using Bisection Method.
$$X3 - 2X - 5 = 0$$
Write the programming implementation of Bisection method for the above question.
Q3. Prove Newton-Raphson method analytically.

Tutorial Sheet 1
Unit II:

Q1. Prove Newton-Raphson method analytically
Q2. What are the various methods to obtain solutions of non-linear equations?
Q3. Solve the following system of linear equations using Gauss Seidel Method, correct to three decimal digits.
$$10x1 + x2 + 2x3 = 44$$
$$2x1 + 10x2 + x3 = 51$$
$$x1 + 2x2 + 10x3 = 61$$

Give the programmatic implementation of Gauss Seidel method

Tutorial Sheet 2
Unit II:

Q1. Give the programmatic implementation of Gauss Jordon method
Q2. What is the difference between the Gauss-Jordon and Gauss-Elimination?
Q3. Give examples of various direct and iterative methods to obtain solutions of non-linear equation.

Tutorial Sheet 3
Unit II:

Q1.Solve the following system of linear equations using Gauss Elimination Method.

$$2x1 + 8x2 + 2x3 = 14$$
$$x1 + 6x2 - x3 = 13$$
$$2x1 - x2 + 2x3 = 5$$

Q2.Give the programming implementation of Gauss elimination method.

Q3.Solve the following system of linear equations using Gauss Jordon Method.

$$2x1 - 2x2 + 5x3 = 13$$
$$2x1 + 3x2 + 4x3 = 20$$
$$3x1 - x2 + 3x3 = 10$$

Tutorial Sheet 1
Unit III:

Q1.What are the ways to approximate a function by a polynomial? Describe each in brief

Q2.We want to compute sin(x) correct to three significant digits. Obtain a series with minimum number of terms using Taylor series.

Q3.We want to compute sin(x) correct to three significant digits. Obtain a series with minimum number of terms using Chebyshev series.

Tutorial Sheet 2
Unit III:

Q1.Give the programmatic implementation of Chebsyshev series.

Q2.Give the derivation of trapezoidal method.

Q3.Give the programmatic implementation of trapezoid method.

Tutorial Sheet 3
Unit III:

Q1.State newton's methods of interpolation – forward difference, backward difference

Q2.State Linear Regression and Polynomial Regression

Q3.Give the programming implementation of Taylor Series

Tutorial Sheet 1
Unit IV:

Q1.Give a brief idea about runge-kutta (RK) methods.

Q2.Given dy/dx = xy with y(1) =5. Find solution correct to decimal positions in the interval [1,1.3] using RK second order method (step size h=0.1)

Q3.Provide the programmatic implementation of RK 2nd order method.

Tutorial Sheet 2
Unit IV:

Q1.Given dy/dx = xy with y(1) =5. Find solution correct to decimal positions in the interval [1,1.3] using RK second order method (step size h=0.1)

Q2.Explain the following terms with suitable examples.
  a. Differential equation
  b. Solution of Differential equation

    c. Order of differential equation

Q3. Using Modified Euler's method, find the solution of the following differential equation $dy/dx = x+y2$, for $x= 1.1, 1.2, 1.3$. Given that $y=1, x=1$.

Tutorial Sheet 3
Unit IV:

Q1. Give the derivation of Modified Euler's method.

Q2. Differentiate between the following:

    a. Single step and multiple step methods

    b. Ordinary and partial derivate

    c. Ordinary and partial differential equations

Give programmatic implementation of Least Square Method for curve fitting.

Subject Code: MCA21107DCE
Subject Name: Computer Architecture and ALP

Unit I:

8086 Microprocessor: 8086 Microprocessor Architecture (BIU, EU, Instruction Queue), Software Model (General Purpose Registers, Segment Registers, Flag & Other Registers). Segmentation. [4L] 8086 Pin Functions, Minimum and Maximum Mode, The 8086 Memory System [3L] 8086 Basic Programming: 8086 Programming Model, 8086 Instruction Formats, Addressing Modes. [3L]

Unit II:

The 8086 Instruction Set. [3L] , Assembly Language Programming: Significance, Assemblers and Linkers, TASM Directives – Data Definitions, Named-constants, User-defined, Segments, Subroutines, Macros, Modular-code. [3L] Programming with Data Transfer, Arithmetic and Logical Instructions: Data Transfer, Arithmetic, Logical/Bit Manipulation Instructions [4L]

Unit III:

Branching and Looping : Unconditional and Conditional Jump instructions, Decision making and looping, Loop instructions, ASCII and BCD Arithmetic, Processor Control Instructions. [5L] Shift Instructions, Rotate Instructions and String Instructions [3L] Stacks: Defining a stack, Push and Pop Instructions [2L]

Unit IV:

Procedures: Defining and Calling procedure. CALL and RET instructions, Parameter Passing Methods, Far procedure [3L] Macros: Working with macros, additional assembler directives [2L] INT 21H: INT 21H Keyboard Services, Display Services, and File Manipulation Services. [3L] Input/Output Instructions [2L]

Text Book: M.T. Savalia. 8086 Programming and Advanced Processor Architecture. Wiley India.

Reference Books: 1. T.P. Skinner. An Introduction to 8086/8088 Assembly Language Programming. John Wiley .
2. W. A. Triebel, A. Singh. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, And Applications. Pearson Education, 2007.
3. B. B. Brey, The Intel Microprocessors: Architecture, Programming and Interfacing, Merrill, 2nd Edition, 1991.

Subject Code: MCA21107DCE
Subject Name: Computer Architecture and ALP

UNIT 1:

LabSheet 1. This week students will learn how to declare, initialize and access varied-sized variables by using Assembler Directives and 8086 instructions.

a. Write a program that declares and initializes two integer variables (one 8-bit wide and another 16- bit wide), and then assigns new values to them using 8086instructions.
b. Write a program that declares and initializes a String array (byte array) of 10 elements, and then assigns new values to each element individually using 8086instructions.

LabSheet 2. This week students will learn how to use INT 21H service to read integers and strings from keyboard and display them on screen.

a. WriteaprogramthatreadsanintegervaluefromkeyboardusingINT21Hkeyboardservice,stores itinmemory,anddisplaysitusingINT21HdisplayserviceafterdoingnecessaryASCIIconversion.
b. Write a program that declares and initializes a String array(byte array), and uses INT 21H display service to displays all elementsindividually.

LabSheet3. Thisweekstudentswilllearnhowtoperformarithmetic operations of 8-bitintegervalues.

a. Write a program that reads two 8-bit integers from keyboard (using INT 21H) and displays their sum and difference (using INT 21H after doing necessary ASCIIconversion).
b. Write a program that reads two 8-bit integers from keyboard (using INT 21H) and displays their multiplication and division result (using INT 21H after doing necessary ASCIIconversion).

UNIT 2:

LabSheet 1. This week students will learn how to perform various logical operations on integer values.

a. Write to program reads two integers from keyboard (using INT 21H) and displays the result ofthe AND, OR, XOR, CMP and TEST operation (using INT 21H after doing necessary ASCII conversion).

LabSheet 2. This week students will learn how to use a subroutine to recursively solve a problem.

a. Write a program that defines a subroutine that uses recursion to calculate factorial of an integer read from keyboard.

Lab Sheet 3. This week students will learn how to use Macros.

a. Write a program that uses a Macro to exchange the values of two 16-bit integer variables.

UNIT 3:

LabSheet 1. This week students will learn how to use 8086 instructions for looping and decision making.

a. Write a program that reads an integer from keyboard (using INT 21H service), and iteratively calculates its factorial.
b. Write a program that declares and initializes an array of 10 elements each 8-bit wide, reads an 8- bit integer from keyboard, searches its existence through the array, and displays the result of the searchoperation.
c. Write a program that declares and initializes an array of 10 elements each 8-bit wide, and sorts its elements in ascendingorder.

LabSheet 2: This weel students will learn how to perform rotate and shift operations.

a. Writetoprogramreadstwointegersfromkeyboard(usingINT21H)anddisplaystheresul tofthe
SHL,SHR,SAR,ROL,ROR,RCL,andRCRoperation(usingINT21Hafterdoingnece ssaryASCII conversion).

LabSheet 3. This week students will learn how to define a subroutine, pass parameters to it, and return value from it.

a. Write a program that defines a subroutine, which takes two 8-bit integers as parameters via Registers, calculates their sum, and returns the result to thecaller.
b. Write a program that defines a subroutine, which takes two 8-bit integers as parameters via Stack, calculates their sum, and returns the result to thecaller.

UNIT 4:

LabSheet 1: This week students will learn how to read and write files residing on secondary storage using INT 21H service.

a. Write a program that opens an existing text file in the current working directory, and display its contents.
b. Writeaprogramthatcreatesafileincurrentworkingdirectory,writestextualdatatoit(rea d from keyboard), and closesit.

LabSheet 2. This week students will learn how to write, install and use a custom software-interrupt.

a. Write a program that creates a subroutine to display "hello world!", installs the subroutine as ISR, and subsequently uses it via INTinterface.

LabSheet 3. This week students will learn how to write a simple device driver for VGA.

a. Writeaprogramthatdefinesasubroutine,whichtakesthreeparameters – row,column,addressof theString,andusesmemory-mappedI/Otodisplayitonscreen.Theprogramcallsthissubroutineto display a String inputted viakeyboard.

MCA21101OE
Fundamentals of Computers

Unit I

Introduction about computers: Computer Basics, characteristics, applications and limitations. Functional Block Diagram of computer.

Computer Architecture: Classification of computer on basis of Purpose, signal and size and portability, Evolution of computer from 1st generation to fifth generation, Data representation in memory.

Unit II

Hardware: Input devices used: Keyboard, mouse, OMR, OCR, MICR, BCR, Scanner, internal structure of CPU: Registers, ALU, Motherboard, HD, Memory, Cache, and Virtual Memory, Magnetic Disk, Optical Disk, Flash memory

Software: types of Software, Languages and their types, operating system, its types and various functions and types of operating system. Basic introduction about Interfaces: its types character user and graphical user interface (DOS and Windows)