GANGADHAR MEHER UNIVERSITY
AMRUTA VIHAR,SAMBALPUR,ODISHA

SCHOOL OF COMPUTER SCIENCE

Syllabus for

M.Sc. in Computer Science

(2-Year Programme)

Course Effective from Academic Year 2021-2022

SCHOOL OF COMPUTER SCIENCE

PROGRAM OUTCOMES(POs):

PO1. **Knowledge and Understanding**: Develop an ability to understand the theoretical foundations of computer science for designing efficient methodologies along with the knowledge of limitations of computing.

PO2. **General, Technical and Professional Skills:** An ability to function effectively as an individual with diversified skills or as a part of a multi-disciplinary team setting to accomplish defined goals.

PO3. **Application of Knowledge and Skills**: Developing problem analysis skills and knowledge and applying the same in real life situation.

PO4. **Research Skills:** Explore research based knowledge and carry out academic investigations on the cutting edge technologies in allied subjects of Computer Science.

PO5. **General Learning Outcomes:** Create, select and apply advanced techniques and tools including modelling complex activities related to Computer Science.

PO6. **Constitutional, Humanistic, Ethical and Moral Values:** Design, develop and evaluate new system components or processes of computer science that meet the desired needs with appropriate considerations of industry, society, public health, safety, culture, environment and sustainable development sticking on to the ethics and values.

PO7: Employability Job Skills and Entrepreneur Skills: Prepare the students to take up a career as versatile contributors in industry, academia, research and development or entrepreneurship employing their expertise to advance personal growth while making meaningful contributions to societal progress

PROGRAM SPECIFIC OUTCOMES(PSOs):

PSO1. To shield students from the rapid obsolescence of computer technology, the program focuses on imparting foundational knowledge, fostering critical thinking skills, and cultivating technical expertise.

PSO2. Apply principles of computer science theory and concepts of software development to create effective computing-based solutions.

PSO3. Empowering the students to function as adept computer science professionals across various domains, including industry, advanced studies, research and development, academia, or entrepreneurship.

Post Graduate
Programme Structure

Year	Semesters	
First Year	Semester I	Semester II
Second Year	Semester III	Semester IV

Part-I: Semester-I

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
CSC101	Discrete Mathematical Structures	20	80	100	4	4
CSC102	Computer Architecture	20	80	100	4	4
CSC103	Data Communication & Networks	20	80	100	4	4
CSC104	Advanced Data Structures	20	80	100	4	4
CSC105	Lab (Data Structure &Python)			100	4	4
Total				**500**		**20**

Part-I: Semester-II

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
CSC201	Object Oriented Programming using JAVA	20	80	100	4	4
CSC202	Mobile Computing	20	80	100	4	4
CSC203	Advanced Operating Systems	20	80	100	4	4
CSC204	Theory of Computation	20	80	100	4	4
CSC205	Lab (Java and OS)			100	4	4
DSE –Papers						
CSC206 A	**Data Warehousing and Mining**	20	80	100	4	4
CSC206 B	**Wireless Sensor Networks**	20	80	100	4	4
CSC206 C	**Internet of Things**	20	80	100	4	4
CSC206D	**Microprocessor and Microcontroller**	20	80	100	4	4
Total				**600**		**24**

Part-II: Semester-III

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
CSC301	Compiler Construction	20	80	100	4	4
CSC302	Database Management Systems	20	80	100	4	4
CSC303	Design and Analysis of Algorithms	20	80	100	4	4
CSC304	Web Technology	20	80	100	4	4
CSC305	Lab (Web Technology and DBMS)			100	4	4
IDSE Papers						
CSC306A	**Network and Internet Technologies**	20	80	100	4	4
CSC306B	**Fundamentals of Computer**	20	80	100	4	4
CSC306C	**Introduction to Programming Using Python**	20	80	100	4	4
CSC306D	**Artificial Intelligence**	20	80	100	4	4
Total				**600**		**24**

Part-II: Semester-IV

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
CSC401	Machine Learning	20	80	100	4	4
CSC402	Software Engineering & OOAD	20	80	100	4	4
CSC403	Information Security	20	80	100	4	4
CSC404	Cloud Computing	20	80	100	4	4
CSC405	Project Work Report and VIVA VOCE			100		4
Total				**500**		**20**
	Grand Total			**2200**		**88**

SEMESTER WISE CREDIT DISTRIBUTION					
Semester	**I**	**II**	**III**	**IV**	**TOTAL**
Total Credit	**20**	**24**	**24**	**20**	**88**

Semester-I

Course Name: DISCRETE MATHEMATICAL STRUCTURES

Category: Programme Core Course

Prerequisite: **Basics of set theory and combinatory.**

Learning Objective:
- The objective is to introduce Logic, Graphs and Algebraic structures.

Learning Outcome:
- Logics and graphs are the key points for algorithm, Networking, coding and many more recent areas. This course helps to understand some areas of computer science in detail.

Paper-CSC101
Discrete Mathematical Structures
UNIT-I: **10 hrs**
Fundamentals of Logic: Propositional Logic, Propositional Equivalences, Predicate and Quantifiers, nested Quantifiers, Rules of Inference.**Set Theory:** Sets, Set Operations. **Introduction to proofs**: proof by Induction, proof by contradiction, proof by cases with examples.**Mathematical Induction:** Introduction to Induction, strong Induction, Recursion. **Relations:** Relations and their properties, n-ary Relations and their applications, Representing relations, Closures of relations, Equivalence relations, and Partial Orderings.
UNIT-II: **10 hrs**
Number Theory: The division algorithm, Remainders, greatest common divisors, The fundamental theorem of arithmetic, infinity of primes. **Graphs:** Graphs, Graph models, special types of graphs, Representing graphs, Graph Isomorphism, connectivity, Euler and Hamilton paths, Planar graphs, Graph Coloring, Matching problem. **Trees**: Introduction to Trees, Applications of Trees, Binary Trees, n-ary Trees, Tree Traversal, Spanning Trees.
UNIT-III: **10 hrs**
Principles of Counting: Counting using Sum Rule and Product rule. Concepts of permutations, combinations and circular permutations. Pigeonhole Principle, Occupancy Problem. **Advanced Counting Techniques:** Recurrence relations, solving linear recurrence relations, Generating functions, Catalan Numbers, Principle of Inclusion and Exclusion, Applications of Inclusion and Exclusion.
UNIT-IV: **10 hrs**
Basic Probability: Random experiment. Sample space.Mutually exclusive events.Empirical definition of probability. Problems based on probability. Axiomatic definition of probability. Properties based on axiomatic definition of probability. Conditional probability.Independent events. **Bayes' Theorem and Applications:** Bayes' Theorem and problems based on conditional probability.
Text Book:
1. K. H. Rosen, **Discrete Mathematics & Its Applications(with Combinatoricsand Graph Theory)**, 6th Edition, McGraw-Hill, 2007.
Reference Books:

1. C.L.Liu, D. P. Mohapatra, **Elements of Discrete Mathematics: A Computer Oriented Aproach**, 3rd Edition, McGraw-Hill, 2008.
2. J.P. Tremblay, R. Manohar, **Discrete Mathematical Structures with Applications to Computer Science**, McGraw-Hill, 1997.
3. R. L. Graham, D. E. Knuth, O. Patashnik, **Concrete Mathematics : A Foundation for Computer Science**, 2nd Edition, Pearson Education, 2007.
4. D. B. West, **Introduction to Graph Theory**, 2nd Edition, PHI Learning, 2009.
5. R. A. Brualdi, Introductory Combinatorics, 4th Edition, Pearson, 2004.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.
CO2	To apply mathematical foundations, algorithmic principles, and computer science theory to the modelling and design of computer based systems.
CO3	Able to construct simple mathematical proofs and possess the ability to verify them.
CO4	Model problems in Computer Science using graphs and trees methods.
CO5	To Understand and prove fundamental results and solve algebraic problems using appropriate techniques

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	2	1	2		2	3	2	1
CO2	3	2	3		3			3	3	3
CO3	2	1	1	2	3		1	3	2	1
CO4	3		3		3			1	1	2
CO5	3	2	2	1	3		2	2	3	2

Course Name: **COMPUTER ARCHITECTURE**

Category: Programme Core Course

Prerequisite: **Digital Logic**

Learning Objective:

- To study design of an elementary basic computer
- To have a better understanding of a hardwired and microprogrammed control unit.
- To introduce the concept of memory hierarchy and pipelining to speed-up the processor

Learning Outcome:

- After this course students understand in a better way to design and interconnection of various modules of a system, the I/O and memory organization in depth.

Paper-CSC102

Computer Architecture

UNIT-I: 12 hrs

Register Transfer and Micro-operations:
Register Transfer Language, Register transfer, Bus and memory transfer, Arithmetic, Logical and Shift Micro Operation, Arithmetic Logic Shift Unit

Basic Computer Organization and Design:
Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle & Register Reference Instructions, Memory Reference Instructions, Input-Output and Interrupt. Design of Basic Computer.

UNIT-II: 12 hrs

Basic Processing Unit:
Some Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Storing a word in Memory, Execution of Complete Instruction, Branch Instructions, Multiple Bus Organization

Micro-Programmed Control:
Control Memory, Address Sequencing: Conditional branching, Mapping of Instruction, Subroutine; Micro Program Example: Computer configuration, Microinstruction format, Symbolic Microinstruction, The fetch routine, Symbolic Microprogram, Binary Microinstruction; Design of Control Unit: Microprogram Sequencer.

UNIT-III: 10hrs

Memory Organization:
Memory Hierarchy, Associative Memory: Hardware Organisation, Match Logic, Read Operation, Write Operation; Cache Memory: Associative Mapping, Direct Mapping, Set Associative Mapping, Write into Cache Memory, Cache Initialization; Virtual Memory: Address Space and Memory Space, Address mapping Using Pages, Associative Memory Page Table, Page Replacement

UNIT-IV: 8hrs

Pipeline and Vector Processing:
Parallel Processing, Pipelining: General Considerations; Arithmetic Pipeline, Instruction Pipeline: Four-segment Instruction Pipeline Example, Data Dependency, Handling of Branch Instructions; Vector Processing; Array Processors

Multiprocessors:
Characteristics of Multiprocessors, Interconnection structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache coherence

Text Books:
1. Computes Organization & Architecture-William Stallings,8th Edition (PHI) .
Reference Books:
1. Computer Architecture and Organization- Rajiv Chopra (S. Chand) 2.Computes Organization- Carl Hamacher, ZvonkoVranesic, SafwatZaky 5th Edition, McGraw-Hill Education India

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Able to know the architecture behind the system, how the systems are working.
CO2	Analyse the problems , and solve the questions by applying the mathematical formulas.
CO3	Able to solve the process of pipeline programs and figure out how they are working .
CO4	Able to Differentiate between how an uniprocessor , multiprocessor and pipeline processor.
CO5	Able to acknowledge the registers, flip flop etc are working.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	2	1	2			3	2	1
CO2	3	2	3		3			3		3
CO3	2	1	1	2	3			3	2	1
CO4	3		3		3			1	1	2
CO5	3	2	2	1	3			2	3	

Course Name: **DATA COMMUNICATION & NETWORKS**

Category: Programme Core Course

Prerequisite: **Basics of Computer**

Learning Objective:

- The objective of the course is to provide an overview of communication network functions and a good foundation for further studies in the subject. It involves understanding and application of design principles and methods for systems development and review of the underlying systems, and communications technologies and significant standardized systems.

Learning Outcome:

- Understand and be able to explain the principles of layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.

Paper-CSC103

Data Communication & Networks

UNIT-I: **12hrs**

Overview of Data Communications and Networking.**Physical Layer**: Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, TransmissionImpairment, More about signals. Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing: FDM , WDM , TDM , Transmission Media:Guided Media, Unguided media (wireless) Circuit switching and Telephone Network: Circuit switching, Telephone network.

UNIT-II: **12hrs**

Data Link Layer: Error Detection and correction: Types of Errors, Detection, ErrorCorrection Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point –to- Point Protocol, MultipleAccess, Random Access, Controlled Access, Channelization. Local area Network: Ethernet,Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs: IEEE 802.11,Bluetooth virtual circuits: Frame Relay and ATM.

UNIT-III: **12hrs**

Network Layer: Host to Host Delivery: Internetworking, addressing, Routing. Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols Transport Layer: Process to Process Delivery: UDP, TCP, congestion control and Quality of service.

UNIT-IV: **4hrs**

Application Layer: Client Server Model, Peer to peer network, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Book:

1. B. A. Forouzan, **Data Communications and Networking**, 4th Edition, Tata McGraw-Hill 2007.

Reference Books:

1.Computer Networks -A S Tenenbaum (PHI)
2. Computer Networking: A Top-Down Approach Featuring the Internet, 3/e - James F. Kurose & Keith W. Ross (Pearson Education India)

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	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Understand the properties of digital and analog signals, functionality of different layers in OSI and TCP/IP network models and the factors which impact performance of data communication systems
CO2	Understand the analog and digital transmission, properties of communication medias,and the concept of multiplexing of data on common communication channel.
CO3	Understand different switching circuits, link layer addressing and exemplifythe different coding methods and error detection and correction methods for digital data.
CO4	Identify and describe the system functions in the correct protocol layer and further describe how the layers interact
CO5	Basic understanding of working of different protocols in various layers.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS1**	**PS2**	**PS3**
CO1	2	2	2	1	3	1	2	2	1	1
CO2	2	2	2	1	3	1	2	2	2	2
CO3	3	3	3	1	3	1	3	2	3	2
CO4	3	2	1	1	3	1	2	2	2	1
CO5	3	2	3	2	2	1	2	2	2	2

Course Name: **ADVANCED DATA STRUCTURES**

Category: Programme Core Course

Prerequisite: **Programming in C**

Learning Objective:

- To get clear understanding about the basic data structures and their operations, the concepts of algorithms, basic search and sort algorithms.
- Student will also gain adequate knowledge to choose appropriate data structure and algorithm to solve a problem.
- Students should be able to select an appropriate data structure in the solution for a real world problem.

Paper-CSC104

Advanced Data Structures

UNIT-I: 12hrs

Introduction to Data Structures, Arrays and Strings, Introduction to Algorithms, Algorithm development, Complexity analysis, Recursion.
Linear Data Structures: Stacks: Operations and Applications, Queues: Operations and Applications, Circular Queues: Operations and Applications.
Linked Lists: Operation – Creations, insertion, Deletion, Circular Lists, and Doubly Linked List.

UNIT-II: 8hrs

Sorting: Insertion Sort, Merge Sort, Quick Sort, Radix Sort, and Heap Sort.
Searching: Binary Search, Selection.
Dictionaries: skip-lists, hashing, analysis of collision resolution techniques.

UNIT-III: 10hrs

Search Trees- Binary search Trees, Threaded binary tree,AVL Trees, B Trees, Red Black trees. Searching, insertion, deletion operations of trees.
Tries and pattern matching: Priority queues and binary heaps

UNIT-IV: 10hrs

Introduction to Graphs: Breadth first search and connected components.Depth first search in directed and undirected graphs and strongly connected components.
Spanning trees: Prim's and Kruskal's algorithm, union-find data structure.Dijkstra's algorithm for shortest path.Shortest path tree.Shortest and longest paths in directed acyclic graphs.Automatic List management, dynamic storage management.

Text Book:

1. Y. Langsam, M. Augenstein, A. M. Tenenbaum, **Data Structure using C and C++**, Prentice Hall, 1996.

Reference Books:

1.E. Horowitz, D. Mehta, S. Sahani. **Fundamentals of Data Structures in C++**, Universities Press. 2007.
2.M. A. Weiss, **Data Structures and Algorithm Analysis in C++**, PearsonEducation 2006.
3.M. T. Goodrich, R. Tamassia, D. Mount, **Data Structures andAlgorithms in C++**, Wiley India Pvt. Ltd, 2004

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Analyse performance of algorithms and apply basic data structures stack and queue to solve real world problems.
CO2	Employ linked list to implement different ADTs and apply it in solving some problems.
CO3	Examine various sorting algorithms and outline different hashing techniques.
CO4	Describe hierarchical data structures and use it in real life applications.
CO5	Explain graph data structures and apply graph related algorithms in real world scenarios.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3		3		1		3	3	3	3
CO2	3		3		2		3	3	3	3
CO3	3		3		1		3	3	3	3
CO4	3		3		3		3	3	3	3
CO5	3		3		3		3	3	3	3

Paper-CSC105

Lab :Data Structure & Python

DATA STRUCTURE PROGRAMS:

1. Implementation of sparse matrix
2. Implementation of linear search, binary search, bubble sort, insertion sort, selection sort
3. Implementation of single linked list and its operations
4. Design a doubly linked list to hold strings and use it for organizing a sequence of cities
5. Repeat Q4 using doubly circular linked list
6. Create a polynomial using single linked list and perform addition operation of two polynomials
7. Implement a stack,use stack for conversion of infix to postfix and evaluation of postfix expression.
8. Implementation of circular queue (using array) with menu options like insert, delete,display and exit.
9. Implementation of a priority queue and use it to organize studentrecords prioritized by marks.
10. Recursive implementation of quick sort and merge sort. Generate 10 random integers in a given range and apply sorting mechanisms.
11. Implement linear search and binary search to find out whether a given element is present or not in the array. Compare two search mechanisms based on number of comparisons required for a successful as well as unsuccessful search.
12. Implementation of a binary search tree with menu options: Construct a tree, insertanode, delete anode, traverse and display preorder, in order and post order sequenceof its nodes.
13. Implementation of Heap Sort.

14. Implementation of digraphs using adjacency matrix and find the transitive closureusingWarshall's algorithm.
15. Implementation of a weighted graph and find minimal cost spanning tree usingPrim's algorithm.
16. Implementation of a weighted graph and find minimal cost spanning tree using Kruskal's algorithm.
17. Implement Dijkstra's algorithm to find single source shortest path.
18. Implement Floyd Warshall's algorithm to find all pair shortest path.
19. Implement Topological sorting.
20. Implementation of a small Real World Application illustrating data structure usage.

PYTHON LAB:

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script

b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is a even number or not.

b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10

c) Write a program using a for loop that loops over a sequence. What is sequence?

d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

a) Find the sum of all the primes below two million.

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

a) Write a program combine_lists that combines these lists into a dictionary.

b) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise - 7 Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions

a) Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius If (distance between two balls centers) <= (sum of their radii) then (they are colliding)

b) Find mean, median, mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued

a) Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.

b) Write a function dups to find all duplicates in the list.

c) Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions - Problem Solving

a) Write a function cumulative_product to compute cumulative product of a list of numbers.

b) Write a function reverse to reverse a list. Without using the reverse function.

c) Write function to compute GCD, LCM of two numbers. Each function shouldn't exceed one line.

Exercise 11 - Multi-D Lists

a) Write a program that defines a matrix and prints

b) Write a program to perform addition of two square matrices

c) Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules

a) Install packages requests, flask and explore them using (pip)

b) Write a script that imports requests and fetch content from the page. Eg. (Wiki)

c) Write a simple script that serves a simple HTTP Response and a simple HTML Page

Exercise - 13 OOP

a) Class variables and instance variable

i) Robot

ii) ATM Machine

Exercise - 14 GUI, Graphics

1. Write a GUI for an Expression Calculator using tk.

Semester-II

Course Name:	**OBJECT ORIENTED PROGRAMMING USING JAVA**
Category:	Programme Core Course
Prerequisite:	**Basic procedural programming Language (like C-Programming)**
Learning Objective:	• Introduces object oriented programming concepts using the Java language. • Introduces the principles of inheritance and polymorphism; and demonstrates howthey relate to the design of abstract classes. • Introduces the implementation of packages and interfaces. • Introduces exception handling, event handling and multithreading. • Introduces the design of Graphical User Interface using applets and swings.

Paper-CSC201	
Object Oriented Programming using JAVA	
UNIT-I:	**8hrs**
Java Evolution and Environment: Java evolution, overview of java language, java history, features of java, how java differs from C and C++, java and World Wide Web, web browser. **Java Environment:** Java Development Kit(JDK), Application Programming Interface(API), java programming structure, java tokens, constants, variables, expressions, decision making statements and looping, java statements, overview of arrays and strings, machine neutral, Java Virtual Machine(JVM), Command Line Arguments.	
UNIT-II:	**12 hrs**
Classes, Objects and Methods: Introduction, defining a class, creating objects, accessing class members, constructors, method overloading, static members. Inheritance: Defining a sub-class, sub-class constructor, multi-level variables, final classes and finalize methods, abstract methods and classes, visibility control.**Arrays and Strings:** One-dimensional arrays, creating an array, declaration of arrays, initialization of arrays, two-dimensional arrays, string arrays, string methods, string buffer class, vectors, wrapper classes, Basic I/O Streams: Scanner, buffered reader, Collection classes.**Managing Errors and Exceptions**: Introduction, types of errors: compile time and run-time errors, exceptions, types of exceptions, syntax of exception handling code, multiple catch statements, using finally statement, throwing our own exceptions.	
UNIT-III:	**10 hrs**
Interfaces, Package and Multi-threaded Programming: Introduction, defining interfaces, extended interfaces, implementing interfaces.**Package:** Creation, importing a package and user-defined package.**Threads:** Introduction to threads, creating threads, extending the thread class, implementing the 'runnable' interface, life-cycle of a thread, priority of a thread, synchronization, and deadlock.	
UNIT-IV:	**10 hrs**
Applet programming: Introduction, how applets differ from applications, building applet code, applet life cycle, about HTML, designing a web page, passing parameters to applets, getting input from the user.**Graphics Programming:** Introduction, abstract window toolkit class hierarchy, frames, event-driven programming, layout managers, panels, canvases, drawing geometric figures.**Introduction to Swings:** Introduction to Swings, overview of Swing components: Jbutton, JCheckBox, JRadioButton, JLabel, JTextField, JTextArea, JList.	

Text Book:
1. H. Schildt, **The Java Complete References**, 9th Edition, Tata McGraw Hill, 2014.
Reference Books:
1. Y.Daniel Liang, **An Introduction to JAVA Programming**, Tata McGraw Hill, 2009. 2. K. Sierra, **Head First java**, 2nd Edition, Shroff Publishers, 2012. 3. 3. E. Balaguruswamy, Programming with JAVA, 2/e, Tata McGraw Hill

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to:-
CO1	Explain the basic principles of object-oriented programming along with its strength and weakness
CO2	Identify Java standard libraries and classes.
CO3	Apply the object-oriented programming techniques in developing small to medium-sized application programs and use it in real life applications.
CO4	Identify Java code utilities in applets, Java packages, and classes.
CO5	Design simple Graphical User Interface applications and use it in real world scenario.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2		3	2	3		3	2	1	1
CO2	3	1	3	3		1	2	2	2	3
CO3	3	3	3	3	2	2	3	3	3	3
CO4	2	2	3	3	2	2	3	3	3	3
CO5	3	2	3	3	2	1	2	3	3	3

Course Name: **MOBILE COMPUTING**

Category: Programme Core Course

Prerequisite: **Data Communication and Computer Networks**

Learning Objective:

- Describe wireless and mobile communications systems and be able to choose an appropriate mobile system from a set of requirements.

Paper-CSC202

Mobile Computing

UNIT-I: 10hrs

Introduction to mobile computing, mobile computing architecture, mobile devices, mobile system networks:Cellular Network and frequency reuse, Channel Assignment, Handoff Strategies, Interferences and System Capacity, Improving coverage and capacity in Cellular Systems – Cell Splitting, Sectoring, Repeaters and Range Extension, Limitations of Mobile Computing.

UNIT-II: 10hrs

Personal Communications Services (PCS): PCS Architecture, mobility management, Global System for Mobile Communication (GSM). System overview: GSM Architecture, Mobility management, Network signalling. General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes

UNIT-III: 10hrs

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunnelling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).
Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT-IV: 10hrs

Mobile Data Communication: WLANs (Wireless LANs), IEEE 802.11 standards.
Mobile Satellite Communication Networks: Case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, VPN, Mobile Ad-hoc networks, 4G Technology, Long Term Evolution (LTE).

Text Book:

1. R. Kamal, **Mobile Computing**, 1st Edition, Oxford University Press, 2006.
2.Mobile Computing Technology, Applications & Service Creation, A K Talukder& R RYavagal (TMH)

3.Wireless Communication, T. S Rappaport, Pearson

Reference Books:

1. Mobile Communications - Jochen Schiller (Addison-Wesley, Second Edition, 2009)
2. Principles of Mobile Computing - UWE Hansmann, LotherMerk, Martin S. Nicklaus, Thomas Stober (Second Edition, Springer)

3.Third Generation Mobile Telecommunication Systems, by P.Stavronlakis, Springer Publishers

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Explain the basic of Mobile Computing.
CO2	Infer the fundamentals of wireless communications.
CO3	Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
CO4	Demonstrate basic skills for cellular networks design.
CO5	Apply knowledge of TCP/IP extensions for mobile and wireless networking.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1		1			2		
CO2	2	2		3				2	1	
CO3	2	3	3	2	2	1	1	2	2	2
CO4	2	3	3	2	2	1	1	3	3	3
CO5	2	3	1		1		1	2	2	

Course Name: # ADVANCED OPERATING SYSTEMS

Category: Programme Core Course

Prerequisite:

- Computer Programming and Data Structures
- Computer Organization and Architecture

Learning Objective:

- Provide an introduction to operating system concepts (i.e., processes, threads, scheduling,
- synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system.
- To master the concepts of a process and how the processes are scheduled and synchronized.
- To develop the understanding of detecting a deadlock situation and be able to recovery from it.
- To understand the different approaches to memory management and disk management.
- To understand the structure and organization of the file systems and I/O systems

Paper-CSC203

Advanced Operating Systems

UNIT-I: 10hrs

Operating System Overview: -Introduction, The Need of Operating Systems, Evolution of Operating Systems, Types of Operating Systems, Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls, Virtual Machines, System Design and Implementation.
Process Management – Process concepts, Life cycle, PCB, Schedulers, Process Scheduling, Threads, Scheduling Levels, CPU Scheduling: Scheduling-Criteria, Algorithms, Algorithm Evaluation.

UNIT-II: 10hrs

Concurrency:-Process synchronization, The Critical- Section Problem, Peterson's Solution, synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock detection, deadlock prevention, deadlock avoidance, Recovery from deadlock.

UNIT-III: 10hrs

Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files

UNIT-IV: 10hrs

Mass-Storage Structure: Overview, Disk Structure, Disk scheduling, disk management, Swap-space management, RAID structure.
File Systems: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File- System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Text Book:

1. A. Silberchatz, P. B. Galvin, G. Gagne, **Operating System Concepts**, 7th Edition, John Wiley, 2003.

Reference Books:

1. Charles Crowley,**Operating systems : A design-oriented approach**, McGraw-Hill, 1996.
2. A. S. Tanenbaum and H. Bos, **Modern Operating Systems**, Pearson, 2015.
3. W. Stallings, **Operating Systems – Internals and Design Principles**, Prentice Hall, 2009.
4. D. M. Dhandhere, **Operating Systems-A Concept Based Approach**, McGraw-Hill, 2006.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	1		1		1	3	1	1
CO2	3	3	1		2		1	3	3	1
CO3	3	3	1		2		1	3	3	1
CO4	3	3	1		2		1	3	3	1
CO5	3	3	1		1		1	3	3	1

Course Name: **THEORY OF COMPUTATION**

Category: Programme Core Course

Prerequisite: **Fundamental of computer science and mathematics**

Learning Objective:

- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages.
- This course enables us to understand the concepts of theory of Computation and its applications.

Paper-CSC204

Theory of Computation

UNIT-I: **10hrs**

Introduction: Automata theory, Computability theory, Complexity theory,Mathematical notations & terminology, Alphabet, String, Languages &operations on strings; Finite Automata (Deterministic): Formal definition,Transition function, Extended transition function, Language of DFA,Design of DFA; Finite Automata (Non-deterministic): Formal definition,Language of NFA, Equivalence of DFA & NFA; NFA with EpsilonTransition: Eliminating "-transitions from NFA, Conversion from Epsilon-NFA to DFA, Minimization of DFA.

UNIT-II: **10hrs**

Moore machines, Mealy machines; Regular expressions: Regular operators and their precedence, Building regular expressions, DFA to Regular expressions, Regular expressions to DFA, Arden's theorem, PumpingLemma for Regular languages, Closure properties of Regular languages.

UNIT-III: **10hrs**

Introduction to Grammars: Definition, Derivation of string, Left and rightlinear grammars, Regular grammars; Context Free Grammars (CFG): Definition,Derivation of string, Language of CFG, Parse Tree, Ambiguity in grammar,Elimination of ambiguity, Normal forms of CFG: Chomsky and Greibachnormal forms, Converting CFG to CNF & GNF, Closure properties of context free languages (CFL).

UNIT-IV: **10hrs**

Push Down Automata(PDA): PDA Components, Moves of a PDA, Design of a PDA, PDA to CFG and CFG to PDA conversion, Pumping lemma for CFL;
Turing Machines (TM): Design of a TM, Variation of TM, Recursively Enumerable Languages and undecidable problems.Church Turing hypothesis, Recursive and recursively enumerablesets, Chomsky's hierarchy of languages. Ackermann's function, Godel numbering; NP Completeness: P and NP, NP complete andNP Hard problems.

Text Books:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, **Introduction to Automata Theory, Languages and Computation**, 3rd Edition, Pearson Education, 2007.
2. P. Linz, **An Introduction to Formal Languages and Automata**, 4th Edition, Jones & Bartlett Learning, 2006.

Reference Books:

1. M. Sipser, **Introduction to the Theory of Computation**, 3rd Edition, Cengage Learning, 2012.

2. J. C. Martin, **Introduction to Languages and the Theory of Computation**, 4th Edition, Tata McGraw-Hill, 2010.
3. K. L. P. Mishra, and N. Chandrasekaran, **Theory of Computer Science: Automata, Languages and Computation**, 3rd Edition, PHI, 2012.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2		3		2	3	3	2
CO2	3	3	2		3		2	3	3	2
CO3	3	3	2		3		2	3	3	2
CO4	3	3	2		3		2	3	3	2
CO5	3	3	2		3		2	3	3	2

Paper-CSC205

Lab : Java and OS

EXPERIMENTS ON JAVA:

1. 1.Programs to illustrate class and objects
   2. Programs to illustrate Overloading & Overriding methods in Java.
   3. Programs to illustrate constructors
   4.Programs Illustrate the Implementation of Various forms of Inheritance. (Ex. Single, Hierarchical, Multilevel inheritance….)
   5.. Program which illustrates the implementation of multiple Inheritance using interfaces in Java.
   6. Program to illustrate the implementation of abstract class.
   7. Programs to illustrate Exception handling
   8. Programs to create Packages in Java.
   9. Program to Create Multiple Threads in Java.
   10. Program to Implement Producer/Consumer problem using synchronization
   11. Developing a simple paint like program using applet
   12. Developing programs onJButtons,JTextBox,JTextButton etc.

EXPERIMENTS ON OS:

1. Basics of UNIX commands.
2. Shell programming
3. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority
4. Implement all file allocation strategies :a)Sequential b)Indexed c)Linked
5. Implement Bankers algorithm for Dead Lock Avoidance
6. Implement an Algorithm for Dead Lock Detection
7. Implement the all page replacement algorithms a) FIFO b) LRU c) Optimal Page Replacement.

8.Implement Paging Technique of memory management

Course Name:	**DATA WAREHOUSING AND MINING**
Category:	Programme Elective Course
Prerequisite:	**Data Structure and Algorithm, Linear Algebra, Basics of Web programming**
Learning Objective:	This course deals with evolving multidimensional intelligent model from a typical system, representation of multi dimensional data for a data warehouse, discovering the knowledge imbibed in the high dimensional system, fiding the hidden interesting patterns in data, and gives the idea to evaluate various mining techniques on complex data objects. This course enables us to understand the concepts of Data Mining and its applications.

DSE Paper – CSC206A

Data Warehousing and Mining

UNIT-I: **10hrs**

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflkes and Fact constellations.

UNIT-II: **10hrs**

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications.

UNIT-III: **10hrs**

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation.
Decision Tree Induction - Bayesian Classifiation – Rule Based Classifiation –Classifiation by Back propagation – Support Vector Machines – Associative Classifiation – Lazy Learners – Other Classifiation Methods.

UNIT-IV: **10hrs**

Clustering techniques – , Partitioning methods- k-means Hierarchical Methods - distance-based agglomerative and divisible clustering,
Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining

Text Books:

1. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMc Graw Hill Edition, Tenth Reprint 2007.

3.G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Easter EconomyEdition, Prentice Hall of India, 2006

Reference Books:

1. Mehmedkantardzic,"Dataminingconcepts,models,methods, and lgorithms", Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3.George M Marakas, Modern Data Warehousing, Mining and Visualization, Prentice Hall, 2003

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Describe the requirement of a data warehouse and its components.
CO2	Explain the data warehouse life cycle.
CO3	Explain the concepts of data mining and data pre-processing.
CO4	Analyze different classification algorithms and apply the same to real life problems.
CO5	Apply different clustering algorithms for solving problems in various domains.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2						1	2	2	2
CO2	2						1	2	2	2
CO3	3		2	2			2	3	3	3
CO4	3		3	3	3		3	3	3	3
CO5	3		3	3	3		3	3	3	3

Course Name: **WIRELESS SENSOR NETWORKS**

Category: Programme Elective Course

Prerequisite: **Basic Computer Network**

Learning Objective: The purpose of this course is to introduce students to
Obtain a broad understanding about the network architecture of wireless sensor network.Understand all basic characteristics of wireless sensor networks and sensor nodes.The principles of data transmission, clustering algorithm and routing protocols.Design and development of new network architecture and MAC protocols.
This course enables us to understand the concepts of wireless sensor network and its applications.

DSE Paper – CSC206B

Wireless Sensor Networks

UNIT-I: **10hrs**

Introduction: Networked wireless sensor devices, Applications: Habitat Monitoring, Smart Transportation, Key design challenges. **Network deployment:** Structured versus randomized deployment, Network topology, Connectivity. Introduction to cloud system,Sensor Cloud Systems, Challenges in Sensor Cloud Systems.

UNIT-II: **8hrs**

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization. **Wireless characteristics:** Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.

UNIT-III: **10hrs**

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.
Classification of Energy Management Schemes **Sleep-based topology control:** Constructing topologies for connectivity, constructing topologies for coverage.

UNIT-IV: **12hrs**

Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing. Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.

Text Books:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli,
TaiebZnati , Wiley Inter Science.
2. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press

Reference Books:

1. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
3. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.
4.Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Define the basic concepts of wireless sensor networks, sensing, and challenges.
CO2	Explain various deployment structures of wireless sensor networks.
CO3	Describe and explore localization, radio standards and wireless characteristics.
CO4	Discuss the communication protocols adopted in wireless sensor networks and distinguish energy management schemes.
CO5	Analyze different routing techniques and identify various storage and retrieval issues.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3							1		
CO2	3		1	1	1		1	1	1	1
CO3	3			1	1		1		1	
CO4	3		2	2	2		2	2	2	
CO5	3		3	3	3		3	2	2	3

INTERNET OF THINGS

Course Name:

Category: Program Elective Course

Prerequisite: **Knowledge of Computer Networks**

Learning Objective:

- To learn the concepts behind IoT and different application areas where sensors can be effectively used to capture real-time data for monitoring and control functions.
- To understand various protocols that govern the functioning of an IoT System
- Understand general concepts of Internet of Things (IoT)
- Recognize various devices, sensors and applications.

	DSE Paper –CSC 206C
	Internet of Things
	UNIT-I: 10hrs
	Introduction to IoT, Basic requirements for building an IoT system, IoT reference framework, IoT network level – performance criteria. IoT devices: Sensors, Types of sensors and their functions: temperature, pressure, air pollution, proximity, infrared, moisture & humidity, flow, level, noise, and speed sensors. Characteristics of sensors. Use of RFID Actuators, Types of actuators and their functions: electrical, mechanical, and hydraulic actuators, controlling IoT devices
	UNIT-II: 10hrs
	IoT requirements for networking protocols, device addressing, credential management, wireless spectrum, determinism, security and privacy, application interoperability, semantic interoperability. IoT Protocol Stack: layered view. Link layer: IEEE 802.15.4 technology, LoRaWAN end-to-end architecture, Time-Sensitive Networking Internet Layer: Routing Protocol for Low-Power and Lossy Networks.
	UNIT-III: 10hrs
	Application Protocols Layer: Data Serialization Formats, Communication Paradigms: Request/Response Versus Publish/Subscribe, Blocking Versus Non-blocking, QoS: Resource Utilization, Data Timeliness, Data Availability, Data Delivery IoT Application Protocols: CoAP, XMPP, MQTT, AMQP, SIP, IEEE 1888, and DDS RTPS. Application Services Layer: ETSI M2M network architecture, oneM2M standards. IoT Services Platform: Functions and Requirements, IoT Platform Manager, Discovery, Communication Manager, Data Management, Management of IoT Devices, Configuration and Fault Management, Performance Management and measures
	UNIT-IV: 10hrs
	IoT security and Privacy: challenges, requirements, IoT Three-Domain Architecture, Attacks and Countermeasures for each domain. Applications of IoT in areas like Smart home, Agriculture, Healthcare, Industry, Transportation, Retail, Oil and Gas, Energy etc. IoT Service Model: Anything as a Service, IoT Connected Ecosystems Models
	Text Books:
	1.Internet of Things from Hype To Reality: The Road to Digitization (2nd ed), AmmarRayes and Samer Salam, Springer, 2019.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	1		2		1	3	3	3
CO2	3	3	3		2		3	3	3	3
CO3	3	3	3		2		3	3	3	3
CO4	3	3	3		2		3	3	3	3
CO5	3	3	3		2		3	3	3	3

Course Name: **MICROPROCESSOR AND MICROCONTROLLER**

Category: Program Elective Course

Learning Objective:

- Timing diagram analyze role of microprocessor and microcontroller in computer systems,
- Distinguish between maskable and non-maskable interrupt and role of DMA in microprocessor.

DSE Paper-CSC206D
Microprocessor and Microcontroller
UNIT-I: **10hrs**
8085 AND 8086MICROPROCESSORS 8085 Microprocessor: Architecture, Pin diagram, Physical memory organization, Timing diagrams, Interrupts of 8085, Instruction set and Assembly Language Programming of 8085. 8086 Microprocessor: Architecture, signal descriptions, common function signals, Minimum and Maximum mode signals, addressing modes, interrupt structure.
UNIT-II: **10hrs**
I/O INTERFACING Interfacing with 8086/ 8085: Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc. Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc. Introduction to microprocessors like 80386, 80486
UNIT-III: **10hrs**
8051 MICROCONTROLLERS: Overview of 8051 microcontroller Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming of serial communication interrupts, programming 8051 timers and counters, Introduction to other micro controllers.
UNIT-IV: **10hrs**
REAL WORLD INTERFACE DESIGN WITH 8051 Real world interface design: LED, SWITCH, keyboard, LCD, ADC, DAC, UART, RTC, PWM, Watch Dog Timer, DC Motor, Stepper Motors.
Text Books:
1. Advance Microprocessor and Peripherals, By, A.K. Roy and K.M. Bhurchandi, Tata McGraw-Hill Education 2. Mazidi and Mazidi, The 8051 Micro controller and Embedded Systems, pearson Education. 3. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, Penram International Publishing

Reference Books:

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, andApplications , by Walter A. Triebel&Avtar Singh,
2. Micro processors and Interfacing, D. V. Hall, TMGH.
   The 8051 microcontroller , Kenneth. J. Ayala. Cengage learning.

3.Microcontrollers and application, Ajay. V. Deshmukh, TMGH

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Analyze role of microprocessor and microcontroller in computer systems.
CO2	Distinguish between maskable and non-maskable interrupt, and role of DMA in microprocessor.
CO3	Analyze working of 8086 and its architecture.
CO4	Analyze the data transfer information through serial & parallel ports.
CO5	Identify a detailed s/w & h/w structure of the Microprocessor.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	1			1	2	1
CO2	1	1			1					
CO3	2	1	1	2	2	2	1	2	2	1
CO4	2	1			1					
CO5	1	1	1	1	1	1		1	2	2

Semester-III

Course Name: **COMPILER CONSTRUCTION**

Category: Programme Core Course

Prerequisite: **Theory of Computation / Automata theory**

Learning Objective:

- To learn various stages of compilation, design phases of a compiler construction process.
- This course will also introduce open source tool Lex and Yaac.
  - Specify and analyse the lexical, syntactic and semantic structures of advanced language features
  - Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation
  - Write a scanner, parser, and semantic analyser without the aid of automatic generators

Paper-CSC301
Compiler Construction
UNIT-I: **10hrs**
Compiler: Introduction – Programs related to compilers. Analysis of source program, Phases of compiler, modules related to compiler, grouping of phases. Lexical analysis – The role of Lexical Analyser. Input Buffering. Specification of Tokens. Recognition of Tokens. The Lexical-analyser Generator Lex.
UNIT-II: **10hrs**
Syntax Analysis – Introduction. Top-Down parsing, Brute Forcing, Recursive Descent, Predicative LL(1),Bottom-Up parsing : Shift reduce parsing, Introduction to LR Parsing, Powerful LR parsers: SLR, CLR,LALR, Parser Generators – Yacc. Error Recovery : Introduction, Error detecting and Reporting in various Phases.
UNIT-III: **10hrs**
Syntax Directed Translation – Syntax Directed Definitions. Evaluation Orders for SDDs. Applications of Syntax Directed Translation. Symbol Table Organization - Structure of Symbol table, Symbol Table organization, Data Structures of symbol Table. Intermediate code generation: Variants of syntax trees. Three-Address Code, Types and Declarations. Translation of Expressions. Type Checking. Control Flow. Activation record, activation tree and run time storage management
UNIT-IV: **10hrs**
Code Generation – Issues in the Design of a Code Generator. The Target Language. Addresses in the Target Code Basic Blocks and Flow Graphs. Optimization of Basic Blocks. Peephole Optimization. Register Allocation and Assignment. Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.
Text Book:
1. A. V. Aho, M. S. Lam, R. S. and J. D. Ullman, **Compilers: Principles, Techniques &Tools** , 2nd Edition, Pearson Education, 2007.
Reference Book:
1. K. D. Cooper and L. Tarezon T. Munakata, **Engineering a Compiler,** 2nd Edition, Elsevier, 2011.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2		3		2	3	3	2
CO2	3	3	2		3		2	3	3	2
CO3	3	3	2		3		2	3	3	2
CO4	3	3	2		3		2	3	3	2
CO5	3	3	2		3		2	3	3	2

Course Name: **DATABASE MANAGEMENT SYSTEMS**

Category: Programme Core Course

Prerequisite: **Basic Knowledge of Computer Programming and data structures**

Learning Objective:

- Classify modern and futuristic database applications based on size and complexity; design a database from understanding an Universe of Discourse, using ER diagrams;
- Map ER model into Relational model and to normalize the relations
- Create a physical database from a design using DDL statements with appropriate key, domain and referential integrity constraints
- Analyze different ways of writing a query and justify which is the effective and efficient way; and compare and contrast various indexing strategies in different database systems and list key challenges in advanced database systems and to critique how they differ from traditional database systems.

- To study the concepts of databases especially Relational Database design and query languages.

Paper-CSC302

Data Base Management Systems

UNIT-I: 10hrs

Introduction to DBMS: Characteristics, Purpose, Application of the Database approach, Advantages of using DBMS approach upon file structure, Three-schema Architecture, Data Abstraction, Data Independence, Data base languages, DBMS Architecture, Data Models overview, Introduction to ER model and Relational data model.
Relational Query Language: Relational algebra, Tuple and Domain Relational Calculus, SQL.

UNIT-II: 12hrs

Database Design and ER model: Overview of Design Process, Entities, Attributes, Constraints, Weak Entities, ER diagram, Extended ER Features, Reduction to Relational Schemas.
Relational Database Design: Feature of Good Relational Design, Atomic Domain and First Normal Form, Functional Dependency Theory, Decomposition of Schemas, Properties of Relational Decompositions, Normal forms and Normalization, 2NF, 3NF, BCNF, Multivalued Dependencies & 4NF. Performance tuning and Denormalization

UNIT-III: 8hrs

Query Processing and Optimization: Evaluation of Relational Algebra Expression, QueryEquivalence, Join strategy, Query optimization algorithms. **Storage Strategies**: Indices, B+Trees, Hashing

UNIT-IV: 10hrs

Transaction Processing: Transaction Concept, ACID Properties of Transaction, Serializability, Recoverability.
Concurrency Control: Overview, Lock-based Protocol, Timestamp ordering protocol, Multi version and Optimistic concurrency control techniques.
Recovery Systems: Database Failure and Recovery, Log based Recovery to preserve Atomicity and Durability

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	Define the basics of databases, database management systems, architecture of database systems, and the role of database users. Explain effectively the features of database management systems and data models.
CO2	Construct formal queries using relational algebra and relational calculus and structured query languages to perform database operations.
CO3	Identify the attributes to code a real world entity and create E-R models for designing databases for real-world applications. Examine the database design to check for improvement using normalization.
CO4	Describe various indexing techniques and explain the basics of query evaluation mechanisms.
CO5	Recognize the state of a database instance. Apply concurrency control and recovery mechanisms to maintain the correctness and consistency in the database.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3				1		1			
CO2	3				1		2	2	2	
CO3	3		3		1		2	3	3	
CO4	3		2	1	1		2			2
CO5	3		2		1		2	2		

Text Book:

1. A. Silberschatz, F. H. Korth, **Database System Concepts**, 6th Edition, MGH, 2010.

Reference Books:

1. R. Elmasri, Fundamental of Database Systems, Pearson Education, 2008.
2. B. Desai, An Introduction to Database System, Galgotia publication.
3. C.J. Date, An Introduction to Database Systems, Pearson Education

Course Name: **DESIGN AND ANALYSIS OF ALGORITHMS**

Category: Programme Core Course

Prerequisite: **Data Structure**

Learning Objective:

- Learn the algorithm analysis techniques.
- Become familiar with the different algorithm design techniques.
- Understand the limitations of Algorithm power.

	Paper-CSC303
	Design and Analysis of Algorithms
	UNIT-I: **10hrs**
	Introduction to Design and analysis of algorithms, Growth of Functions (Asymptotic notations), Recurrences, Solution of Recurrences by substitution, Recursion tree method, Master Method, Analysis of Searching and Sorting Techniques: Brute Force Technique, Selection sort, Bubble sort.
	UNIT-II: **10hrs**
	Divide and Conquer: Merge sort, Quick sort, Time complexity analysis for Merge and Quick sort. Transform and Conquer: Balanced search tree, Heaps and Heap sort. Dynamic Programming algorithms: Matrix Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, 0/1 Knapsack problem.
	UNIT-III: **10hrs**
	Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes. Graph Algorithm - BFS and DFS, Minimum Spanning Trees, Kruskal algorithm, Prim's Algorithm, Single Source Shortest paths, Bellmen Ford Algorithm, Dijkstra's Algorithm.
	UNIT-IV: **10hrs**
	String matching, Rabin-Karp Algorithm, KMP Algorithms. Theory of NP-completeness: Complexity classes of P, NP, NP-Hard, NP complete. Polynomial reduction, Cook's theorem, discussion on SAT, CNF-SAT, Min vertex cover, max clique, Graph coloring.
	Text Book:
	1. T.H.Coreman et.al. **Introduction to Algorithms**,MIT press Cambridge, 2001.
	Reference Books:
	1.M. R. Kabat, **Design and Analysis of Algorithms**, PHI, 2013. 2. S. Sridhar, **Design and Analysis of Algorithms**, Oxford University Press 3. E. Horowitz, S. Sahni, **Fundamentals of Computer Algorithms**, computer science press, 1978.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	Describe asymptotic notation, its properties and use it in measuring algorithm behaviour
CO2	Apply mathematical principles in analysis of algorithms to solve real world problems
CO3	Analyze and apply the complexities of various algorithms and select the best one
CO4	Know the different strategies that are known to be useful in finding efficient algorithms to solve problems and to be able to apply them in real scenario
CO5	Choose appropriate data structures and algorithms and use it to design algorithms for a specific problem

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2		2	3	2	1	3	3	3
CO2	2	2	3	2	3	2	1	2	2	2
CO3	2	2	3	3	2	1	2	3	3	3
CO4	2	3	3	3	2	3	2	2	2	3
CO5	2	3	2	3	2	3	2	3	3	3

Course Name: **WEB TECHNOLOGY**

Category: Programme Core Course

Prerequisite: Goodunderstanding of Object Oriented Programming

- Basic programming skills

Learning Objective:

- Understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
- Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice.
- Learn the language of styling the web page using HTML and CSS.
- Acquire knowledge to develop valid and well-formed XML document.
- Learn techniques of responsive web application design.
- Develop basic programming skills using JavaScript and PHP.

- Design and implement dynamic websites with good aesthetic sense of designing.

- Have a Good grounding of web application terminologies and web development tools.
- Develop multiplatform interactive and dynamic web applications.
- Outline the key components that facilitate the interoperability nature of web services.

Paper-CSC304	
Web Technology	
UNIT-I:	**8hrs**
Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols - The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. **Markup Languages: XHTML**. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents-Case Study.	
UNIT-II:	**8hrs**
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. **Client-Side Programming:** The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.	
UNIT-III:	**12hrs**
PHP: Introducing PHP, PHP Language Basics–Using variables, Understanding Data Types, Operators and Expressions, Constants. Decisions and Loops–Making Decisions, Doing Repetitive Tasks with Looping, Mixing Decisions and Looping with HTML.**Strings**–Creating and Accessing Strings, Searching Strings, Replacing Text with strings, Dealing with Upper and Lowercase, Formatting Strings.**Arrays**–Creating Arrays, Accessing Array Elements, Looping Through Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays.**Functions**, writing your own Functions, Working with References, Writing Recursive Functions.	

Objects–Introduction OOP Concepts, Creating Classes and Objects in PHP, Creating and using Properties, Working with Methods.
UNIT-IV: **12hrs**
PHP MySQL: HandlingHTML Forms with PHP–How HTML form works,Capturing Form Data with PHP, Dealing with Multi-Value Fields, Generating Web Forms with PHP, Storing PHP Variables in Forms, Creating File Upload Forms, Redirecting After a Form Submission.**Introducing Databasesand SQL**–Deciding How to Store Data, Understanding Relational Databases, SettingUpMySQL, AQuick Play with MySQL, Connecting MySQL from PHP.**Retrieving Data from MySQL with PHP**–Setting Up the Book Club Database, Retrieving Data with SELECT, Creating a Member Record Viewer. Manipulating MySQL Data with PHP–Inserting, Updating, and Deleting Records.
Text Books:
1. M. Doyle, **Beginning PHP 5.3**, 1st Edition, John Wiley & Sons, 2011. 2. J.Duckett,**Beginning HTML, XTML, CSS and JavaScript**, 1st Edition,John Wiley & Sons, 2011
Reference Books:
1. L. Welling, L. Thomson, **PHP and MySQL Web Development**, 1st Edition, Sams Publishing, 2003.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	Identify basic HTML elements, XML elements and develop static webpages.
CO2	Describe different styles in web page design. Apply style sheets and java script to prepare elegant webpages with client side validations.
CO3	Implement server side business logic into dynamic web pages using PHP.
CO4	Use PHP to design user interactive forms for data entry with proper validation.
CO5	Develop aesthetic web applications with database connectivity using PHP.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3		1	1	1		1	1	1	1
CO2	3		2	2	2		2	2	2	2
CO3	3		3	3	3		3	3	3	3
CO4	3		3	3	3		3	3	3	3
CO5	3		3	3	3		3	3	3	3

Paper-CSC305

Lab : Web Technology and DBMS

EXPERIMENTS ON WEB TECHNOLOGY:

1. Design a web page for your college containing a description of courses, departments, faculties using different HTML elements.
2. Customize the HTML page using CSS.
3. Create a login form which will check for username and password. If login successful then goto next form(Student registration form) that contains form with fields Name, Email, Mobile No ,Gender and a button .write a JavaScript code to validate data of above form.
4. Develop simple calculator for addition, subtraction, and multiplicationanddivisionoperation using JavaScript.
5. Design a web page to create your resume usecolor, textcolor, an Image, font etc. You may use CSS to format web page.
6. Create user Student registrationform (use textbox, checkbox, radiobutton, select box etc.)
7. Design an examination registration form using HTML. Sore the required data in a database (create it using MySQL) using PHP and also display message regarding status of registration (Success or Unsuccess).
8. Create a database through PHP and MySQL, and create, delete and modify data on database.
9. Store the data from a HTML form designed for registering a webinar and using PHP and MySQL, store, and update the data. Display the database data in HTML form.
10. Create anapplication using HTML, PHP. Create login form using HTML and checkusername and password using PHP, if login successful it will go on next HTML page and if failure again goesback to login page.

EXPERIMENTS ON DBMS:

1. Creation of a tables using create command and writing SQL queries to retrieve information from the tables.
2. Implement data definition languages (Create, Alter, Drop, Truncate, and Rename) &data manipulation languages (Insert, Update, and Delete) for updating and viewing records.
3. Implement SELECT command with different clauses (where clause, having clause, group by clause, order by clause).
4. Implement Single Row function (character, numeric, data functions).
5. To implement Group function (AVG, MIN, MAX, SUM).
6. Implement various types of integrity constraints (NOT NULL Constraint, DEFAULT Constraint, UNIQUE Constraint, PRIMARY Key, FOREIGN Key, CHECK Constraint).
7. Creation of Views, Synonyms, Sequence, Indexes, Save point.
8. Creating relationship between tables.
9. Implementation of PL/SQL block.
10. Write a PL/SQL block to satisfy some conditions by accepting input from theuser.
11. Write a PL/SQL block that handles all types of exceptions.

Course Name:NETWORK AND INTERNET TECHNOLOGIES

Category:IDSE Course

Prerequisite: Basic knowledge of a computer system and Internet is required.

Learning Objective:

- study the fundamental concepts of computer networks.
- Introduce the fundamental concepts of Web Design.
- expose students to develop basic web applications.

Learning Outcome:

- describe the basics of computer networks topology.
- understand the basic concept of transmission media, LAN topology and network devices,
- develop web applications using web technologies

IDSE-Paper-CSC306A	
Network and Internet Technologies	
UNIT-I:	**10hrs**
Computer Networks: Introduction to computer network, datacommunication, components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet,extranet.**Network Models:** Client/ server network and Peer-to-peer network, OSI, TCP/IP, layersandfunctionalities.	
UNIT-II:	**12hrs**
Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable, Opticalfiber. Unguided media: Microwave, Radio frequency propagation,Satellite.**LAN Topologies:** Ring, bus, star, mesh and treetopologies.**Network Devices:** NIC, repeaters, hub, bridge, switch, gateway androuter.**Internet Terms:** Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online andoffline.	
UNIT-III:	**5hrs**
Introduction to Web Design: Introduction to hypertext markup language (html) Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration.	
UNIT-IV:	**13hrs**
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. **Client-Side Programming:** The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.	
Text Book:	
1. J. A. Ramalho, **Learn Advanced HTML 4.0 with DHTML**, BPB Publications,2007	

Reference Books:

1. B. A. Forouzan, Data Communication and Networking , Tata McGrawHill, 2008.
2. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer, 2007.
3. HTML A Beginner's Guide, Tata McGraw-Hill Education,2009.
4. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications,2007

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Understand the fundamental concepts of Computer networks with architecture.
CO2	Basic Concept of various Network Devices
CO3	Understand the basic concept of transmission media, LAN topology.
CO4	Understand Fundamentals of Web Design
CO5	Develop Web Applications using Web Technologies

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS1**	**PS2**	**PS3**
CO1	2	2	2	1	2	1	1	2	2	1
CO2	2	2	2	1	2	1	2	2	2	1
CO3	2	2	2	2	2	1	2	2	2	1
CO4	2	2	2	1	2	1	2	2	2	2
CO5	2	2	2	1	2	1	3	2	2	2

Course Name **FUNDAMENTALS OF COMPUTER**

Category **IDSE Course**

Prerequisite: Basic mathematics

Learning Objective: Simplify computer basics for students to grasp and learn easily. To make them familiar with the parts and functions of computer.

Learning Outcome: Identify and describe the functionality of various parts of digital computer. Describe the working principle of Computer. Perform various binary arithmetic operations. Describe the use of different type of memory used in computer

IDSE-Paper-CSC306B
Fundamentals of Computer
.
UNIT-I: **10hrs**
Computer Basics: Simple model of computer, Problem solving using computer (flowchart, program, working of a computer, hardware and software). **Data Representation**: Character representation, representation of integers and fractions, Decimal to binary conversion. **Input / Output Units**.
UNIT-II: **10hrs**
Memory System: Basic Concepts RAM, ROM,Speed, size and cost, Cache Memory concepts, Cache Memory mappingtechniques, Virtual Memory concepts,SecondaryStorage.**Processor**: Structure of instructions, Description of a processor, Machine language program, Algorithm to simulate the hypothetical computer.
UNIT-III: **10hrs**
Binary Arithmetic: Addition, subtraction, signed numbers, Two's complement representation of numbers, addition/subtraction of numbers in 2's complement notation, binary multiplication, binary division, floating point representation of numbers, arithmetic operation with normalized floating point numbers.
UNIT-IV: **10hrs**
Logic circuits: switching circuits, AND, OR, NOT operation, Boolean functions, canonical forms for Boolean function, logic circuits. Computer Architecture: Interconnection of of Units, Processor to memory communication, I/O devices to processor communication, Bus architecture of personal computers; **Introduction to Programming Language, Operating system.**.
Text Book:
1. V. Rajaraman, and N. Adabala, **Fundamentals of computers**, PHI, 2014. 2. A. Goel, **Computer Fundamentals**, Pearson Education, 2010.
Reference Book:
1. P. Aksoy, L. DeNardis, **Introduction to Information Technology**, Cengage Learning, 2006. 2. P. K. Sinha, P. Sinha, **Fundamentals of Computers**, BPB Publishers, 2007.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Describe the basic of computer.
CO2	Classify the architectural level of the system
CO3	Explain the memory and its related concepts of the system.
CO4	Evaluates the complements of the numbers both for positive and negative numbers.
CO5	Discuss the concepts of Programming languages and its basic classifications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS1**	**PS2**	**PS3**
CO1	2	1	1	1	2	1	1	1	1	1
CO2	2	1	1	1	2	1	1	1	1	1
CO3	2	1	1	1	2	1	1	1	1	1
CO4	2	1	1	1	2	1	1	1	1	1
CO5	2	2	2	1	2	1	2	2	2	2

Course Name: **INTRODUCTION TO PROGRAMMING USING PYTHON**

Category:IDSE Course

Prerequisite: Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course. Prior experience with any other programming language will be beneficial.

Learning Objective:

- Introduce Python programming to students.
- Apply problem solving techniques to solve computational problems using python.
- Expose students to develop application for solving computational problems.
- Able to install and set the python environment in their PC and execute python programs.
- Proficiently use functions and core data structure like list, dictionaries, tuple.
- Understand Python syntax, flow control, and functions to solve real life application.
- Develop application using Object Oriented Programming concepts of Python.

IDSE-Paper-CSC306C	
Introduction to Programming Using Python	
UNIT-I:	**10hrs**
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:	**10hrs**
Standard Data Types: Numbers, Strings, Lists, Tuples, Dictionary; Data Type Conversion; Basic Operators: Arithmetic, Comparison, Assignment, Bitwise; Operators: Logical, Membership, Identity; Operators Precedence; Python Numbers & Mathematical functions **Data Type Conversion:** Basic Operators: Arithmetic, Comparison, Assignment, Bitwise; Basic Operators, Python Numbers & Mathematical functions; Python Strings.	
UNIT-III:	**12hrs**
Python statements and Loops: if, if-else, While, for loops, break, continue, pass, Python Function; Files I/O. **Functions**: Definition, call, positional and keyword parameter. Default parameters, variable number of arguments. Modules - import mechanisms. Functional programming - map, filter, reduce, max, min. lambda function - list comprehension	
UNIT-IV:	**8hrs**
Object Oriented Programming: classes and objects - Inheritance – Polymorphism overloading; Error handling & Exceptions - try, except and raise - exception propagation **File Processing:** reading and writing files.	
Text Book:	
.1. Python Programming Fundamentals - A Beginner's Handbook, NischaykumarHegde	
Refrence Book:	
1.Python: The Complete Reference by Martin C.Brown	

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	Identify basic HTML elements, XML elements and develop static webpages.
CO2	Describe different styles in web page design. Apply style sheets and java script to prepare elegant webpages with client side validations.
CO3	Implement server side business logic into dynamic web pages using PHP.
CO4	Use PHP to design user interactive forms for data entry with proper validation.
CO5	Develop aesthetic web applications with database connectivity using PHP.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3		1	1	1		1	1	1	1
CO2	3		2	2	2		2	2	2	2
CO3	3		3	3	3		3	3	3	3
CO4	3		3	3	3		3	3	3	3
CO5	3		3	3	3		3	3	3	3

Course Name: **ARTIFICIAL INTELLIGENCE**

Category: Programme Core Course

Prerequisite: **Linear Algebra, Programming Language**

Learning Objective

- To learn the difference between optimal reasoning VS human like reasoning.
- To understand the notions of state space representation and heuristic search.
- To learn different knowledge representation techniques.
- To understand the applications of AI: namely Game playing, Theorem Proving. Expert systems , machine learning and Natural language Processing.

Learning Outcome:

- Understand different types of AI agents.
- Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms).
- Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving.
- Know how to build simple knowledge-based systems.

Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

IDSE-Paper-CSC306D
Artificial Intelligence
UNIT-I: **10hrs**
Introduction to Artificial Intelligence, AI Problems, AI Techniques,Problems ,Problem Space and Search, Defining the problem as a state space search, Production system, Problem characteristics, **Heuristic search Technologies:** Generate and Test, Hill Climbing, Best First Search, Problem Reduction, means-end-analysis, optimal and A*,AND-OR Graphs, AO* Algorithms.
UNIT-II: **10hrs**
Representation Knowledge using Predicate Logic, Representing simple facts in logic, Representing Instance and ISA relationships, Computable functions and Predicates, Resolution, Representing Knowledge using Rules, Forward Vs Backward Reasoning, Matching , Control Knowledge, , Weak slot and Filter structures, Semantic nets, Frames
UNIT-III: **10hrs**
Strong slot and Filter structures, Conceptual Dependencies, Scripts. Introduction to Non monotonic reasoning ,Logics for Non monotonic reasoning, Implementation : Depth First Search, Dependency-Directed Back Tracking, Justification based Truth Maintenance Logic based Truth Maintenance systems,Statistical Reasoning, Probability and Bayes Theorem,Certainty factors, Rule based Systems, Beyesian Networks, Dempster-Shaffer Theory
UNIT-IV: **10hrs**
Minmax search, alpha-beta cutoffs, Planning system, Goal stack planning, Hierarchical Planning, Natural Language Processing., Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing. Introduction and Fundamentals of Artificial Neural Networks, Biological Prototype, Artificial Neuron, Single Layer Artificial Neural Networks, Multilayer Artificial Neural Networks, Training of Artificial Neural Networks,Genetic Algorithms
Text Books:
1.Elaine Rich, Kevin Knight and ShivashankarB . Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008. 2.Neural Computing: Theory and practice- Waserman
Reference Books:

1. Artificial Intelligence Structures and Strategies complex problem solving-George F. Lugar Pearson Education
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
3. Dan W. Patterson, Artificial Intelligence and Expert Systems, PHI.

Neural Networks: A Comprehensive Foundation 2/e- Symen Pearson Education.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1		2		1	3	3	1
CO2	3	3	1		2		1	3	3	1
CO3	3	3	1		2		1	3	3	1
CO4	3	3	1		2		1	3	3	1
CO5	3	3	1		2		1	3	3	1

Semester-IV

Course Name: **MACHINE LEARNING**

Category: Programme Core Course

Prerequisite: **Basic knowledge of Mathematics**

Learning Objective:

- learn the fundamental concepts behind supervised, unsupervised & reinforcement learning,
- understand the concept behind dimensionality reduction in case of high dimensional data.
- assess& select appropriate model and use cross validation to tune their parameters.

Learning Outcome:

- Analyze the concepts of supervised unsupervised & reinforcement learning and its functionalities.
- Perform classification using Bayes classifier, Neural network, K-nn, SVM, and Decision Tree.
- Reduce dimensionality using feature selection and extraction.
- Determine most appropriate model in a specific context using model cross validation techniques

Paper-CSC401	
Machine Learning	
UNIT-I:	**10hrs**
Introduction to AI and intelligent agents. Problem Solving : Solving Problems by Searching, heuristic search techniques. Learning ((Supervised, Unsupervised and Reinforcement learning), Learning Models (Classification, Regression, Clustering). Cluster Analysis, Partitioning Methods (k-Means, k-Medoids), Hierarchical Methods, Density-Based Methods, Evaluation of Clustering.	
UNIT-II:	**10hrs**
Conditional Probability, Bayes' Theorem, Naïve Bayes Classifier, K-nearest neighbour, Multiple linear regression, Shrinkage method, Ridge regression, Logistic regression, Linear Discriminant Analysis.	
UNIT-III:	**10hrs**
Neural Networks - Introduction, Early Models, Perceptron Learning, Neural Networks - Backpropagation, Neural Networks - Initialization, Training & Validation, Parameter Estimation. Decision Tree, Decision Tree Induction, Attribute Selection Measures, Information Gain, Gain Ratio, ID3, C4.5, Gini Index, CART.	
UNIT-IV:	**10hrs**
Support Vector Machine for linearly separable data, Kernel function, Support Vector Machine for linearly non-separable data.	

Dimensionality reduction, Feature selection, Feature extraction, Principal Component Analysis.Model Cross- validation, Performance of Classification algorithms (Confusion Matrix, Precision and Recall).
Text Book:
T1. Trevor Hastie, Robert Tibshirani,Jerome Friedman , **The Elements of Statistical Learning-Data Mining, Inference, and Prediction**, Springer Verlag Second Edition, 2009. T2. Simon Haykin, **Neural Networks and Learning Machines**, Pearson Education, third edition, 2009.
Reference Book:
R1. Year Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, **An introduction to statistical learning with applications in R**, Springer, 2013. R2. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2006.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3		3	3	3	3
CO2	3	3	3	2	3		3	3	3	3
CO3	3	3	3	2	3		3	3	3	3
CO4	3	3	3	2	3		3	3	3	3
CO5	3	3	3	2	3		3	3	3	3

Course Name: **SOFTWARE ENGINEERING & OOAD**

Category:	Programme Core Course
Prerequisite:	**Knowledge on programming and data structure**
Learning Objective:	• To understand common cycle process life processes. • To understand the basic concepts in Requirement engineering,software design, coding, testing and maintenance • To learn about the role of project management including scheduling, planning, risk management etc. • To have a basic knowledge about software quality,how to ensure good quality software.
Learning Outcome:	• After successful completion of the course the students will be able to demonstrate basic software engineering methods and practices, and their appropriate application.

Paper-CSC402

Software Engineering & OOAD

UNIT-I:

Software and software engineering: Basic concepts about software and program, the nature ofsoftware, Evolution of Software Engineering, Stakeholders in software engineering, Softwarequality, Software engineering projects, Activities common to software projects, Basic conceptson process and life cycle models.

UNIT-II:

Models: Waterfall, Prototype, Evolutionary, Incremental, Spiral, V-model, RAD.
RequirementAnalysis: System and software requirements, Types of software requirements, Functional andnon-functional requirements, Domain requirements, User requirement Elicitation and analysisof requirements, Overview of requirement techniques, Viewpoints, Interviewing, Scenario,Requirement validation, Requirement specification, Software requirement Specification (SRS)Structure and contents, SRS format

UNIT-III:

Introduction to Object Orientated Technology: Development and OO Modeling History, Modeling Concepts,
Object Oriented Analysis: Identifying Use-Cases, Complexity in ObjectOriented Analysis, Business Process Modeling and Business Object Analysis, Use-Case DrivenObject Oriented Analysis, Use-Case Model.
Class Modeling: Object and class concepts, linkand association, Generalization and Inheritance, Advanced class modeling- aggregation,Abstract class, constraints. State Modeling: Event, state, Transition and conditions, statediagram, state diagram behaviour,concurrency, Relation of Class and State models. InteractionModeling: sequence models, activity diagrams

UNIT-IV:

Software Project Management: Overview of Project Management,Responsibilities of ProjectManager, Project Planning , Metrics for Project Size Estimation, Factors Influencing Project Management, Project Estimation Techniques, COCOMO Model and its versions, Scheduling,Work Breakdown Structures (WBS), Activity Network, Critical Path Method(CPM), Program Evaluation and Review Technique (PERT) Chart, GANTT Chart, Risk Management, Configuration Management

Software Testing: Testing overview, concepts, Scope of Testing, Testing Constraints, TestingLife Cycle, Levels of Testing, Blackbox Testing, Whitebox Testing, Integration Testing, Testing Object Oriented Programs
Text Books:
1. R.S. Pressman, "Software Engineering", A Practitioner's Approach, 7/e, McGraw-Hill, 2009 2. Timothy C. Lethbridge, Robert Laganière, "Object-Oriented Software Engineering Practical Software development using UML and Java", McGraw-Hill, Second Edition.
Reference Books:
1. Sommerville, "Software Engineering", 9/e, Addison Wesley. 2. R. Mall, "Fundamentals of Software Engineering", 3/e, PHI

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Describe fundamentals of software engineering and SDLC phases.
CO2	Prepare requirements analysis report, estimation, planning, scheduling, and perform other software project management activities.
CO3	Apply object oriented analysis and design to build a software system.
CO4	Explain project management tasks, design artifacts, testing strategies and implement them appropriately.
CO5	Discuss maintenance, quality standards and reliability issues of softwares.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	1	2	1	2	1	3	1	2	2
CO2	2	1	2	1	2	1	2	1	2	1
CO3	2	2	2	1	1	1	2	1	1	1
CO4	3	2	2	1	2	1	2	1	2	3
CO5	2	2	2	1	2	1	2	2	2	2

Course Name:	**INFORMATION SECURITY**
Category:	Programme Core Course
Prerequisite:	**Computer Network**
Learning Objective:	• Explain the objectives of information security • Explain the importance and application of each of confidentiality, integrity, authentication and availability • Understand various cryptographic algorithms. • Understand the basic categories of threats to computers and networks • Describe public-key cryptosystem. • Describe the enhancements made to lPv4 by IPSec • Understand Intrusions and intrusion detection • Discuss the fundamental ideas of public-key cryptography. • Discuss aboutWeb security and Firewalls. • Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues. • Ability to identify information system requirements for both of them such as client and server. • Ability to understand the current legal issues towards information security.

Paper-CSC403

Information Security

UNIT-I: 10hrs

Attacks on Computers and Computer Security: Introduction, The need for security, Security goals, Security attacks(Attack on Confidentiality,Integrity,Availability)Security Services and Mechanisms, Techniques(Cryptography,Steganography).

Introduction to plain text and cipher text, encryption and decryption. substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, steganography, possible types ofcryptanalysis attacks.

UNIT-II: 14hrs

Symmetric key Ciphers: Block Cipher principles &Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers RC4,Location and placement of encryption function.

Introduction to number theory-Prime numbers,Euler's Phi-Function,Fermat's and Euler's theorem, Chinese Remainder Theorem,Generating Primes(MersennePrime,Fermat Prime),Primality testing(Deterministic algorithms,Probalistic algorithms)

Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman), Key Distribution.

UNIT-III: 6hrs

Message Authentication Algorithms and Hash Functions: Message authentication (MDC,MAC)Nested MAC,HMAC,CMAC,Whirlpool. Hash functions: MD5 Message Digest algorithm,SHA-1. Digital signatures, Authentication Applications: Kerberos, X.509 Authentication Service, Public — Key Infrastructure, Biometric Authentication.

UNIT-IV: 10hrs

E-Mail Security: Pretty Good Privacy, S/MIME IP **Security:lP** Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction. Intrusion Detection System(types, techniques). **Intruders, Virus and Firewalls:** Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.
Text Book:
1. B. A. Forouzan,D.Mukhopadhyay,**Cryptography and Network Security**, 2nd Edition, McGraw Hill, 2007.
Reference Books:
1. A. Kahate, **Network Security**, 2nd Edition, McGraw Hill, 2008. 2. W. Stalling, **Cryptography and Network Security**, 4th Edition, Pearson Education, 2006.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Analyze the working of various Symmetric and Asymmetric key cryptographic algorithms for information security purpose
CO2	Identify the basic categories of threats in a networks
CO3	Able to demonstrate the design and use of hash functions, digital signatures, and key distribution with a wide range of key types
CO4	Discuss about Web security and Firewalls
CO5	Discuss about Intrusion Detection system.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS1**	**PS2**	**PS3**
CO1	2	2	2	1	3	1	1	2	2	1
CO2	2	1	2	1	2	1	1	2	1	2
CO3	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	1	2	1	2	2	2	1
CO5	2	2	2	2	2	2	2	2	2	2

Course Name: **CLOUD COMPUTING**

Category: Programme Core Course
Prerequisite: **Computer Networks and Operating System**

Learning Objective:

- Provides a comprehensive study of cloud computing
- Know the different models of distributed system
- Know the design issues of cloud computing platforms
- Understands the workflow of service-oriented architectures
- Analyze the different cloud computing resource management policies

Learning Outcome:

- Ability to understand various service delivery models of a cloud computingarchitecture.
- Knows the design issues of cloud computing platforms
- Understand the concepts of service-oriented architecture
- Analyze the different workflows of service-oriented architecture
- Ability to understand the security challenges and address the challenges
- Understand the ways in which the cloud can be programmed and deployed

Paper-CSC404
Cloud Computing
UNIT-I:
Distributed System Models and Enabling Technologies: scalable computing over the Internet, technologies for network-based systems, system models for distributed and cloud computing, software environments for distributed systems and clouds, performance, security, and energy efficiency.
UNIT-II:
Virtual Machines and Virtualization of Clusters and Data Centers: implementation levels of virtualization, virtualization structures/tools and mechanisms, virtualization of CPU, memory and I/O devices, virtual clusters and resource management, virtualization of data-center automation. .
UNIT-III:
Cloud Platform Architecture over Virtualized Data Centers: cloud computing and service models, data-center design and interconnection networks, architecture design of compute and storage clouds, public cloud platforms: GAE, AWS (EC2 and S3) and Azure,inter-cloud resource management, cloud security and trust management.
UNIT-IV:
Cloud Programming and Software Environments: features of cloud and grid platforms, parallel and distributed programming paradigms, programming support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, emerging cloud software environments

Advanced Topics in Cloud Computing and Applications: Energy efficiency in clouds, market-based management of clouds, federated clouds/intercloud, third-party cloud services, scientific applications: healthcare, biology, geoscience and business and consumer applications.
Text Books:
1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an imprint of Elsevier, 2012. 2.RajkumarBuyya, Christian Vecchiola and S. ThamaraiSelvi, "Mastering Cloud Computing: Foundations and Applications Programming", MK Publisher, Elsevier, 2013
Reference Books:
1. Tom White, "HadoopThe Definitive Guide", First Edition. O'Reilly, 2009. 2. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann. 3.P. K. Pattnaik, M. R. Kabat and S. Pal, Fundamentals of Cloud Computing, Vikas Publishing House Pvt. Ltd., 2015

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Ability to understand various service delivery models of a cloud computing architecture
CO2	Describe the concepts of service-oriented architecture
CO3	Analyze the different workflows of service-oriented architecture
CO4	Ability to understand the security challenges and address the challenges
CO5	Understand the ways in which the cloud can be programmed and deployed

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	1	2	2	2		1	3	3	3
CO2	3	3	1	1	3		2	2	2	2
CO3	2	2	3	3	1		2	3	2	1
CO4	1	2	1	2	2		3	2	3	3
CO5	2	1	2	1	3		2	2	1	2

Paper-CSC405
Project Work Report and VIVA VOCE
Web-development project: Students must follow software engineering principles to make the project. Research project: Students can take a research work, review the related literatures, then propose a method or implement an existing one.