COMMON SYLLABUS FOR B.Sc. (ITM)

PREAMBLE

Information and Communication Technology (ICT) has today become integral part of all industry domains as well as fields of academics and research. The industry requirements and technologies have been steadily and rapidly advancing. Organizations are increasingly opting for open source systems. A genuine attempt has been made while designing the syllabus for this 3- year B. Sc. (ITM) course. It prepare the students for a career in Software industry. The core philosophy of overall syllabus is to:

a. Introduce emerging trends to the students in gradual way,

b. Groom the students for the challenges of ICT industry

The Government of Odisha has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of the State of Odisha in line with the University Grants Commission (UGC). The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The Government of Odisha has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Universities & Colleges in Odisha in line with UGC. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the Universities and Colleges must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the Universities and Colleges in the states as well as the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines, which is being adopted by the state of Odisha.

CHOICE BASED CREDIT SYSTEM (CBCS): The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in Odisha. This will benefit the students to move across institutions within Odisha to begin with and across states and countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

PROGRAMME LEARNING OUTCOMES

Upon completion of the B. Sc. (Information Technology and Management) programme, students will be able to:

- To apply current technical concepts and practices in the core Information Technologies of Human Computer Interaction, Information Management, Programming, Networking, and Web Systems and Technologies.

- To think analytically, creatively and critically in developing robust, extensible and highly maintainable technological solutions to simple and complex problems.

- To apply their knowledge and skills to be employed and excel in IT professional careers and/or to continue their education in IT and/or related Post Graduate Programmes.

- To apply the knowledge and understanding to the analysis of a given Information Management problem.
- To function in multidisciplinary teams by working cooperatively, creatively and responsibly as a member of a team.

- To be capable of managing complex IT projects with consideration of the human, financial and environmental factors.

- To work effectively as a part of a team to achieve a common stated goal.

- To communicate effectively with a range of audiences both technical and non-technical.

- To develop an aptitude to engage in continuing professional development.

Outline of Choice Based Credit System:

1. **Core Course**: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective/ Inter-disciplinary (GE/ IC) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective/ Inter-disciplinary.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course**: They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

GUIDELINES FOR PROJECT FORMULATION

As the project work constitutes a major component in most of the professional programs and it is to be carried out with due care and should be executed with seriousness by the candidates.

TYPE OF PROJECT

As majority of the students are expected to work out a real-life project in some industry/research and development laboratories/educational institutions/software companies, it is suggested that the project is to be chosen which should have some direct relevance in day-to-day activities of the candidates in his/her institution. It is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of Guide.

PROJECT PROPOSAL (SYNOPSIS)

The project proposal should be prepared in consultation with the guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project work should compulsorily include the software development. The project proposal should contain complete details in the following form:

1. Title of the Project

2. Introduction and Objectives of the Project

3. Project Category (RDBMS/OOPS/Networking/Multimedia/Artificial Intelligence/Expert Systems etc.)

4. Analysis (DFDs at least up to second level, ER Diagrams/ Class Diagrams/ Database Design etc. as per the project requirements).

5. A complete structure which includes: Number of modules and their description to provide an estimation of the student's effort on the project. Data Structures as per the project requirements for all the modules. Process Logic of each module. Testing process to be used. Reports generation

6. Tools / Platform, Hardware and Software Requirement specifications

7. Future scope and further enhancement of the project.

B.Sc. (ITM)

Effective from the Academic Session 2019-20

SEMESTER	COURSE OPTED	COURSE NAME	CREDITS
I	Ability Enhancement Course-1	AEC-1 (Environmental Science)	4
	Core Course-1	Digital Logic	4
	Core Course-1 Practical/Tutorial	Digital Logic LAB	2
	Core Course-2	Programming using C++	4
	Core Course-2 Practical/Tutorial	Programming using C++ LAB	2
	Generic Elective/ Interdisciplinary Course -1	GE/IC-1 (Discrete Mathematical Structures)	4
	Generic Elective/ InterdisciplinaryCourse -1 Practical/Tutorial	GE/IC-1 LAB/Tutorial(Discrete Mathematical Structures LAB)	2
II	Ability Enhancement Course-2	AEC-2 (English/ MIL Communication)	4
	Core Course-3	Computer Organization	4
	Core Course-3 Practical / Tutorial	Computer Organization LAB	2
	Core Course-4	Data Structure	4
	Core Course-4 Practical/Tutorial	Data Structure LAB	2
	Generic Elective/ InterdisciplinaryCourse -2	GE/IC-2 (Numerical Techniques)	4
	Generic Elective/ InterdisciplinaryCourse -2 Practical/Tutorial	GE/IC-2 LAB/Tutorial (Numerical TechniquesLAB)	2
III	Core Course-5	Java Programming	4
	Core Course-5 Practical/Tutorial	Java Programming LAB	2
	Core Course-6	Database Systems	4
	Core Course-6 Practical/Tutorial	Database Systems LAB	2
	Core Course-7	Principles of Management	4
	Core Course-7 Practical/ Tutorial	Principles of Management Tutorial	2
	Skill Enhancement Course-1	SEC-1 (Python Programming)	4
	Generic Elective/ Interdisciplinary Course -3	GE/IC-3 (Statistical Techniques)	4
	Generic Elective/ InterdisciplinaryCourse -3	GE/IC-3 LAB/Tutorial (Statistical Techniques LAB)	2

	Practical/Tutorial		
IV	Core Course-8	Computer Graphics	4
	Core Course-8 Practical/Tutorial	Computer Graphics LAB	2
	Core Course-9	Business Accounting	4
	Core Course-9 Practical/Tutorial	Business Accounting Tutorial	2
	Core Course-10	Operating System	4
	Core Course-10 Practical/Tutorial	Operating System LAB	2
	Skill Enhancement Course-2	SEC-2 (Android Programming)	4
	Generic Elective/ Interdisciplinary Course -4	GE/IC-4 (Operations Research)	4
	Generic Elective/ Interdisciplinary Course -4 Practical/Tutorial	GE/IC-4LAB/Tutorial (Operations Research LAB)	2
V	Core Course-11	Web Technology	4
	Core Course-11 Practical/Tutorial	Web Technology LAB	2
	Core Course-12	Software Engineering	4
	Core Course-12 Practical/Tutorial	Software Engineering Lab	2
	Discipline Specific Elective-1	DSE-1 (Data Science)	4
	Discipline Specific Elective-1 Practical/Tutorial	DSE-1 LAB/ Tutorial (Data Science LAB)	2
	Discipline Specific Elective-2	DSE-2 (Managerial Economics)	4
	Discipline Specific Elective-2 Practical/Tutorial	DSE-2 LAB/ Tutorial (Managerial Economics Tutorial)	2
VI	Core Course-13	Management Accounting	4
	Core Course-13 Practical/Tutorial	Management AccountingTutorial	2
	Core Course-14	Computer Networks	4
	Core Course-14 Practical/Tutorial	Computer Networks LAB	2
	Discipline Specific Elective-3	DSE-3 (Financial Management)	4
	Discipline Specific Elective-3 Practical/Tutorial	DSE-3 LAB/ Tutorial (Financial Management Tutorial)	2
	Discipline Specific Elective-4	DSE-4 (Project Work / E-Commerce)	6/4
	Discipline Specific Elective-4 Practical/Tutorial	DSE-4 LAB/ Tutorial(E-Commerce Tutorial)	2

CORE Papers:

CORE–1: Digital Logic

CORE–2: Programming Using C++

CORE– 3: Computer Organization

CORE – 4: Data Structure

CORE – 5: Java Programming

CORE – 6: Database Systems

CORE – 7: Principles of Management

CORE – 8: Computer Graphics

CORE – 9:Business Accounting

CORE – 10: Operating System

CORE – 11: Web Technologies

CORE – 12: Software Engineering

CORE – 13: Management Accounting

CORE – 14: Computer Networks

Discipline Specific Electives (DSE) Papers:

DSE–1: Data Science

DSE–2:Managerial Economics

DSE–3:Financial Management

DSE–4: Project Work / E-Commerce

Skill Enhancement Courses (SEC):

SEC – 1:PythonProgramming

SEC – 2: Android Programming

Ability Enhancement Courses(AEC):

AEC – 1: Environmental Science

AEC – 2: English/ MIL Communication

Generic Elective (GE)/ InterdisciplinaryCourse (IC):

GE/IC – 1:Discrete Mathematical Structures

GE/IC – 2:Numerical Techniques

GE/IC – 3:Statistical Techniques

GE/IC – 4: Operations Research

Detailed Syllabus

CORE–1: DIGITAL LOGIC

OBJECTIVES

- To understand different methods used for the simplification of Boolean functions and binary arithmetic.
- To design and implement combinational circuits, synchronous & asynchronous sequential circuits.
- To study in detail about Semiconductor Memory Systems.

Unit-1

Character Codes, Decimal System, Binary System, Decimal to Binary Conversion, Hexadecimal Notation, Boolean Algebra, Basic Logic Functions: Electronic Logic Gates, Synthesis of Logic Functions, Minimization of Logic Expressions, Minimization using Karnaugh Maps, Synthesis with NAND and NOR Gates, Tri-State Buffers

Unit-2

Arithmetic: Addition and Subtraction of Signed Numbers, Addition/ Subtraction Logic Unit, Design of Fast Adders: Carry-Lookahead Addition, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth Algorithm, Fast Multiplication: Bit-Pair Recodng Multipliers, Carry-Save Addition of Summands, Integer Division, Floating-Point Numbers and Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations.

Unit-3

Flip-Flops, Gated Latches, Master-Slave Flip-Flops, Edge-Triggering, T Flip-Flops, JK Flip-Flops. Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices (PLDs), Programmable Array Logic (PAL), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Array (FPGA), Sequential Circuits, UP/ DOWN Counters, Timing Diagrams, The Finite State Machine Model, Synthesis of Finite State Machines.

Unit-4

Memory System: Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Asynchronous DRAMS, Synchronous DRAMS, Structure of Large Memories, Memory System Considerations, RAMBUS Memory. Read-Only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Speed, Size, and Cost of Memory. Secondary Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems.

Text Books:

1. Carl Hamacher, Z. Vranesic, S. Zaky: Computer Organization, 5/e (TMH)

Reference Books:

1. M. Morris Mano: Digital Logic and Computer Design, Pearson

CORE–1 PRACTICAL: DIGITAL LOGIC LAB

1. Introduction to Xilinx software (VHDL)

Write the VHDL code for

2. Realizing all logic gates.

3. Combination Circuit.

4. ADDER.

5. SUBTRACTOR.

6. MUX.

7. DE-MUX.

8. Encoder.

9. Decoder.

10. PAL.

11. PLA.

Write the VHDL program for the following Sequential Logic Circuits

12. Flip Flops.

13. Shift Registers.

14. Counters.

15. Memory Elements.

CORE–2: PROGRAMMING USING C++

OBJECTIVES

- To know about the Object Oriented Programming concepts.

- To learn basics of C++ programming language.

- To be able to develop logics to create programs/ applications in **C++.**

Unit-1
Principles of Object-Oriented Programming: Object-Oriented Programming (OOP) Paradigm, Basic Concepts of OOP, Benefits of OOP, Characteristics of OOPS, Object Oriented Languages, Applications of OOP.
Introduction to C++, Difference between C & C++, Tokens, Data types, Operators, Structure of C++ Program, C++ statements, Expressions and Control Structures.
Functions in C++: Argument passing in function, Inline Functions, Default Arguments, Const. Arguments, Friend function.

Unit-2
Classes and Objects: Defining Member Functions, Making an outside Function Inline, Nested Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions.
Constructors & Destructors: Constructors, Parameterized Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructors, Destructors.

Unit-3
Inheritance: Basics of Inheritance, Type of Inheritance, Virtual Base Classes, Abstract Classes, Member Classes, Nesting of Classes. Polymorphism: Pointers, Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions, Function Overloading, Operator Overloading.

Unit-4
Managing Console I/O Operations: C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Formatted Console I/O Operations, Managing Output with Manipulators.
Files: Classes for File Stream Operations, Opening and Closing a File, Detecting end-of-file, File Modes, File Pointers and their Manipulations, Sequential Input and Output Operations, Updating a File: Random Access, Error Handling during File Operations, Command-line Arguments.

Text Books
1. E. Balgurusawmy, Object Oriented Programming with C++, 4/e (TMH).
2. Paul Deitel, Harvey Deitel, "C++: How to Program", 9/e. Prentice Hall.

Reference Books:
1. Bjarne Stroustroup, Programming - Principles and Practice using C++, 2/e, Addison-Wesley 2014
2. Herbtz Schildt, C++: The Complete reference, MGH, 4/ed.
3. P. C. Sethi, P. K. Behera, "Programming in C++"- Kalyani Publisher, Ludhiana

CORE–2 PRACTICAL/TUTORIAL: PROGRAMMING USING C++ LAB

1. Write a Program to find greatest among three numbers using nested if…else statement.
2. Write a Program to check a number is prime or not.
3. Write a Program to find the GCD and LCM of two numbers.
4. Write a program to print the result for following series: 1! + 2! + 3! + …………
5. Write a program to print multiplication table from 1 to 10.
6. Write a Program for Swapping of two numbers using pass by value.
7. Write a Program for Swapping of two numbers using pass by address.
8. Write a Program for Swapping of two numbers using pass by reference.
9. Write a Program to find sum of four numbers using default argument passing.
10. Write a Program to find square and cube of a number using inline function.
11. Write a Program to find the factorial of a number.
12. Write a Program to find reverse of a number.
13. Write a program to find sum of four numbers using default argument passing in member function.
14. Write a Program to find area of circle, triangle and rectangle using function overloading.
15. Write a program to distinguish the properties of static and non-static ata members.
16. Write a program to show the method of accessing static private member function.
17. Write a program to show the ways of calling constructors and destructors.
18. Write a program to perform ++ operator overloading using member function.
19. Write a program to perform ++ operator overloading using friend function.
20. Write a program to perform + operator overloading for two complex number addition.
21. Write a program to perform + operator overloading for string concatenation.
22. Write a program to perform single inheritance.
23. Write a program to perform multiple inheritance.
24. Write a program to create an integer array using new operator and find the sum and average of array elements.
25. Write a program to implement virtual destructor.
26. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
27. Write a program to Copy the contents of one file to other.

CORE–3: COMPUTER ORGANIZATION

OBJECTIVES
- To study the basic organization of digital computers (CPU, memory, I/O, software).
- To have a better understanding and utilization of digital computers.
- To be familiar with Assembly Language Programming (ALP)

Unit-1

Basic Structure of Computers: Computer Types, Functional Units, Input Unit, Memory Unit, Arithmetic and Logic Unit, Output Unit, Control Unit, Basic Operational Concepts, Bus Structures, Software. Machine Instructions and Programs: Numbers, Arithmetic Operations, and Characters: Number Representation, Addition of Positive Numbers, Addition and Subtraction of Signed Numbers, Overflow of Integer Arithmetic, Floating-Point Numbers & Operations, Characters, Memory Locations and Addresses, Byte Addressability, Word Alignment, Accessing Numbers, Characters, and Character Strings, Memory Operations, Instructions and Instruction Sequencing, Register Transfer Notation, Basic Instruction Types, Instruction Execution and Straight-Line Sequencing, Branching, Condition Codes, Generating Memory Addresses, Addressing Modes, Implementation of Variables and Constants, Indirection and Pointers, Indexing and Arrays, Relative Addressing.

Unit-2
Basic Processing Unit: Register Transfers, Performance on Arithmetic or Logic Operation, fetching a Word from Memory, Storing a Word in Memory. Execution of a Complete Instruction, Branch Instruction, Multiple Bus Organization Hardwired Control, A Complete Processor. Micro-programmed Control: Microinstructions, Microprogram Sequencing, Wide-Branch Addressing, Microinstructions with Next-Address Field, Prefetching Microinstructions, Emulation.

UNIT-3
Input/ Output Organization: Accessing I/O Devices, Interrupts, Interrupt Hardware, Enabling & Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions. Direct Memory Access, Bus Arbitration, Buses, Synchronous Bus, Asynchronous Bus, Interface Circuits: Parallel Port, Serial Port, Standard I/O Interfaces, Peripheral Component Interconnect (PCI) Bus, SCSI Bus, Universal Serial Bus (USB)

Unit-4
Pipelining: Role of Cache Memory, Pipeline Performance, Data Hazards: Operand Forwarding, Handling Data Hazards in Software, Side Effects. Instruction Hazards: Unconditional Branches, Conditional Branches and Branch Prediction. Influence on Instruction Sets: Addressing Modes, Condition Codes, Data path and Control Considerations. Superscalar Operation: Out-of-Order Execution, Execution Completion, Dispatch Operation, RISC & CISC Processors.

Text Books

1. Carl Hamacher, Z. Vranesic, S. Zaky: Computer Organization, 5/Ed (TMH)

Reference Books
1. William Stallings: Computer Organization and Architecture (Design for Performance), 9/Ed
2. S. Brown, & Z. Vranesic, "Fundamentals of Digital Logic Design with VHDL", 2/Ed, McGraw-Hill

CORE–3PRACTICAL/TUTORIAL: COMPUTER ORGANIZATION LAB

1. Study of the complete Architecture of 8085 Microprocessor along with its instruction set.

2. Introduction to GNU Simulator 8085, with its features.

3. Write an Assembly Language Program to add N consecutive numbers.

4. Write an Assembly Language Program to find the smallest and largest number from a given series.

5. Write an Assembly Language Program for subtraction of two 8-bit numbers.

6. Write an Assembly Language Program for displaying a Rolling message "Hello 123".

7. Write an Assembly Language Program to perform ASCII to Decimal conversion.

8. Write an Assembly Language Program to add two unsigned binary numbers.

9. Write an Assembly Language Program to subtraction of two unsigned binary numbers.

Demonstrate the followings:

10. Assembling and Dis-assembling of computer.

11. Trouble shooting in Computer.

CORE–4: DATA STRUCTURE

OBJECTIVES
- To learn how the choice of data structures impacts the performance of programs.
- To study specific data structures such as arrays, linear lists, stacks, queues, hash tables, binary trees, binary search trees, heaps and AVL trees.
- To learn efficient searching and sorting techniques.

Unit-1

Introduction: Basic Terminology, Data structure, Time and space complexity, Review of Array, Structures, Pointers.

Linked Lists: Dynamic memory allocation, representation,Linked list insertion and deletion, Searching, Traversing in a list, Doubly linked list, Sparse matrices.

Unit-2

Stack: Definition, Representation, Stack operations, Applications (Infix–Prefix–Postfix Conversion & Evaluation, Recursion).

Queues: Definition, Representation, Types of queue, Queue operations, Applications.

Unit-3

Trees: Tree Terminologies, General Tree, Binary Tree, Representations,Traversing, BST,Operations on BST, Heap tree, AVL Search Trees, M-way search tree, Applications of all trees.

Unit-4

Sorting: Exchange sorts, Selection Sort, Bubble sort, Insertion Sorts, Merge Sort, Quick Sort, Radix Sort, Heap sort.

Searching: Linear search, Binary search.

Text Books:
1. Classic Data Structure ,D.Samanta , PHI , 2/ed.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Publications, 2000.

2. Sastry C.V., Nayak R, Ch. Rajaramesh, Data Structure & Algorithms, I.K.International Publishing House Pvt.Ltd, New Delhi.

CORE – 4 PRACTICAL/TUTORIAL: DATA STRUCTURE LAB

Write a C/ C++ Program for the followings

1. To insert and delete elements from appropriate position in an array.
2. To search an element and print the total time of occurrence in the array.
3. To delete all occurrence of an element in an array.
4. Array implementation of Stack.
5. Array implementation of Linear Queue.
6. Array implementation of Circular Queue.
7. To implement linear linked list and perform different operation such as node insert and delete, search of an item, reverse the list.
8. To implement circular linked list and perform different operation such as node insert and delete.
9. To implement double linked list and perform different operation such as node insert and delete.
10. Linked list implementation of Stack.
11. Linked list implementation of Queue.
12. Polynomial representation using linked list.
13. To implement a Binary Search Tree.
14. To represent a Sparse Matrix.
15. To perform binary search operation.
16. To perform Bubble sort.
17. To perform Selection sort.
18. To perform Insertion sort.
19. To perform Quick sort.
20. To perform Merge sort.

CORE – 5: JAVA PROGRAMMING

OBJECTIVES

1. To learn the fundamentals of Object Oriented Programming in Java environment.
2. To learn the use of Java language and the Java Virtual Machine.
3. To write simple Java programming applications.

Unit-1
Introduction to Java: Java History, Architecture and Features, Understanding thesemantic and syntax differences between C++ and Java, Compiling andExecuting a Java Program, Variables, Constants, Keywords (super, this, final, abstract, static, extends, implements, interface) , Data Types, Wrapper class,Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, DoingBasic Program Output, Decision Making Constructs (conditional statements andloops) and Nesting, Java Methods (Defining, Scope, Passing and ReturningArguments, Type Conversion and Type and Checking, Built-in Java ClassMethods). Input through keyboard using Commandline Argument, the Scanner class, BufferedReader class.

Unit-2
Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining & Using Classes, Class Variables & Methods, Objects, Object reference, Objects as parameters, final classes, Garbage Collection.
Constructor- types of constructor, this keyword, super keyword. Method overloading and Constructor overloading. Aggregation vs Inheritance, Inheritance: extends vs implements, types of Inheritance, Interface, Up-Casting, Down-Casting, Auto-Boxing, Enumerations,Polymorphism, Method Overriding and restrictions. Package: Pre-defined packages and Custom packages.

Unit-3
Arrays: Creating & Using Arrays(1D, 2D, 3D and Jagged Array), Array of Object, Referencing Arrays Dynamically. Strings and I/O: Java Strings: The Java Stringclass, Creating & Using String Objects, Manipulating Strings, String Immutability& Equality, Passing Strings To & From Methods, StringBuffer Classes and StringBuilder Classes. IO package: Understanding StreamsFile class and its methods, Creating, Reading,Writing using classes: Byte and Character streams,FileOutputStream, FileInputStream, FileWriter, FileReader, InputStreamReader, PrintStream, PrintWriter. Compressing and Uncompressing File.

Unit-4
Exception Handling, Threading, Networking and Database Connectivity:Exception types, uncaught exceptions, throw, built-in exceptions, Creating yourown exceptions; Multi-threading: The Thread class and Runnable interface,creating single and multiple threads, Thread prioritization, synchronization andcommunication, suspending/resuming threads. Using java.net package,Overview of TCP/IP and Datagram programming. Accessing and manipulatingdatabases using JDBC.
Text Books:
1. E. Balagurusamy, "Programming with Java", TMH, 4/Ed,
Reference books:
1. Herbert Schildt, "The Complete Reference to Java", TMH, 10/Ed.

CORE – 5 PRACTICAL/TUTORIAL:JAVA PROGRAMMING LAB
1. To find the sum of any number of integers entered as command line arguments.

2. To find the factorial of a given number.
3. To convert a decimal to binary number.
4. To check if a number is prime or not, by taking the number as input from the keyboard.
5. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
6. Write a program that show working of different functions of String and StringBufferclasss like setCharAt( ), setLength( ), append( ), insert( ), concat( )and equals( ).
7. Write a program to create a – "distance" class with methods where distance is computed interms of feet and inches, how to create objects of a class and to see the use of this pointer
8. Modify the – "distance" class by creating constructor for assigning values (feetandinches)to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
9. Write a program to show that during function overloading, if no matching argument is found, then Java will apply automatic type conversions(from lower to higher data type)
10. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword.
11. Write a program to show the use of static functions and to pass variable length arguments in a function.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the userand the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program – "DivideByZero" that takes two numbers a and b as input, computes a/b,and invokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate different mouse handling events like mouseClicked( ), mouseEntered( ), mouseExited( ), mousePressed( ), mouseReleased( ) & mouseDragged( ).
23. Write a program to demonstrate different keyboard handling events.

CORE-6: DATABASE SYSTEMS

OBJECTIVES

- To learn the fundamental elements of database system.
- To learn the basic concepts of relational database management systems.
- To learn various SQL commands.

Unit-1

Introduction to Database and Database Users, Database System Concepts and Architecture: data Models, schema, and instances, Conceptual Modeling and Database Design: Entity Relationship (ER) Model: Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, ER Naming Conventions. Enhanced Entity-Relationship (EER) Model.

Unit-2

Database Design Theory and Normalization: Functional Dependencies, Normal Forms based on Primary Keys, Second and third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Unit-3

Relational data Model and SQL: Relational Model Concepts, Basic SQLs, SQL Data Definition and Data types, Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, UPDATE Statements in SQL, Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Binary Relation: JOIN and DIVISION.

Unit-4

Introduction to Transaction ProcessingConcepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Properties of Transactions, Recoverability, Serializability, Concurrency Control Techniques, Locking techniques for Concurrency Control, Concurrency Control based on Time-Stamp Ordering.

Text Book:

1. Fundamentals of Database Systems, 6th edition, RamezElmasri, ShamkantB.Navathe, Pearson Education

Reference Book:

1. An Introduction to Database System, Date C.J.- Pearson Education, New Delhi- 2005

CORE-6 Practical/Tutorial: Database Systems Labs

Create and use the following database schema to answer the given queries.

EMPLOYEE Schema

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

DEPARTMENT Schema

Field	Type	NULL	KEY	DEFAULT
Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than 2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of Rs1500 and Rs 2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.
10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Mangers Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
18. Query to display Name and calculate the number of months between today and the date

each employee was hired.

19. Query to display the following for each employee <E-Name> earns <Salary> monthly but wants <3*Current Salary>. Label the Column as Dream Salary.

20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.

21. Query to display Name, Hire Date and Day of the week on which the employee started.

22. Query to display Name, Department Name and Department No for all the employees.

23. Query to display Unique Listing of all Jobs that are in Department # 30.

24. Query to display Name, Department Name of all employees who have an 'A' in their name.

25. Query to display Name, Job, Department No. and Department Name for all the employees working at the Dallas location.

26. Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees Name who do not have a Manager.

27. Query to display Name, Department No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.

28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies Rs 100.

29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees.

30. Query to display the number of employees performing the same Job type functions.

31. Query to display the no. of managers without listing their names.

32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.

33. Query to display Name and Hire Date for all employees in the same dept. as Blake.

34. Query to display the Employee No. And Name for all employees who earn more thanthe average salary.

35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.

36. Query to display the names and salaries of all employees who report to King.

37. Query to display the department no, name and job for all employees in the Sales department.

CORE–7: PRINCIPLES OF MANAGEMENT

OBJECTIVES

- To understand the basic principles of management.
- To provide a basis of understanding towards working of business organization through the process of management.

Unit-1
Nature of Management: Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management-Administration-Organization.

Evolution of Management Thought: Contribution of F.W.Taylor, Henri Fayol ,Elton Mayo, Chester Barhard & Peter Drucker to the management thought. Various approaches to management (i.e. Schools of management thought)Indian Management Thought.

Unit-2
Functions of Management (Part-I)
Planning - Meaning - Need & Importance, types levels– advantages & limitations, Forecasting - Need & Techniques, Decision making - Types - Process of rational decision making & techniques of decision making,
Organizing - Elements of organizing & processes: Types of organizations, Delegation of authority - Need, difficulties in delegation – Decentralization,

Unit-3
Functions of Management (Part-II)
Staffing - Meaning & Importance, Direction - Nature – Principles, Communication - Types & Importance, Motivation - Importance – theories, Leadership - Meaning - styles, qualities & functions of leaders
Controlling-Need, Nature, importance, Process & Techniques, Coordination - Need, Importance.

Unit-4
Strategic Management
Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits, Strategic Management in India.

Text Books:
1. Horold Koontz and Iteinz Weibrich, Essential of Management, McGraw Hills International
2. K.Aswathapa, Essential of Business Administration, Himalaya Publishing House

Reference Books:
1. L.M.Parasad Principles & practice of management - Sultan Chand & Sons - New Delhi
2. Tripathi, Reddy, Principles of Management, Tata McGraw Hill

CORE-7PRACTICAL/TUTORIAL: PRINCIPLES OF MANAGEMENT TUTORIAL

CORE – 08: COMPUTER GRAPHICS
OBJECTIVES

- To be able to learn the core concepts of Computer Graphics.
- To be able to create effective programs for solving graphics problems.

Unit-1
Computer Graphics: A Survey of Computer graphics, Overview of Graphics System: Video Display Devices, Raster-Scan Systems, Input Devices, Hard-Copy Devices, Graphics Software.

Unit-2

Graphics Output Primitives: Point and Lines, Algorithms for line, circle & ellipse generation, Filled-Area Primitives. Attributes of Graphics Primitives: Point, line, curve attributes, fill area attributes, Fill methods for areas with irregular boundaries.

Unit-3
Geometric Transformations (both 2-D & 3-D): Basic Geometric Transformations, Transformation Matrix, Types of transformation in 2-D and 3-D Graphics: Scaling, Reflection, shear transformation, rotation, translation. 2-D, 3-D transformation using homogeneous coordinates.

Unit-4
Two Dimensional Viewing: Introduction to viewing and clipping, Viewing transformation in 2-D, Viewing pipeline, Clipping Window, Clipping Algorithms: Point clipping, Line clipping and Polygon clipping.

Text books
1. Mathematical Elements for Computer Graphics,D.F.Rogers&J.A.Adams, MGH, 2/ed.
2. Donald Hearn & M. Pauline Baker, "Computer Graphics with OpenGL", Pearson Education.

Reference books
1. D.Hearn and M.Baker,"Computer Graphics with Open GL", Pearson,2/ed.
2. D. F. Rogers, "Procedural Elements for Computer Graphics", MGH

CORE – 8PRACTICAL: COMPUTER GRAPHICS LAB

Develop the programs using C/C++ or Java

1. Write a program to implement Bresenham's line drawing algorithm.
2. Write a program to implement mid-point circle drawing algorithm.
3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.
4. Write a program to clip a polygon using Sutherland Hodgeman algorithm.
5. Write a program to fill a polygon using Scan line fill algorithm.
6. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates).
7. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

CORE – 9: BUSINESS ACCOUNTING

OBJECTIVES

- To impart the basic business accounting knowledge.

Unit-1

Introduction: Financial Accounting-definition and Scope,objectives of Financial Accounting, Accounting v/s BookKeeping terms used in accounting, users of accountinginformation and limitations of Financial Accounting.

Conceptual Framework: Accounting Concepts,Principles and Conventions, Accounting Standardsconcept,objectives, benefits, brief review of AccountingStandards in India, Accounting Policies, Accounting as ameasurement discipline, valuation Principles, accountingestimates

Unit-2

Recording of transactions: Voucher system; AccountingProcess, Journals, Subsidiary Books, Ledger, Cash Book,Bank Reconciliation Statement, Trial Balance.

Depreciation: Meaning, need & importance ofdepreciation, methods of charging depreciation.

Unit-3

Preparation of final accounts: Preparation of Trading andProfit & Loss Account and Balance Sheet of soleproprietary business

Unit-4

Introduction to Company Final Accounts: Importantprovisions of Companies Act, 1956 in respect ofpreparation of Final Accounts, Understanding of finalaccounts of a Company.

Computerized Accounting: Computers and Financialapplication, Accounting Software packages, An overviewof computerized accounting system - Salient features andsignificance, Concept of grouping of accounts,Codification of accounts, Maintaining the hierarchy ofledger, Generating Accounting Reports.

Text Books :
1. Anil Chowdhry,"Fundamentals of Accounting & Financial Analysis", Pearson Education
2. Rajesh Agarwal, R. Srinivasan,"Accounting Made Easy", TMH

Reference Books:
1. Amrish Gupta,"Financial Accounting for Management", Pearson Education
2. S. N. Maheshwari,"Financial Accounting for Management: Vikas Publishing House

CORE-9 Practical/Tutorial: Business Accounting Tutorial

CORE–10: OPERATING SYSTEM

OBJECTIVES

- To understand Operating system structure and services.
- To understand the concept of a Process, memory, storage and I/O management.

Unit–1

Introduction to Operating System, System Structures: Operating system services, system calls, system programs, Operating system design and implementation, Operating system structure.

Unit–2

Process Management: Process Concept, Operations on processes, Process scheduling and algorithms, Inter-process Communication, Concepts on Thread and Process, Deadlocks: Deadlock detection, deadlock prevention, and deadlock avoidance fundamentals.

Unit-3

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory Management: Concepts, implementation (Demand Paging), Page Replacement, Thrashing.

Unit–4

Storage Management: File System concept, Access Methods, File System Mounting, File Sharing and File Protection, Implementing File Systems, Kernel I/O Systems.

Text book:
1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, Eighth Edition, Wiley Student Edition 2009.

Reference book:
1. Modern Operating System, Tanenbaum,Pearson, 4/Ed. 2014
2. Richard F Ashley, Linux with Operating System Concepts, Chapman and Hall/CRC Published August 26, 2014
3. Richard Blum, Linux Command Line and Shell Scripting Bible, O' Reilly

CORE-10 PRACTICAL/TUTORIAL: OPERATING SYSTEM LAB

1. Write a program (using *fork()* and/or *exec()* commands) where parent and child execute:
   a) same program, same code.
   b) same program, different code.
c) before terminating, the parent waits for the child to finish its task.
2. Write a program to report behavior of Linux kernel including kernel version, CPU type and model. (CPU information)
3. Write a program to report behavior of Linux kernel including information on configured memory, amount of free and used memory. (memory information)
4. Write a program to print file details including owner access permissions, file access time, where file name is given as argument.
5. Write a program to copy files using system calls.
6. Write a programusing C to implement FCFS scheduling algorithm.
7. Write a program using C to implement Round Robin scheduling algorithm.
8. Write a program using C to implement SJF scheduling algorithm.

9. Write a program using C to implement non-preemptive priority based scheduling algorithm.
10. Write a program using C to implement preemptive priority based scheduling algorithm.
11. Write a program using C to implement SRTF scheduling algorithm.
12. Write a program using C to implement first-fit, best-fit and worst-fit allocation strategies.

CORE – 11:WEB TECHNOLOGY

OBJECTIVES

- To learn the fundamentals of web designing.
- To design and develop standard and interactive web pages.
- To learn some popular web scripting languages.

Unit-1
Web Essentials: Clients, Servers and Communication:
The Internet –Basic Internet protocols–The WWW,HTTP request message –response message,web clients web servers – case study.
Introduction to HTML: HTML, HTML domains, basic structure of an HTML document– creating an HTML document, mark up tags, heading, paragraphs, line breaks, HTML tags. Elements of HTML, working with text, lists, tables and frames, working with hyperlink, images and multimedia, forms and controls

Unit-2
Introduction to cascading style sheets: Concepts of CSS, creating style sheet, CSS properties, CSS styling(background, text format, controlling fonts), working with the block elements and objects. Working who lists and tables, CSS ID and class.Box model(introduction, border properties, padding properties, margin properties), CSS colour, groping, Dimensions, display, positioning, floating, align, pseudo class, Navigation bar, image sprites.

Unit-3
Java scripts: Client side scripting, what is java script, simple java script, variables, functions, conditions, loops and repetitions. Java scripts and objects, java script own objects, the DOM and web browser environment, forms and validations.
DHTML: Combining HTML, CSS, java scripts, events and buttons, controlling your browser.

Unit-4
PHP: Starting to script on server side, PHP basics, variables, data types, operators, expressions, constants, decisions and loop making decisions. Strings – creating, accessing strings, searching, replacing and formatting strings.Arrays: Creation, accessing array, multidimensional arrays, PHP with Database.

Text Book:
1. Web Technologies – Black Book – DreamTech Press
2. Matt Doyle, Beginning PHP 5.3 (wrox-Willey publishing)
3. John Duckett, Beginning HTML, XHTML, CSS and Java script.

Reference Book:
1. HTML, XHTML and CSS Bible, 5ed, Willey India-Steven M. Schafer.

CORE – 11PRACTICAL/TUTORIAL: WEB TECHNOLOGY LAB

1. Acquaintance with elements, tags and basic structure of HTML files.
2. Practicing basic and advanced text for formatting.
3. Practice use of image, video and sound in HTML documents.
4. Designing of web pages- Document layout, list, tables.
5. Practicing Hyperlink of web pages, working with frames.
6. Working with forms and controls.
7. Acquaintance with creating style sheet, CSS properties and styling.
8. Working with background, text, font, list properties.
9. Working with HTML elements box properties in CSS.
10. Develop simple calculator for addition, subtraction, multiplication and division operation using java script.
11. Create HTML page with java script which takes integer number as a input and tells whether the number is odd or even.
12. Create HTML page that contains form with fields name, Email, mobile number, gender, favoritecolour and button; now write a java script code to validate each entry. Also write a code to combine and display the information in text box when button is clicked.
13. Write a PHP program to check if number is prime or not.
14. Write a PHP program to print first ten Fibonacci numbers.
15. Create a MySQL data base and connect with PHP.
16. Write PHP script for string and retrieving user information from my SQL table.
    a. Write a HTML page which takes Name, Address, Email and Mobile number from user (register PHP).
    b. Store this data in MySQL data base.
    c. Next page display all user in HTML table using PHP (display .PHP).
17. Using HTML, CSS, Javascript, PHP, MySQL, design a authentication module of a web page.

CORE – 12: SOFTWARE ENGINEERING

_____

OBJECTIVES:
- To learn the way of developing software with high quality and the relevant techniques.
- To introduce software engineering principles for industry standard.

- To focus on Project management domain and Software risks management.

Unit-1

Introduction: Evolution of Software to an Engineering Discipline, Software Development Projects, Exploratory Style of Software Development, Emergence of Software Engineering, Changes in Software Development Practices, Computer Systems Engineering.
Software Lifecycle Models: Waterfall Model and its Extensions, Rapid Application Development (RAD), Agile Development Models, Spiral Model.

Unit-2

Software Project Management: Software Project Management Complexities, Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Halstead's Software Science, Staffing Level Estimation, Scheduling, Organization and Team Structures, Staffing, Risk Management, Software Configuration Management.

Unit-3

Requirement Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specifications, Formal System Specification Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL.
Software Design: Design Process, Characterize a Good Software Design, Cohesion and Coupling, Layered Arrangements of Modules, Approaches to Software Design (Function Oriented & Object-Oriented).

Unit-4

Coding and Testing: Coding: Code Review, Software Documentation, Testing, Unit Testing, Black Box and White Box Testing, Debugging, Program Analysis Tools, Integration Testing, System Testing, Software Maintenance.

Text Book:
1. Fundamental of Software Engineering, Rajib Mall, Fifth Edition, PHI Publication, India.

Reference Books:
1. Software Engineering– Ian Sommerville, 10/Ed, Pearson.
2. Software Engineering Concepts and Practice – Ugrasen Suman, Cengage Learning India Pvt, Ltd.

CORE – 12 PRACTICAL/TUTORIAL: SOFTWARE ENGINEERING LAB

S. No. Practical Title

1. • Problem Statement,
   • Process Model
2. Requirement Analysis:
   • Creating a Data Flow
   • Data Dictionary, Use Cases
3. Project Management:
   • Computing FP
   • Effort
   • Schedule, Risk Table, Timeline chart
4. Design Engineering:
   • Architectural Design
   • Data Design, Component Level Design
5. Testing:
   • Basis Path Testing

Sample Projects:

1. **Criminal Record Management:** Implement a criminal record management system forjailers, police officers and CBI officers.

2. **Route Information**: Online information about the bus routes and their frequency andfares

3. **Car Pooling**: To maintain a web based intranet application that enables the corporateemployees within an organization to avail the facility of carpooling effectively.

4. Patient Appointment and Prescription Management System

5. Organized Retail Shopping Management Software

6. Online Hotel Reservation Service System

7. Examination and Result computation system

8. Automatic Internal Assessment System

9. Parking Allocation System

10. Wholesale Management System

CORE – 13: MANAGEMENT ACCOUNTING
OBJECTIVES

- Toencourage the acquisition of knowledge and skills relating to the application of management accounting concepts and techniques for business decisions.
- To introduce the short-term and long-termstrategic decision-making models.

Unit-1
Nature, Scope of Management Accounting: Meaning, definition, nature and scope ofManagement Accounting; Comparison of Management Accounting with CostAccounting and Financial Accounting. Cost concepts: Meaning, Scope, Objectives, andImportance of

Cost Accounting; Cost, Costing, Cost Control, and Cost Reduction;Elements of Cost, Components of total Cost, Cost Sheet. Classification of Costs: Fixed,Variable, Semi-variable, and Step Costs; Product, and Period Costs; Direct, and IndirectCosts; Relevant, and Irrelevant Costs; Shut-down, and Sunk Costs; Controllable, andUncontrollable Costs; Avoidable, and Unavoidable Costs; Imputed / Hypothetical Costs;Out-of-pocket Costs; Opportunity Costs; Expired, and Unexpired Costs; ConversionCost. Cost Ascertainment: Cost Unit and Cost Center. Introduction to Overheadallocation, Overhead apportionment, and Overhead absorption.

Unit-2
Cost-Volume-Profit Analysis: Contribution, Profit-Volume Ratio, Margin of safety, CostBreak-even Point, Composite Break-even Point, Cash Break-even Point, Key Factor,Break-even Analysis. Relevant Costs and Decision Making: Pricing, ProductProfitability, Make or Buy, Exploring new markets, Export Order, Sell or ProcessFurther, Shut down vs. Continue.

Unit-3
Budgets and Budgetary Control: Meaning, Types of Budgets, Steps in BudgetaryControl, Fixed and Flexible Budgeting, Cash Budget. Responsibility Accounting:Concept, Significance, Different responsibility centers, Divisional performance −Financial measures, Transfer pricing.

Unit-4
Standard Costing and Variance Analysis: Meaning of Standard Cost and StandardCosting, Advantages, Limitations and Applications; Material, Labor, Overhead andSales variances. Introduction to Target Costing, Life Cycle Costing, Quality Costing, and Activity based Costing.

Text Books:
1. C.T. Horngren, Gary L. Sundem, Jeff O. Schatzberg, and Dave Burgstahler:Introduction to Management Accounting, Pearson
2. M.N. Arora: A Textbook of Cost and Management Accounting, Vikas PublishingHouse Pvt. Ltd.

Reference Books:
1. M.Y. Khan, and P.K. Jain, Management Accounting: Text Problems and Cases,McGraw Hill Education (India) Pvt. Ltd.

CORE – 13 PRACTICAL/TUTORIAL: MANAGEMENT ACCOUNTING TUTORIAL

CORE – 14: COMPUTER NETWORKS
OBJECTIVES

- To learn how do computers and terminals actually communicate with each other.
- To understand the parts of a communication network and how they work together.

Unit-1
Introduction to Data Communications and Network Models: Protocols and Standards, Layers in OSI Models, Analog and Digital Signals, Transmission Modes, Transmission Impairment,

Data Rate Limits, Performance, Digital Transmission, Network Devices & Drivers: Router, Modem, Repeater, Hub, Switch, Bridge (fundamental concepts only).

Unit-2

Signal Conversion: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Digital-to-analog Conversion, Analog-to-analog Conversion.
Transmission Media: Guided Media, Unguided Media, Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-Circuit Networks, and Structure of a Switch.

Unit-3

Error Detection and Correction: Checksum, CRC, Data Link Control: Framing, Flow and Error Control, Noiseless Channels, Noisy channels, (Stop and Wait ARQ, Slidding Window Protocol , Go Back N, Selective Repeat) HDLC, Point-to-Point Protocol. Access Control: TDM,CSMA/CD, and Channelization (FDMA, TDMA, and CDMA).

Unit-4

Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Virtual-Circuit Networks: Frame Relay and ATM, Transport Layer: Process-Process Delivery: UDP, TCP. Application layers: DNS, SMTP, POP, FTP, HTTP, Basics of WiFi (Fundamental concepts only), Network Security: Authentication, Basics of Public Key and Private Key, Digital Signatures and Certificates (Fundamental concepts only).

Text Books: 1. Data
Communications and Networking, Fourth Edition by Behrouza A. Forouzan,TMH.

Reference Books: 1.
Computer Networks, A.S.Tanenbaum, 4th edition, Pearson Education.

CORE – 14 PRACTICAL/TUTORIAL:COMPUTER NETWORKS LAB

Use C/C++/ any Network Simulator

1. Simulate Even Parity generator and checker.
2. Simulate two dimensional Parity generator and checker.
3. Simulate checksum generator and checker.
4. Simulate Hamming code method.
5. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
6. Simulate and implement stop and wait protocol for noisy channel.
7. Simulate and implement go back n sliding window protocol.
8. Simulate and implement selective repeat sliding window protocol.
9. Simulate and implement distance vector routing algorithm.

DSE-1: DATA SCIENCE

OBJECTIVES:

* To learn emerging issues related to various fields of data science.
* To understandthe underlying principles of data science, exploring data analysis.
* To learn the basics of R Programming.

Unit-1
Data Scientist's Tool Box: Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and RStudio.

Unit-2
R Programming Basics: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling.

Unit-3
Getting and Cleaning Data: Obtaining data from the web, from APIs, from databases and from colleagues in various formats, basics of data cleaning and making data "tidy".

Unit-4
Exploratory Data Analysis: Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data.

Text Books:
1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" : Schroff/O'Reilly, 2013.

Reference Books:
1. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking by O'Reilly, 2013.
2. John W. Foreman, "Data Smart: Using Data Science to Transform Information into Insight" : John Wiley & Sons, 2013.
3. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.

DSE-1 PRACTICAL/TUTORIAL: DATA SCIENCE LAB

1. Write a program that prints "Hello World" to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement linear search.
8. Implement binary search.
9. Implement matrices addition, subtraction and Multiplication

10. Fifteen students were enrolled in a course. There ages were:

                         20 20 20 20 20 21 21 21 22 22 22 22 23 23 23
       i. Find the median age of all students under 22 years
       ii. Find the median age of all students
       iii. Find the mean age of all students
       iv. Find the modal age for all students

v. Two more students enter the class. The age of both students is 23. What is now mean, mode and median?

DSE–2: MANAGERIAL ECONOMICS

OBJECTIVES:

- To introduce the economic concepts.
- To familiarize with the students the importance of economic approaches in managerial decision making.
- To understand the applications of economic theories in business decisions.

Unit-1:
Demand, Supply and Market equilibrium: individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply: Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply; Theory of consumer behavior: cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and giffen goods), revealed preference theory.

Unit-2:
Producer and optimal production choice: optimizing behavior in short run(geometry of product curves, law of diminishing margin productivity, three stages of production), optimizing behavior in long run (isoquants, isocost line, optimal combination of resources) Costs and scale: traditional theory of cost (short run and long run, geometry of cot curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Unit-3:
Theory of firm and market organization: perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes); monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity); oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma)

Unit-4:
Factor market: demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

Text Books:
1. Yogesh Maheswari, Managerial Economics, PHI Learning, New Delhi.
2. G.S.Gupta, Managerial Economics, Tata Mcgraw-Hill, New Delhi.
Reference Books:
1. Moyer &Harris, Managerial Economics, Cengage Learning, New Delhi.
2. Geetika, Ghosh & Choudhury, Managerial Economics, Tata Mcgrawhill, New Delhi.
3. Dominick Salvatore, Principles of Microeconomics, Oxford University Press, (5th Ed.)

DSE-2 PRACTICAL/TUTORIAL: MANAGERIAL ECONOMICS TUTORIAL

DSE-3: FINANCIAL MANAGEMENT

OBJECTIVES:

- To introduce students to financial planning, its objectives, its benefits, its stages, and the factors that help towards the success of financial planning.
- To introduce students about the methods used in financial planning to assess the short-term financialneeds.

Unit-1

Nature of Financial Management: Finance and related disciplines; Scope of FinancialManagement; Profit Maximization, Wealth Maximization - Traditional and ModernApproach; Functions of finance – Finance Decision, Investment Decision, DividendDecision; Objectives of Financial Management; Organization of finance function;Concept of Time Value of Money, present value, future value, and annuity; Risk &Return: Historical return, expected return, absolute return, holding period return,annualized return, arithmetic & geometric return; Risk - Systematic & unsystematic risk– their sources and measures.

Unit-2

Long -term investment decisions: Capital Budgeting - Principles and Techniques;Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminalvalue; Evaluation techniques - Accounting Rate of Return, Net Present Value, InternalRate of Return & MIRR, Net Terminal Value, Profitably Index Method. Concept andMeasurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost ofcapital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of PreferenceShare; Cost of Retained Earning; Computation of over-all cost of capital based onHistorical and Market weights.

Unit-3

Capital Structures: Approaches to Capital Structure Theories - Net Income approach,Net Operating Income approach, Modigliani-Miller (MM) approach, Traditionalapproach, Capital Structure and Financial Distress, Trade-Off Theory.Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General,MM hypothesis; Relevance of dividends: Walter's model, Gordon's model; LeverageAnalysis: Operating and Financial Leverage; EBIT -EPS analysis; Combined leverage.

Unit-4

Working Capital Management: Management of Cash - Preparation of Cash Budgets(Receipts and Payment Method only); Cash management technique,Receivables Management-Objectives; Credit Policy, Cash Discount, DebtorsOutstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost,Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; MinimumLevel; Maximum Level; Reorder Level; Safety Stock; EOQ, Determination of WorkingCapital.

Text Books:
1. M.Y. Khan, P.K. Jain, Financial Management Text Problem and Cases, TMH.
2.I.M. Pandey, Financial Management, Theory and Practices, Vikas PublishingHouse.
Reference Books:
1. R.A. Brealey, S.C. Myers, F. Allen, P. Mohanty: Principles of Corporate Finance,McGraw Hill Higher Education.
2. J. V. Horne, J.M. Wachowicz, Fundamentals of Financial Management, PrenticeHall.

DSE-3 PRACTICAL/TUTORIAL: FINANCIAL MANAGEMENT TUTORIAL

DSE-4:SOFTWARE PROJECT WORK / E-COMMERCE

DSE-4: E-COMMERCE

OBJECTIVES

- Tointroduce the concepts of electronic commerce.
- To make the user understand how electronic commerce is affecting business enterprises, governments, consumers and people in general.

Unit-1
Introduction to E-Commerce: Definition and scope of E-Commerce and M-Commerce, E-Commerce trade cycle,Electronic Markets, Internet Commerce, Benefits and Impacts of E-Commerce.
Elements of E-Commerce: Various elements, e-visibility, e-shops, Delivery of goods and services, Online payments,After- sales services, Internet E-Commerce security.

Unit-2
EDI and Electronic Payment Systems: Introduction and definition of EDI, EDI layered Architecture, EDI technology andstandards, EDI communications and transactions, Benefits and applications of EDI withexample, Electronic Payment Systems: credit/debit/smart cards, e-credit accounts, e-money.

Unit-3
Introduction to EC models: Inter-organization and intra-organization E-Commerce, E-Commerce Models: B2B, B2C,C2B, C2C, G2C, C2G
E-Business: Introduction to Internet bookshops, Grocery Suppliers, Software Supplies and support,Electronic newspapers, Virtual auctions, Online share dealing, e-diversity.

Unit-4
E-Security and Legal Issues: Security concerns in E-Commerce, Privacy, integrity, authenticity, non-repudiation,confidentiality, SSL, Digital Signatures and fire walls, IT Act 2000,Cyber-crimes andcyber laws
Mobile Commerce and Future of E-Commerce: Introduction to Mobile Commerce, Benefits of Mobile Commerce, Impediments of M-Commerce,M-Commerce framework, Emerging and future trends.

Text Books:
1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies, Himalaya Publishing House.
2. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce Fundamentals and Applications, Wiley Student Edition.

Reference Books:
1. Gray P. Schneider , Electronic commerce, International Student Edition.

DSE-4 Practical/Tutorial: E-Commerce Tutorial

SEC – 1: PYTHON PROGRAMMING

OBJECTIVES:

- To enable the students to understand the basic principles of the Python Language.
- To use the tools to do simple programs in python.

Unit-1
Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Unit-2
Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Unit-3
Overview of Programming: Structure of a Python Program, Elements of Python
Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator)

Unit-4
Creating Python Programs: Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.),Defining Functions, default arguments.

Text Books
1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Reference Books
1. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012
OnlineReferences:
1. Python Tutorial/Documentation www.python.or 2015
2. http://docs.python.org/3/tutorial/index.html
3. http://interactivepython.org/courselib/static/pythonds
4. http://www.ibiblio.org/g2swap/byteofpython/read/

Software Lab based on Python Programming:
1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon users choice.
2. Write a Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:
   Grade A: Percentage >=80

Grade B: Percentage>=70 and <80
Grade C: Percentage>=60 and <70
Grade D: Percentage>=40 and <60
Grade E: Percentage<40

3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4. Write a Program to display the first n terms of Fibonacci series.
5. Write a Program to find factorial of the given number.
6. Write a Program to find sum of the following series for n terms: $1 - 2/2! + 3/3! - - - - - n/n!$
7. Write a Program to calculate the sum and product of two compatible matrices.

AEC–1: Environmental Science

AEC–2: English Communication/MIL

SEC-2: ANDROID PROGRAMMING

OBJECTIVES:

- To learn the basics of Android Programming.
- Todevelop simple Android applications.

Unit-1
Introduction: History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture.

Unit-2
Overview of Object Oriented programming using Java: OOPs Concepts: Inheritance, Polymorphism, Interfaces, Abstract class, Threads, Overloading and Overriding, Java Virtual Machine.

Unit-3
Development Tools: Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating an android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.
User Interface Architecture: Application context, intents, Activity life cycle, multiple screen sizes.

Unit-4
User Interface Design: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners(Combo boxes),Images, Menu, Dialog.
Database: Understanding of SQLite database, connecting with the database.

Text Books:
1. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.

Reference Book:
1. James C. Sheusi, "Android application Development for Java Programmers", Cengage Learning, 2013.

2. M. Burton, & D. Felker, "Android Application Development for Dummies", 2/e, Wiley India.

OnlineReferences:
1. http://www.developer.android.com
2. http://docs.oracle.com/javase/tutorial/index.htm (Available in the form of free downloadable ebooks also).
3. http://developer.android.com/guide/components/fundamentals.html
4. http://developer.android.com/training/multiscreen/screensizes.html
5. http://developer.android.com/guide/topics/ui/controls.html

Software Lab based on Android Programming:
1. Create "Hello World" application. That will display "Hello World" in the middle of the screen in the emulator. Also display "Hello World" in the middle of the screen in the Android Phone.
2. Create an application with login module. (Check username and password).
3. Create spinner with strings taken from resource folder (res >> value folder) and on changing the spinner value, Image will change.
4. Create a menu with 5 options and selected option should appear in text box.
5. Create a list of all courses in your college and on selecting a particular course teacher-in-charge of that course should appear at the bottom of the screen.
6. Create an application with three option buttons, on selecting a button colour of the screen will change.
7. Create and Login application as above. On successful login, pop up the message.
8. Create an application to Create, Insert, update, Delete and retrieve operation on the database.

GE/IC–1:DISCRETE MATHEMATICAL STRUCTURES

OBJECTIVES

- To learn the mathematical foundations for Computer Science.
- Topics covered essential for understanding various courses.

Unit-1
Logics and Proof: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers Nested Quantifiers, Rules inference, Mathematical Induction.

Sets and Functions: Sets, Relations, Functions, Closures of Equivalence Relations,Partial ordering well ordering, Lattice, Sum of products and product of sums principle of Inclusions and Exclusions

Unit-2
Combinatory: Permutations, Combinations, Pigeonhole principle
Recurrence Relation: Linear and Non-linear Recurrence Relations, Solving Recurrence Relation using Generating Functions.

Unit-3

Graphs:Introduction to graphs, graphs terminologies, Representation of graphs, Isomorphism,

Connectivity& Paths: Connectivity, Euler and Hamiltonian Paths, Introduction to tree, tree traversals, spanning tree and tree search: Breadth first search, Depth first search, cut-set, cut-vertex.

Unit-4

Modeling Computation: Finite State Machine, Deterministic Finite Automata(DFA), Non-Deterministic Finite Automata(NFA), Grammars and Language,Application of Pumping Lemma for Regular Language.

Text Books:
   1. "Discrete Mathematics and its Applications with Combinatory and Graph Theory" 7th edition by Kenneth H. Rosen.

Reference Books:
   1. Elements of Discrete Mathematics by C.L. Liu and D.P. Mohapatra, TMH, 2012
   2. J.P Tremblay, R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TMH, 1997.

GE/IC-1 PRACTICAL/TUTORIAL: DISCRETE MATHEMATICAL STRUCTURES LAB

Write the following programs using C/ C++

1. Tower of Hanoi
2. Graph representation using Adjacency List.
3. Graph representation using Adjacency Matrix.
4. String Matching using finite state machine.
5. Detecting whether a number is even or odd using Finite State Machine.
6. To identify keywords such as char, const, continue using Finite State Machine.
7. To find the power set for a given set.
8. To find GCD of two numbers using recursion.
9. To find Binomial coefficients.
10. To find Permutation and Combination result for a given pair of values n and r.
11. To check a number is prime or not.
12. To calculate the Euclidean distance between two points.
13. To find the Roots of polynomials.
14. Find the shortest path pair in a plane.

GE/IC-2: NUMERICAL TECHNIQUES

OBJECTIVES:

   • To learn various numerical techniques.

- To be able to implement different numerical techniques using programming language.

Unit-1
Floating point representation and computer arithmetic, Significant digits, Errors: Round-off error, Local truncation error, Global truncation error, Order of a method, Convergence and terminal conditions, Efficient computations.

Unit-2
Bisection method, Secant method, Regula−Falsi method Newton−Raphson method, Newton's method for solving nonlinear systems.

Unit-3
Interpolation: Lagrange's form and Newton's form Finite difference operators, Gregory Newton forward and backward differences Interpolation Piecewise polynomial interpolation: Linear interpolation.

Unit-4
Numerical integration: Trapezoid rule, Simpson's rule (only method), Newton−Cotes formulas, Gaussian quadrature, Ordinary differential equation: Euler's method Modified Euler's methods, Runge-Kutta second methods

Text books
1. S.S. Sastry, "Introductory Methods of Numerical Analysis", EEE , 5/ed.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publisher, 6/e (2012)

Reference books
1. Numerical Analysis: J. K. Mantri & S. Prahan, Laxmi Publication.
2. Introduction to Numerical Analysis, Josef Stoer and Roland Bulirsch, Springer.

GE/IC – 2 PRACTICAL/TUTORIAL: NUMERICAL METHODS LAB

Implement using C/ C++ or MATLAB/ Scilab

1. Find the roots of the equation by bisection method.

2. Find the roots of the equation by secant/Regula−Falsi method.

3. Find the roots of the equation by Newton's method.

4. Find the solution of a system of nonlinear equation using Newton's method.

5. Find the solution of tri-diagonal system using Gauss Thomas method.

6. Find the solution of system of equations using Jacobi/Gauss-Seidel method.

7. Find the cubic spline interpolating function.

8. Evaluate the approximate value of finite integrals using Gaussian/Romberg integration.

9. Solve the boundary value problem using finite difference method.

GE/IC–3:STATISTICAL TECHNIQUES

OBJECTIVES

- To understand the concept of population and sample.
- To use frequency distribution to make decision.
- To understand and to calculate various types of averages and variation.

Unit-1
Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample.**Data:** quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, intervaland ratio. **Presentation:** tabular and graphical, including histogram.

Unit-2
Measures of Central Tendency: mathematical and positional. **Measures of Dispersion:** range, quartiledeviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments,factorial moments, skewness and kurtosis, Sheppard's corrections.

Unit-3
Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3-variables only), rankcorrelation. Simple linear regression.

Unit-4
Principle of least squares and fitting of polynomials and exponential curves. Theory of attributes:Independence and association of attributes, consistency of data, measures of association and contingency,Yule's coefficient of colligation.

Text Books:
1. S.C. Gupta, Fundamentals of Statistics, Sultan chand & sons, Delhi.
2. A.M.Goon, M.K.Gupta and B. Dasgupta, Fundamentals of Statistics, The World Press, Kolkata.

Reference Books:
1. S.P. Gupta, Statistical Methods, Sultan Chand and sons New Delhi

GE/IC–3PRACTICAL/TUTORIAL: STATISTICAL TECHNIQUES LAB

List of Practical
1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.
7. Karl Pearson's correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Lines of regression, angle between two lines of regression and estimated values of variables.
10. Spearman rank correlation with and without ties.
11. Partial and multiple correlations.
12. Planes of regression and variances of residuals for given simple correlations.

GE/IC-4:OPERATIONS RESEARCH

OBJECTIVES:

- To enable the students to understand various operational research methods.
- To learn various methods ofsolving optimization problems.

Unit-1
Linear Programming: Formulation of L.P. Problems, Graphical Solutions (Specialcases: Multiple optimal solution, infeasibility, unbounded solution); Simplex Methods(Special cases: Multiple optimal solution, infeasibility, degeneracy, unbounded solution)Big-M method and Two-phase method; Duality and Sensitivity (emphasis on formulation& economic interpretation); Formulation of Integer programming, Zero-oneprogramming, Goal Programming.

Unit-2
Elementary Transportation: Formulation of Transport Problem, Solution by N.W. CornerRule, Least Cost method, Vogel's Approximation Method (VAM), Modified DistributionMethod. (Special cases: Multiple Solutions, Maximization case, Unbalanced case,prohibited routes) Elementary Assignment: Hungarian Method, (Special cases: MultipleSolutions, Maximization case, Unbalanced case, Restrictions on assignment.)

Unit-3
Network Analysis: Construction of the Network diagram, Critical Path- float and slackanalysis (Total float, free float, independent float), PERT, Project Time Crashing

Unit-4
Decision Theory: Pay off Table, Opportunity Loss Table, Expected Monetary Value,Expected Opportunity Loss, Expected Value of Perfect Information and SampleInformation

Text Books:
1. N. D. Vohra, Quantitative Management, Tata McGraw Hill.
2. P. K. Gupta, Man Mohan, KantiSwarup, Operations Research, Sultan Chand.

Reference Books:
1. V. K. Kapoor, Operations Research, Sultan Chand & Sons.
2. J. K. Sharma, Operations Research Theory & Applications, Macmillan IndiaLimited.

GE/IC-4 Practical/Tutorial: Operations Research Lab

Use C/C++ for implantation of the following Problems.
1. Mathematical formulation of L.P.P and solving the problem using graphical method.
2. Mathematical formulation of L.P.P and solving the problem using Simplextechnique.
3. Allocation problem using Transportation model
4. Allocation problem using Assignment model
5. Networking problem using CPM and PERT

Equipment

1.**Desktop Computer**

Core i5 (minimum 8th Generation Processor, 8 GB RAM, 2 TB HDD)

Number of Desktops: 30 (or as per student strength). It must be connected through structured Local Area Network (LAN).

2.Software

LibreOffice, Scilab, C, C++, Java, Assembler, VHDL, Linux/ Unix Prolog etc. preferably Open Source Software.

Faculty Training

Faculty training may be organized for the following Courses in phased manner (six month before the beginning of the Subject in the concerned semester).

    i.   Digital Logic

ii.   Computer Organization
iii.   Data Structure
iv.   Operating System
v.   Database Systems
vi.   Java Programming
vii.   Web Technology
viii. Data Science
ix. Python Programming
x.   Android Programming