Appendix- A

SAMBALPUR UNIVERSITY

JYOTI VIHAR, BURLA-768019

Two Year M.Sc. Degree Course in

Computer Science

M.Sc. Computer Science

(Effective from Academic year 2022-2023)

Semester Structure

First Semester - August to December.

Second Semester - January to June.

Third Semester - July to December.

Fourth Semester - January to June.

Course Structure of M.Sc. Computer Science Programme

Semester - I	Semester - II	Semester - III	Semester - IV
Object Oriented Programming using C++	Programming with JAVA	Python Programming	Software Engineering
Data Structure	Database Management System	Internet of Things	Web Technology
Operating System	Data Communication &Networking	Digital Image Processing	Computer Graphics
Computer Organization and Architecture	Discrete Mathematics	Design and Analysis of Algorithm	Lab on Web Technology
Lab on C++	Lab on JAVA Programming	Lab on Python Programming	Lab on Computer Graphics
Lab on Operating System	Lab on DBMS	Lab on Digital Image Processing	Dissertation /Project
Env. Studies & Disaster Management	Inter Dept. Course (IDC) or Open Elective	Entrepreneurship Development	
Yuva Sanskar	NCC/NSS/Sports/Performing Arts/Yoga (any one)	MOOCs (one paper)	

Semester - I

Course Code	Course Title	No. of Credits	Hours/Week
MSC101	Object Oriented Programming using C++	4	4
MSC102	Data Structure	4	4
MSC103	Operating System	4	4
MSC104	Computer Organization and Architecture	4	4
MSC105	Lab on C++	2	2
MSC106	Lab on Operating System	2	2
ESDMS -419	Env. Studies & Disaster Management	2	2
	Yuva Sanskar	0	
Total Credits	**22**	-	

Semester – II

Course Code	Course Title	No. of Credits	Hours/Week
MSC201	Programming with JAVA	4	4
MSC202	Database Management System	4	4
MSC203	Data Communication &Networking	4	4
MSC204	Discrete Mathematics	4	4
MSC205	Lab on JAVA Programming	2	2
MSC206	Lab on DBMS	2	2
IDC(Dept. Code)-429	Inter Dept. Course (IDC) or Open Elective	3	3
	NCC/NSS/Sports/Performing Arts/Yoga (of which one has to be opted)	0	
Total Credits	**23**	-	

Semester – III

Course Code	Course Title	No. of Credits	Hours/Week
MSC301	Python Programming	4	4
MSC302	Internet of Things	4	4
MSC303	Digital Image Processing	4	4
MSC304	Design & Analysis of Algorithm	4	4
MSC305	Lab on Python Programming	2	2
MSC306	Lab on Digital Image Processing	2	2
MSC307	MOOCs one paper	3	3
EDPS -439	Entrepreneurship Development	2	2
Total Credits	**25**	-	

Semester – IV

Course Code	Course Title	No. of Credits	Hours/Week
MSC401	Software Engineering	4	4
MSC402	Web Technology	4	4
MSC403	Computer Graphics	4	4
MSC404	Lab on Web Technology	2	2
MSC405	Lab on Computer Graphics	2	2
MSC406	Dissertation/Project	4	4
Total Credits	**20**	-	

Total Credits of the Course

Semesters	Sem - I	Sem - II	Sem - III	Sem - IV	TOTAL
Credits	22	23	25	20	**90**

NOTE:

- Furthermore, following non-credit course will be taken by the students
  1. Yuva Sanskar in 1st Semester
  2. NSS/ NCC/ Sports/ Performing Arts/ Yoga (any one) in 2nd Semester.
- Students have to opt for a Inter Department Course (IDC) offered by other departments of the university in 2nd Semester.

- Students will, apply in prescribed form their preference for NCC/NSS/sports/Performing Art/Yoga at the beginning of the session, i.e., in 1st Semester.

- The students will take one MOOCs Course other than the core courses present in the MSc Computer Science syllabus. The student may opt according to his/her preference in consultation with HOD from 1st Semester and submit document in support of undertaking the MOOCs course to the Department. Further, the student has to submit the completion certificate of the opted MOOCs course before the exam form fill up in 4th Semester.

First Semester

Course Title: OBJECT ORIENTED PROGRAMMING USING C++

Course Code: MSC101

No. of Credits - 4

Objectives

- To understand basics of OOPS which includes classes, objects etc.
- To understand inheritance, polymorphism concept
- To understand how to use exceptional handling in C++

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Object-Oriented Programming using C++ Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of Object-Oriented Programming using C++
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained

UNIT-I

Object-Oriented programming paradigm, Basic data types, Tokens, Keywords, Identifiers, Variables, Operators: Arithmetic, Relational, Logical, Assignment, Ternary, Bitwise, Unary Operators, Expressions and statements, Input and Output in C++, manipulators with parameters, Flow of control - if, if-else, while, do-while, for loop, Switch, break and continue.

UNIT-II

Single and multidimensional arrays. Character array, string variables, reading multiple lines, arrays of strings, specifying the structure, accessing structure members, array of structures. Classes and objects, Class declaration, Data member and Member functions, private and public members, scope resolution operator

UNIT-III

Inline Functions, passing objects as arguments, returning objects, Function overloading, Friend function, constructors, destructors, overloaded constructors, Types of Constructors, operator overloading: Unary Operator, Binary Operator

UNIT-IV

Inheritance: Derived Class and Base Class, accessing base class members, the protected access specifier, abstract base class, single, multilevel, multiple inheritance, ambiguity in multiple inheritance. Polymorphism, pointers, Virtual base class, Virtual functions & dynamic binding, Exception handling.

Books Recommended:

1. E. Balguruswamy,"Object-Oriented programming with C++",TMH, 5th Edition, 2011
2. R.Lafore,"Object-oriented programming in TURBOC++", Galgotia, 1st Edition, 1997
3. Y.P.Kanetkar,"Let us C++", BPB publication , 2nd Edition, 2015
4. Stanley B. Lippman, Josée Lajoie, "C++ Primer", Pearson Education, 4th Edition

FIRST SEMESTER
Course Title: DATA STRUCTURE
Course Code: MSC102
No. of Credits - 4

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.

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DATA STRUCTURE Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DATA STRUCTURE
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

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-II

Stack: Definition, Representation, Stack operations, Applications (Infix–Prefix–Postfix Conversion & Evaluation, Recursion). Queues: Definition, Representation, Types of queues, Queue operations, Applications.

Unit-III

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-IV

Sorting: Selection Sort, Bubble sort, Insertion Sorts, Merge Sort, Quick Sort, Radix Sort, Heap sort. Searching: Linear search, Binary search.

Books Recommended:

1. Classic Data Structure, P. Samanta , PHI , 2/ed.
2. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Galgotia Publications, 2000.
3. Sastry C.V., Nayak R, Ch. Rajaramesh, Data Structure & Algorithms, I. K. International Publishing House Pvt. Ltd, New Delhi.

FIRST SEMESTER
Course Title: OPERATING SYSTEM
Course Code: MSC103
No. of Credits - 4

Objectives

- To know the basics such as process and CPU scheduling algorithms
- To understand the critical regions and dead lock problem
- To understand virtual memory concept, thrashing problem and page replacement algorithms
- To understand the file tables, access algorithms, and spoofing

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Operating System Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Operating System
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

Evolution of Operating Systems: Types of operating systems, Operating system services. The process management: Process concept, Process Control Block, Short term, medium term, and long-term Schedulers, Context Switch, Operation on Processes.

UNIT-II

CPU Scheduling: CPU Scheduler, preemptive Scheduling, Scheduling criteria, Scheduling Algorithms-FCFS, SJF, Priority and round robin scheduling. Deadlocks: Necessary conditions for deadlock, Resource Allocation graph, Methods of handling Deadlocks, Deadlock prevention & avoidance, Deadlock Detection and deadlock Recovery

UNIT-III

Memory Management: Logical versus physical Address, Swapping, Single partition allocation, multiple partition allocation, paging, segmentation. Demand paging, Virtual memory, page fault, Page replacement algorithms-FIFO, Optimal, LRU.

UNIT-IV

File Systems: general model of a file system, Disk structure, disk scheduling: FCFS scheduling, SSTF scheduling, SCAN scheduling, C-SCAN scheduling, LOOK scheduling.

Books Recommended:

1. Silberschatz& P.B. Galvin, "Operating Systems Concepts", Addison - Wesley, 9th Edition, 2012
2. Tanenbaum," Modern Operating System", Pearson Education, 3rd Edition, 2015
3. William Stallings ,"Operating Systems: Internals and Design Principles", 6th Edition
4. Dhananjay Dhamdhere, "Operating System a Concept Based Approach", 3rd Edition, 2017

FIRST SEMESTER
Course Title: COMPUTER ORGANIZATION AND ARCHITECTURE
Course Code: MSC104
No. of Credits - 4

Objectives

- To impart the essential knowledge on the fundamentals and applications of digital circuits and digital computing principles
- To provide an overview on the design principles of digital computing systems
- To provide technical knowledge about various digital hardware components

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Computer Organization and Architecture Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Computer Organization and Architecture
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I:

Basic organization of the computer and block level description of the functional units as related to the execution of a program. Digital logic gates, Boolean algebra, Boolean Function and simplification, Simplification of Boolean function using K-Map. Canonical form of Boolean functions-SOP and POS.

UNIT-II:

Combinational and Sequential Circuits- Adders, Subtractors, Carry-Look-Ahead (CLA) adder, encoder and decoders, multiplexer and demultiplexer. Flip Flops- RS, JK, D, T and Master Slave Flip Flops. Registers and counters.

UNIT-III:

CPU Organization: Instruction codes, Computer Instructions, Instruction Cycles, Execution of Instructions, Instruction Formats (Zero, One and Two address instruction), Addressing Modes, Discussions about RISC versus CISC architectures.

UNIT-IV:

Memory and IO access: Memory maps, Read Write operation, Programmed IO and interrupt driven IO, DMA controller and data transfer. Memory organization: static and dynamic memory, Memory Hierarchy, cache memory and its access techniques; Virtual memory.

Books Recommended:

1. M. Morris Mano, "Computer System Architecture", PHI, 3rd Edition
2. William Stallings , "Computer Organization and Architecture", Pearson / PHI, 9th Edition, 2013
3. B.RAM , "Fundamentals of Microprocessor and Microcontrollers", Dhanpat Rai Publication, 2010 Edition

FIRST SEMESTER
Course Title: LAB ON C++ PROGRAMMING
Course Code: MSC105
(Based on Paper-MSC 101: PROGRAMMING IN C++)
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Lab on C++ Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of Lab on C++
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

FIRST SEMESTER
Course Title: LAB ON OPERATING SYSTEM
Course Code: MSC106
(Based on Paper-MSC 103: OPERATING SYSTEM)
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Lab on Operating System Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Lab on Operating System
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

FIRST SEMESTER
Course Title: ENV. STUDIES & DISASTER MANAGEMENT
Course Code: ESDMS -419
No. of Credits - 2

SECOND SEMESTER

Course Title: PROGRAMMING WITH JAVA

Course Code: MSC201

No. of Credits - 4

Objectives

- To understand basic syntax of JAVA programming language
- To able to understand concepts of inheritance and polymorphism in java
- To understand use of exceptional handling in JAVA

Programme Education Objectives

PEO1	Understand the nature and basic concepts of PROGRAMMING WITH JAVA Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of PROGRAMMING WITH JAVA
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT I

Overview of Java Language, JDK, Differences between Java and C, and Java and C++, Tokens, Keywords, Identifiers, Data types, Variables, Operators: Arithmetic, Relational, Logical, Assignment, Bitwise, Conditional Operators, Special Operators, Expressions and statements, Flow of control - if, if-else, while, do-while, for loop, switch statement, label, break and continue

UNIT II

Class and Object Creation, Reference variable, Constructor in Java, Method overloading, Constructor overloading, Static Class and methods, Abstract methods, and Abstract Class, Inheritance: Derived Class and Base Class, specifying the derived class, accessing base class members, Single Level, super, this, Multilevel, Hierarchical, Multiple Inheritance through Interface.

UNIT III

Package in Java, Access specifiers and its scope, 1D arrays: Declaration, Creation, and Initialization, Array length, 2D Array, variable size arrays, Strings, String Methods, String Buffer Class, Wrapper Classes: Autoboxing and Unboxing, standard system streams, IO streams.

UNIT IV

Multithreading: Thread Lifecycle, Thread Class, Runnable Interface, Synchronization,
File & Stream: File Class, I/O Stream Hierarchy, File Input Stream, File Output Stream
Exception handling: Definition, Types of Errors, Built-in Exception, User Defined Exception

Books Recommended:

1. Herbert Schildt, "JAVA- The Complete Reference", Mcgraw Higher Ed, 7th Edition, 2007
2. David Flanagan**,** "Java in Nutshell", O'Reilly, 6th Edition, 2015
3. E. Balaguruswami,"Programming with JAVA 5th Edition", Mcgraw Higher Ed, 5th Edition, 2014

SECOND SEMESTER
Course Title: DATABASE MANAGEMENT SYSTEM
Course Code: MSC202
No. of Credits - 4

Objectives

- To understand the different database models and language queries to access databases
- To understand the normalization forms in building an effective database table
- To protect the data and the database from unauthorized access and manipulation
- To get basic idea about transaction and concurrency control system
- To get basics of distributed databases

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DBMS
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DBMS
CO2	Analyse the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

Database: Definition, Database Management, Structure, Limitations of traditional file processing systems, Advantages and disadvantages of DBMS, Users of DBMS. Components of DBMS, Data Independence and 3-tier architecture and View of Data. Data Model: Hierarchical, Network, Relational, Entity Relationship model: Concepts of entity, entity set, attributes, E-R diagram.

UNIT-II

Relational Query Languages, Relational Algebra and operations, Tuple and Domain Relational Calculus, Functional Dependency, Super key, Candidate Key, Primary Key, Alternate and foreign keys. Strong and weak entities. Integrity constraints. SQL- Languages: DDL, DML and DCL.

UNIT-III

Relational Database Design: Normal Forms (1NF, 2NF, 3NF, BCNF), Decomposition, Dependency Preservation and Lossless Join. Codd's rules. Object Oriented Databases Need for OODBMS, Object structure: Class, polymorphism, encapsulation, inheritance.

UNIT-IV

The distributed databases -Motivation for Distributed Database, Distributed Database concepts. Transaction Management: Transaction Management and Concurrency Control Transaction: Properties (ACID), states, Commit, Rollback Concurrency: Control, Lost update problems, Locks, two phase locking, serialization.

Books Recommended:

1. Silberschatz, Korth, Sudarshan, "Database System Concepts", McGraw Hill, 4th Edition 2002
2. Elmasari, Navathe," Fundamentals of Database Systems", Pearson, 7th Edition, 2016
3. Ramakrishnan, "Database Management Systems", Mcgraw Higher Ed, 3rd Edition, 2014
4. Atul Kahate,"Introduction to Database Management Systems", Pearson Education, 1st Edition,2004

SECOND SEMESTER
Course Title: DATA COMMUNICATION & NETWORKING
Course Code: MSC203
No. of Credits - 4

Objectives

- To provide insight about networks, topologies, and the key concepts
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities
- To understand the principles, key protocols, and significance of each layer in ISO and TCP/IP

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DATA COMMUNICATION & NETWORKING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DATA COMMUNICATION & NETWORKING
CO2	Analyse the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I:

Overview of Data Communications and Networking. Networking - Needs and Advantages, Network Types- Client, Server and Peers. Network Topology-Bus, Ring, Star and Mesh Topologies. Mode of data communication. Physical Layer: Analog and Digital, data and signals, Signal properties, Data Rate Limits, Transmission Impairment.

UNIT-II

Digital Transmission: Line coding, Pulse Code Modulation(PCM), Transmission mode. Analog Transmission: Modulation of Digital Data (ASK, FSK, PSK, QAM), Modulation of Analog signals (AM, FM, PM). Multiplexing: FDM, WDM and TDM, Transmission Media: Guided Media, Unguided media (wireless)

UNIT-III

Data Link Layer: Flow and error Control, Stop-and-wait ARQ. Go-Back-N -ARQ, Selective Repeat ARQ, Point-to-Point Access: Point-to Point Protocol, Multiple-Access: Random Access, Controlled Access, Channelization. Local Area Network: Ethernet, Token bus (IEEE- 802.4), Token ring (IEEE-802.5).

UNIT-IV

Network Layer: Internetworking, IPv4 addressing and Subnetting, IPv6 Address, Internet Protocol (IP), Transport Layer: Process to process Delivery, Client Server Paradigm, Port Number, UDP, TCP congestion control. Application Layer: Domain Name System (DNS), Electronic Mail, and File transfer (FTP), Telnet, HTTP and WWW,

Books Recommended:

1. B.A. Forouzan,"Data Communication and Networking", TMH, 4th Edition, 2006
2. A.S. Tannenbaum, "Computer Networks", Pearson, 5th Edition, 2012
3. William Stallings , "Data and Computer Communications", Pearson, 8th Edition, 2009

SECOND SEMESTER
Course Title: DISCRETE MATHEMATICS
Course Code: MSC204
No. of Credits - 4

Objectives

- To get familiar and understand the fundamental notions in discrete mathematics
- To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics
- To identify the basic properties of graphs and trees and model simple applications
- To understand the basic concept of group theory and its application
- To get familiar with some statistical measures

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DISCRETE MATHEMATICS Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DISCRETE MATHEMATICS
CO2	Analyse the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT - I

Fundamentals of logic, Prepositional equivalences, Predicates and Quantifiers, Mathematical Induction. Sets, Set operations, Properties of binary relations, Equivalence relations and partitions, Partial ordering relations and lattices, Properties of lattices, Distributive and Complemented lattices, Boolean algebra,

UNIT - II

The basics of counting, Permutations and Combinations, Recurrence relations, Solving Recurrence relations, Generating functions

UNIT - III

Groups, Subgroups, Cosets and Lagrange's Theorem, Codes and Group codes, Homomorphism and Normal subgroups, Isomorphism, Ring, Integral Domains and Fields.

UNIT-IV

Introduction to graphs, Graph terminology, Representing graphs and Graph isomorphism, Euler and Hamilton paths, Introduction to trees, Applications of trees.

Frequency Distribution, Measures of Central Tendencies, Dispersion, Skewness, Kurtosis, Mathematical Expectation.

Books Recommended:

1. Kenneth H. Rosen, "Discrete Mathematics & Its Application", TMH, 7th Edition, 2011
2. C. L. Liu, "Elements of Discrete Mathematics", TMH, 2nd Edition, 2000
3. BernardiKolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structure", PHI, 6th Edition, 2008
4. S.P.Gupta,"Statistical Methods", S.Chand& Sons, 2011 Edition

SECOND SEMESTER
Course Title: LAB ON JAVA PROGRAMMING
Course Code: MSC205
(Based on Paper- MSC201: PROGRAMMING WITH JAVA)
No. of Credits - 2 F.M. -100

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON JAVA PROGRAMMING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON JAVA PROGRAMMING
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

SECOND SEMESTER
Course Title: LAB ON DBMS
Course Code: MSC206
(Based on Paper- MSC202: DATABASE MANAGEMENT SYSTEM)
No. of Credits - 2 F.M. -100

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON DBMS Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON DBMS
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

SECOND SEMESTER
Course Title: Inter Department Course (IDC)
Course Code: IDCCSA-429
No. of Credits - 3

Students have to opt for a Inter Department Course (IDC) offered by other departments of the university.

THIRD SEMESTER
Course Title: Python Programming
Course Code: MSC301
No. of Credits - 4

Objectives

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

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Python Programming Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of Python Programming
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Introduction: Installation, First Python Program: Interactive Mode Programming, Script Mode Programming; Identifiers, Reserved Words, Lines and Indentation, Multi-Line Statements, Quotation & Comments; Assigning Values to Variables, Multiple Assignment.

Unit-II

Standard Data Types: Numbers, Strings, Lists, Tuples, Dictionary, Set; Basic Operators: Arithmetic, Comparison, Assignment, Bitwise; Python Numbers & Mathematical functions.

Unit-III

Python statements and Loops: if, if-else, While, for loops, break, continue, pass; Functions: Definition, call, positional and keyword parameter. Default parameters, variable number of arguments, lambda function.

Unit-IV

Object Oriented Programming: classes and objects – Inheritance, Polymorphism; Error handling & Exceptions - try, except and raise, File Processing: reading and writing files.

Books Recommended:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012

THIRD SEMESTER
Course Title: INERNET OF THINGS
Course Code: MSC302
No. of Credits - 4

Objectives

- To provide insight about Intent of Things, topologies, and the key concepts
- To gain comprehensive knowledge about the IoT connectivity, Data Protocols, Communication Protocols.
- To understand the principles and process to implement IoT applications.
- To understand the integration of Cloud services with IoT devices to witness real-time IoT communication.

Programme Education Objectives

PEO1	To understand the fundamentals of Internet of Things.
PEO2	To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards.
PEO3	To apply the concept of Internet of Things in the real-world scenario
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Student should be able to design a portable IoT using Arduino/ equivalent boards and relevant protocols.
CO2	Student should be able to develop web services to access/control IoT devices.
CO3	Student should be able to deploy an IoT application and connect to the cloud.
CO4	Student should be able to analyse applications of IoT in real time scenario

UNIT-I

Introduction to Internet of Things: Sensing, Actuation, Basic components of IoT, Applications, Service Oriented Architecture, Basics of associated technologies with IoT (Cloud Computing, WSN, IoV, M2M, CPS, IoE), Challenges in IoT,

UNIT-II

Connectivity: IPv6, RPL ,
Data Protocol: MQTT, CoAP, AMQP
Communication Protocols: IEEE 802.15.4, ZigBee, 6LowPAN, Bluetooth, NFC, RFID

UNIT-III

Implementation of IoT: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED and push button, Basic Networking with ESP8266 Wi-Fi module, Various Wi-Fi library, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

UNIT-IV

Cloud Computing: Recent trends in Computing, NIST visual model, Characteristics, components, service model (SaaS, PaaS, IaaS), Public cloud, private cloud and hybrid clouds, Service management and security, Cloud simulators, Open-source clouds, commercial clouds, IOT Cloud platforms, ThingSpeak API, Interfacing ESP8266 with Web services

Books Recommended:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

THIRD SEMESTER
Course Title: DIGITAL IMAGE PROCESSING
Course Code: MSC303
No. of Credits - 4

Objectives

- To learn the fundamental concepts of Digital Image Processing
- To study basic image processing operations
- To understand image analysis algorithms
- To expose students to current applications in the field of digital image processing

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DIGITAL IMAGE PROCESSING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DIGITAL IMAGE PROCESSING
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

What is Digital Image Processing, Fundamental Steps in Digital Image Processing, Elements of Visual Perception, Image Sampling and Quantization, Some basic relationships between Pixels, Image Enhancement: Gray Level Transformation: Image Negatives, Log Transformations, Histogram Processing: Histogram Equalization, Basics of Spatial Filtering

UNIT-II

Image Transforms; Fourier Transform and their properties, Smoothing Frequency-Domain Filtering: Ideal, Butterworth, Gaussian Low pass Filters, Sharpening Frequency Domain Filtering: Ideal, Butterworth, Gaussian High pass Filters.

UNIT-III

Image Restoration: A model of the Image Degradation/Restoration Process, Noise Models. Restoration in the Presence of Noise Only-spatial Filtering. Estimating the Degradation Function. Inverse Filtering. Minimum Mean Square Error (Wiener) Filtering. Morphological Image Processing: Preliminaries. Dilation and Erosion. Opening and Closing, The Hit-or- Miss Transformation.

UNIT-IV

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression: Variable length coding, LZW coding, Image Segmentation: Detection of Discontinuity, Edge linking and Boundary Detection, Region based Segmentation.

Books Recommended:

1. R.C.Gonzalez&R.E.Wood, "Digital Image Processing", Addison Wesley.
2. B.Channda&D.Dutta,"Digital Image Processing and Analysis", PHI, 2nd Edition, 2011
3. A.K.Jain, "Fundamentals of Digital Image Processing",Pearson Education, 1st Edition, 2015

THIRD SEMESTER
Course Title: DESIGN AND ANALYSIS OF ALGORITHM
Course Code: MSC304
No. of Credits - 4

Objectives

- To understand the importance of algorithm and its complexity
- To analyse the complexity of an algorithm in terms of time and space complexities
- To design and implement various programming paradigms and its complexity

Programme Education Objectives

PEO1	Understand the nature and basic concepts of the subject
PEO2	To understand the importance of algorithm and its complexity
PEO3	To design and implement various algorithm design paradigms
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DESIGN AND ANALYSIS OF ALGORITHM
CO2	Analyse the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

Algorithms and Complexity: Introduction to Algorithm, Asymptotic Notations and Basic Efficiency Classes (Big O, θ, Ω, ω, little o) in analysis of algorithms. Growth of functions, Recurrences: Recursive algorithms, Substitution method, Recurrence Tree method, Master method.

UNIT-II

Sorting and Searching Techniques: Bubble Sort, Insertion Sort, Sequential Search, Binary Search, Depth First Search and Breadth First Search, Divide and Conquer Paradigm: problem solving, Algorithm design and Complexity of Merge Sort, Quick Sort. Heap Sort: Heaps, Maintaining Heap property, Building a heap, Heap Sort algorithm, Priority Queues.

UNIT-III

Greedy Techniques: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's and Bellman Ford Algorithm, Huffman Trees, Fractional Knapsack problem. Dynamic Programming Paradigm : Floyd-Warshall Algorithm, Matrix Chain Multiplication Problem, Longest Common Subsequence Problem, 0/1 Knapsack Problem.

UNIT-IV

Travelling Salesman Problem and its State Space Search Tree. Introduction to Computability: Complexity Classes, P, NP, NP-Hard, NP-Completeness and Reducibility, Approximation Algorithms: Vertex Cover Problem.

Books Recommended

1. Horowitz E. &Sahni S and S.Rajasekaran,"Fundamentals of Computer Algorithms", Universities Press, 2nd Edition, 2008
2. Aho, Hopcroft & Ullman, "The Design and Analysis of Computer Algorithms", Pearson, 1st Edition, 1974
3. T.H.Coremen, C.E Leiserson, R.L.Rivest and C.Stein," Introduction to Algorithms", PHI, 3rd Edition, 2009.

THIRD SEMESTER
Course Title: LAB ON PYTHON PROGRAMMING
(Based on Paper- MSC301: PROGRAMMING WITH PYTHON)
Course Code: MSC305
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON PYTHON PROGRAMMING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON PYTHON PROGRAMMING
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

THIRD SEMESTER
Course Title: LAB ON DIGITAL IMAGE PROCESSING
(Based on Paper- MSC303: DIGITAL IMAGE PROCESSING)
Course Code: MSC306
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON DIGITAL IMAGE PROCESSING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON DIGITAL IMAGE PROCESSING
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

THIRD SEMESTER
Course Title: MOOCs
Course Code: MSC307
No. of Credits - 3

Students have to opt for a MOOCs course offered in SWAYAM/ NPTEL platform.

FOURTH SEMESTER
Course Title: Software Engineering
Course Code: MSC401
No. of Credits - 4

Objectives

- To understand the importance of software engineering lifecycle models in the development of software
- To understand the various design principles in modelling a software
- To develop a software which adheres to the standard benchmarks
- To undergo the technical knowledge in the process of software testing outcomes

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Software Engineering &OOAD Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Software Engineering &OOAD
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

Introduction: Software Life cycle Models, project planning, metrics (LOC, Functional Point), estimation techniques: empirical and heuristic (COCOMO), Scheduling: Work Breakdown Structure, Critical Path Method, PERT chart, Risk management, Requirements analysis and specification: Requirement gathering and analysis, Software Requirement Specification.

UNIT-III

Software Design: Overview of Design, Cohesion and coupling, Function oriented software design: Data Flow Diagrams, Object-oriented Design: Object modeling using UML, use case diagram, class diagram, Interaction diagrams: activity diagram, Package, Component and Deployment diagram, State chart Diagram.

UNIT-IV

Coding and Testing: Coding, Code review, software documentation, testing, unit testing, black box and white box testing, integration and system testing. Maintenance: Characteristics, maintenance tasks, types of maintenance, software maintenance process models, Estimation of maintenance cost.

UNIT-IV

Software quality: SEI CMM and ISO-9000. Software reliability and fault-tolerance. Computer-aided software engineering (CASE): Characteristics of CASE Tools, Architecture of CASE environment, Software reuse.

Books Recommended:

1. Rajib Mall," Fundamentals of Software Engineering", PHI, 4th edition.
2. R.S. Pressman, "Software Engineering Practitioner's Approach", TMH, 7th Edition, 2010
3. Pankaj Jalote, "A Concise Introduction to Software Engineering", Springer

FOURTH SEMESTER
Course Title: Web Technology
Course Code: MSC402
No. of Credits - 4

Objectives

- To understand basic concept of internet and web browsing
- Learn to create web page using HTML
- Learn to format the web page
- Learn to host own website on internet
- To understand the basics of PHP and MYSQL

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Web Technology Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Web Technology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Introduction to WWW: Protocols and programs, secure connections, application and development tools, the web browser, what is server. Web Design: Web site design principles, planning the site and navigation, Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure

Unit-II

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

Unit- III

JavaScript: Client-side scripting, what is Java script, how to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.

Ajax: Introduction, advantages & disadvantages, Purpose of it, ajax based web application, alternatives of ajax

Unit-IV

PHP: Starting to script on server side, Arrays, function and forms, advance PHP, cookies, sessions Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

Books Recommended:

1. Steven Holzner," HTML Black Book " , Dreamtech press.
2. Web Technologies, Black Book , Dreamtech press.
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley

FOURTH SEMESTER
Course Title: Computer Graphics
Course Code: MSC403
No. of Credits - 4

Objectives

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

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Computer Graphics Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of Computer Graphics
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

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-II

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- III

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-IV

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.

Books Recommended:

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.
3. D. F. Rogers, “Procedural Elements for Computer Graphics”, MGH

FOURTH SEMESTER
Course Title: Lab on Web Technology
Course Code: MSC404
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON WEB TECHNOLOGY
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON WEB TECHNOLOGY
CO2	Analyze the Various Concepts to understand them through practical
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

FOURTH SEMESTER
Course Title: Lab on Computer Graphics
Course Code: MSC405
No. of Credits - 2

Programme Education Objectives

PEO1	Understand the nature and basic concepts of LAB ON COMPUTER GRAPHICS Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of LAB ON COMPUTER GRAPHICS
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

FOURTH SEMESTER
Course Title: Dissertation/ Project
Course Code: MSC406
No. of Credits - 4

Project work of 4th Semester will be assigned to the student(jointly or individually) at the beginning of the 3rd semester and will be completed in the 4th semester.

Semester wise work and distribution of marks in % for project			
III Semester (20%) Evaluation of Interim Report of the Project Work			
Background of the Problem (5%)	Review of Literature (5%)	Objectives (5%)	Methodology (5%)
IV Semester (80%) Evaluation of Final Report of the Project Work			
Project work (50%)		Viva (30%)	

SECOND SEMESTER
Course Title: COMPUTER FUNDAMENTAL
Inter Dept. Course (IDC) or Open Elective
Course Code: IDC(CSA)-429
No. of Credits -3

Unit-1
Introduction: Introduction to computer system, uses, types.
Data Representation: Number systems and character representation, binary arithmetic,
Software: Introduction, types of software, fundamentals of Operating system, utility programs

Unit-2
Input and output devices (with connections and practical demo): keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer
Computer Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks

Unit-3
Computer Organization and Architecture Fundamentals: C.P.U., registers, system bus, main memory unit, cache memory,
Computer Networking Fundamentals: Introduction, Types of Networks, Internet, Email, Client-Server, Web Services.

Recommended Books:

1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
3. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007