COURSE OUTCOME – UNDERGRADUATE COMPUTER SCIENCE HONOURS
(CBCS SYSTEM)

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
BSC	2018	COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 CC 1: Programming Fundamentals using C (FM 40)	Unit 1: Introduction to C	Students will learn basic concepts of programming language and evolution of C
			Unit 2: Understanding Compilation and Execution in C	Students will get the idea of compilation and execution process of C language.
			Unit 3: Data Types, Variables, Constants, Operators and Basic I/O	The students will learn basic building blocks of C language like data types, constants, various kinds of operators and how to perform basic I/O operations.
			Unit 4: Expressions, Conditional Statements and Iterative Statements	The students will gain knowledge of conditional and iterative statements as well as how to write them in the C programming language.
			Unit 5: Understanding Functions	In this section, students will learn about the concepts of library and user-defined functions. They will understand the difference between these two types of functions and how to create and call them in their programs. Additionally, they will explore the advantages of using functions to modularize their code and make it more organized and reusable.
			Unit 6: Implementation of Arrays and Strings	Students will understand how to store and manipulate data efficiently using arrays and strings, which are fundamental data structures in computer programming.
			Unit 7: User-defined Data Types (Structures and Unions)	Structures and Unions are important concepts in programming that allow for the creation of custom data types. By understanding these concepts, students will be able to create more complex and efficient programmes

			Unit 8: Pointers and References in C	Pointers and references are powerful tools in C programming that allow for efficient memory management and manipulation of data. By mastering these concepts, students will be able to write more complex and efficient programs.
			Unit 9: Memory Allocation in C	Students will learn how to use functions such as malloc() and free() to allocate and release memory, as well as the importance of managing memory efficiently to avoid memory leaks and other issues.
			Unit 10: File I/O	Students learn how to read and write data to files using various functions such as fopen(), fclose(), fprintf(), fscanf(), etc. They also learn about file modes, error handling, and binary file operations.
			Unit 11: Preprocessor Directives	Students will learn about preprocessor directives such as #define, #include, and #ifdef and how to use them to enhance the functionality of their code and make it more efficient.
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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 CC 1 PRACTICAL (FM 20)	Programming Fundamentals using C Lab	In Programming Fundamentals using C Lab, students will learn how to write and debug C programs, as well as how to use fundamental programming concepts such as variables, data types, control structures, and functions. They will also gain hands-on experience in writing and debugging C programs to solve various problems.
		SEMESTER – 1 CC2 [Computer System Architecture] (Theory)(FM 40)	Unit 1: Introduction	1. Get familiar with different electronics Logic Gates, Combinational circuits and sequential circuit with their architecture and working process 2. Learns concept of Boolean values, different postulates and Boolean algebra.

			Unit 2: Data Representation and Basic Computer Arithmetic	1. Learns different types of Number System, used in computer system and their representation types. Different basic arithmetic operations of integer number that are done within computer system are also learned.
			Unit 3: Basic Computer organization and Design	Students learn organization of a computer system including different hardware units ,their interconnectivity and BUS system.
			Unit 4: Central Processing Unit	1. To learn CPU (specially 8085) organization involving registers and other units . 2. To understand concept of addressing modes, instruction codes, assembly language, RISC-CISC architecture.
			Unit 5: Memory Organization	1. To get familiar with different types of memory unit, present in computer system specially cache memory, associative memory and their mapping techniques.
			Unit 6: Input-Output Organization	1. To understand different Input-Output units of a computer system , their structure and connectivity.
		SEMESTER – 1 CC2 [Computer System Architecture] (Practical) (FM 20)		1. To learn practical implementation of different digital combinational and sequential circuits using IC TRAINER KIT and different IC's.
		SEMESTER – 2 CC3 : Programming in JAVA (Theory)(FM 40)	Unit 1 : Introduction to Java	In the introductory part of JAVA programming, students will learn the basics of java programming. They will also learn how to write and run simple programs using the JAVA programming language.

			Unit 2: Arrays, Strings and I/O	The ability to handle input and output as well as manage strings and arrays will be acquired by learners.
			Unit 3: Object-Oriented Programming Overview	Students will learn the basics of object-oriented programming, such as classes, objects, inheritance, polymorphism and different characteristics of OOP.
			Unit 4: Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata	Understanding these concepts will help students to develop efficient and organized program. Inheritance and interfaces, for example, enable the creation of reusable code, while packages and metadata aid in the organization and documentation of large projects.
			Unit 5: Exception Handling, Threading, Networking and Database Connectivity	Students will learn some important JAVA programming concepts, such as exception handling, which guarantees that the application can manage unexpected errors; threading, allows the application to carry out multiple tasks at once; networking, which enables the application to interact with other systems and database connectivity, which allows the application to store and retrieve data effectively.
			Unit 6: Applets and Event Handling	The students will learn how to create Applets. Additionally, they will also learn how to handle events such as mouse clicks and keyboard inputs in their Java programs.
			Unit 6: Applets and Event Handling	Students learn how to handle Applets and events such as mouse clicks and keyboard inputs.
		SEMESTER – 2 CC3 (Practical) (FM 20)	Programming in JAVA Lab	In Programming in JAVA Lab students will learn the fundamentals of programming in JAVA, including data types, control structures, and object-oriented programming concepts. They will also gain hands-on experience through coding exercises and projects to reinforce their understanding of the material.
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		SEMESTER – 2 CC4 [Discrete Structures] (Theory +Tutorial) (FM 60)	Unit 1: Introduction	To learn concept of set, relation and their types, Permutation-Combination, Mathematical Induction.
			Unit 2: Growth of Functions	To get familiar with different mathematical asymptotic notations, summation formulas and properties etc
			Unit 3: Recurrences	To learn recurrence relations ,linear recurrence relations, generating functions etc.
			Unit 4: Graph Theory	To get familiar with basic terminology of graph theory, different models of graph and their representation, graph connectivity, tree and spanning tree.
			Unit 5: Prepositional Logic	To understand logic connectives, WFF, Tautologies, Inference theory.
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		SEMESTER – 3 CC5 : Data Structures (FM 40)	Unit 1: : Arrays	In this module of the data structure course students will learn to store and manipulate collections of data. Students will learn how to declare, initialize, and access arrays, as well as perform common operations such as sorting and searching.
			Unit 2: Stacks	In this module of data structure students will comprehend the idea of Last-In-First-Out (LIFO) and how to implement it using arrays and linked lists. Additionally, they will learn about stack operations such as push, pop, peek, and isEmpty.
			Unit 3: Linked Lists	Students will learn to store and manipulate collections of data using Linked Lists which consist of nodes that are linked together to form a sequence, allowing for efficient insertion and deletion of elements.
			Unit 4: Queues	Students will comprehend how to put a queue data structure into practice and be able to use it to address real-world issues

				involving first-in, first-out data management.
			Unit 5: Recursion	Students will learn the concept of recursion, a potent technique that enables functions to call themselves and is frequently used in data structures like trees and linked lists.
			Unit 6: Trees	In this module, students will learn the concepts of non-linear data structure.
			Unit 7: Searching and Sorting	The various algorithms for searching and sorting data, as well as how to use them in different programming languages, will be taught to the students. Additionally, they will explore the importance of efficiency and performance when it comes to searching and sorting large amounts of data.
			Unit 8: Hashing	By understanding hashing, students will learn to store and retrieve data efficiently. It involves converting data into a unique numerical value that can be used as an index to access the data quickly.
		SEMESTER – 3 CC5 PRACTICAL (FM 20)	Data Structures Lab	In this lab students will learn how to organize and manipulate data efficiently using various data structures such as arrays, linked lists, stacks, queues, trees, and graphs. They will also gain practical experience in implementing these data structures and analyzing their time and space complexities
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		SEMESTER – 3 CC 6 [Operating System] (theory) (FM 40)	Unit 1: Introduction	To learn basic OS functions, types of OS and their working principles.
			Unit 2: Operating System Organization	To understand user mode, kernel mode of OS, system call etc.
			Unit 3: Process Management	To learn concept of process, threads, process scheduling and related algorithms, inter-process communication, semaphore,

				deadlock.
			Unit 4: Memory Management	To understand different memory types, memory allocation strategies, partitioning, paging and segmentation, virtual memory concept.
			Unit 5: File and I/O Management	To learn file and directory structure, file operations, file allocation methods
			Unit 6: Protection and Security	To learn protection and security mechanism of OS, authentication, authorization.
		SEMESTER – 3 CC 6 PRACTICAL (FM 20)		To learn Bash Shell scripting with some example programs.
		SEMESTER – 5 CC7: Computer Networks (theory) (FM 40)	Unit 1: Introduction to Computer Networks	In this introductory segment, students will gain knowledge of the fundamentals of networking, like different network architectures, protocols, and topologies. They will learn about the OSI mode. Additionally, they will understand the importance of networking in today's digital age and how it impacts businesses and individuals alike.
			Unit 2: Data Communication Fundamentals and Techniques	The students in this section will learn about some mechanisms that are required for data transmission, like modulation, mutiplexing and encoding techniques.
			Unit 3: Networks Switching Techniques and Access mechanisms	Students will learn about the different types of switching techniques used in computer networks, such as circuit switching, packet switching, and message switching.
			Unit 4: Data Link Layer Functions and Protocol	Students will learn about how data is transmitted and received between network devices. Students will also gain knowledge on the error detection and correction techniques used in this layer.

			Unit 5: Multiple Access Protocol and Networks	Students will explore different types of Multiple Access Protocols that allow multiple devices to communicate over a shared communication channel with each other.
			Unit 6: Networks Layer Functions and Protocols	In this module, students will learn about the different functions of the network layers including routing and addressing. They will gain an understanding of how data is transmitted through the network layer and the role it plays in routing packets to their intended destinations.
			Unit 7: Transport Layer Functions and Protocols	In this section, students will learn about the various transport layer protocols, such as TCP and UDP, their differences, and how they are used to ensure reliable data transmission over the network. They will also explore the functions of the transport layer, including flow control, congestion control, and error detection and correction.
			Unit 8: Overview of Application layer protocol	This segment will cover the various types of application layer protocols used in computer networks, including HTTP, FTP, SMTP, and DNS. Students will also gain an understanding of how these protocols enable communication between different devices and applications on a network.
		CC 7L: Computer Networks PRACTICAL PRACTICAL (FM 20)		In Computer Networks Lab students will learn how to design, implement, and troubleshoot computer networks. They will also gain hands-on experience with network devices and protocols such as routers, switches, TCP/IP, and DNS.
		SEMESTER – 3 SEC-E1 Digital Electronics and System Maintenance (FM-60)	Unit-1: Boolean Logics	To get students familiar with Boolean algebra, Boolean expression and different representation.
			Unit-2:Digital Electronics	To make students understand concepts of digital logic gates and structure and working principle of different digital circuit.

			Unit-3:Desktop/PC Hardware Maintenance	To introduce different computer building hardware blocks and to sense their maintenance.
			Unit-4:OS installation and System Maintenance	To learn students how to maintain a computer system to keep it working by installing appropriate Operating System ,Antivirus and other required software.
		SEMESTER – 3 SEC-E2 Website Design with HTML and PHP [FM-60]	Unit-1:Introduction	To introduce students basics of markup language and HTML
			Unit-2:Links,Images and Tables	To understand students the use of link, image and table within a HTML page
			Unit-3:Introduction to XML	To make students familiar with basics of XML and its goal
			Unit-4:Introduction to PHP	To introduce students with basics of PHP programming language
			Unit-5:Hndling HTML form with PHP	To learn about HTML form ,its styling and its use
			Unit-6:PHP conditional events and Loop	To learn different conditional statements and loops to use in a PHP program
			Unit-7:PHP Functions	To learn about PHP function, its need, use and scope.
			Unit-8:String Manipulation and Regular Expression	To learn how to work with string and regular expression
			Unit-9:Array	To familiar with array: its basics and use
		SEMESTER – 3 SEC-E3 Python programming [FM-60]	Unit-1:Planning the computer program	To learn the planning procedure before starting to solve a problem with a program
			Unit-2:Techniques of Problem solving	To get introduce with different programming methodologies
			Unit-3:Overview of programming	To understand basic structure of a Python program
			Unit-4:Introduction to Python	To learn basics of python programming
			Unit-5:Creating python program	To learn some python programming elements such as I/O statements and control statements
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		SEMESTER - 4 CC8 : Design and Analysis of Algorithms (FM 40)	Unit 1: Introduction	Students will learn about the fundamental concepts of algorithm design, including time and space complexity analysis.
			Unit 2: Algorithm Design Techniques	Students will learn various methods for designing efficient algorithms to solve complex problems, including divide and conquer, dynamic programming, and greedy algorithms. They will also learn how to analyze the time and space complexity of algorithms and make trade-offs between efficiency and correctness.
			Unit 3: Sorting and Searching Techniques	Students will gain knowledge of advanced searching and sorting techniques that include Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques and how to use various algorithms, including quicksort, mergesort, binary search, and hash tables, to effectively organise and search through large amounts of data.
			Unit 4: Lower Bounding Techniques	students will learn how to determine the minimum possible value of a given function or problem, which is useful in optimizing algorithms. They will also explore techniques such as linear programming and dynamic programming to efficiently solve complex problems.
			Unit 5: Balanced Trees	Students will learn how to effectively carry out operations like insertion, deletion, and search on a self-balancing binary search tree using Red Black Trees.
			Unit 6: Advanced Analysis Technique	Amortized analysis will help students to understand the average time complexity of an algorithm over a sequence of operations rather than just the worst-case scenario, which can provide a more accurate understanding of its performance.
			Unit 7: Graphs	In this part, students will learn about graph theory and its applications in computer science, including algorithms

				for traversing graphs, finding the shortest paths, and determining connectivity. They will also explore real-world examples of graph-based systems, such as social networks and transportation networks.
			Unit 8: String Processing	Students learn to use regular expressions and KMP to solve string matching problems.
		SEMESTER - 4 CC8 PRACTICAL (FM 20)	Design and Analysis of Algorithms Lab	The effectiveness of algorithms will be analysed by students using a variety of techniques, and they will also learn how to create effective algorithms for various problems. Students will gain hands-on experience developing and testing algorithms by using programming languages like C or Java.
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		SEMESTER - 4 CC9 [Software Engineering Theory] (Theory-FM 40)	Unit-1:Introduction	To gain knowledge on basics of a software and its development process models.
			Unit-2:Requirement Analysis	To learn process of gathering and analysis of user requirements for a software, to be developed.
			Unit-3:Software Project Management	To learn the management system, required to deploy during the development of a software product.
			Unit-4:Risk Management	To understand and manage different risks those may arise during software development process
			Unit-5:Quality Management	To learn how to develop and maintain a reliable, efficient and quality software.

			Unit-6:Design Engineering	To understand all the design issues of a software architecture.
			Unit-7:Testing Strategies	To learn the process of testing a software product, after development and during maintenance, to find errors and weak points to get perfection. .
		SEMESTER - 4 CC9 [Software Engineering PRACTICAL] (FM-20)		To get familiar with practical software development environment by developing some real life system.
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		SEMESTER - 4 CC10 [Database Management System] (Theory-FM 40)	Unit-1:Introduction	To gain basic knowledge of database systems and database management systems software.
			Unit-2:ER Modeling	To have ability to model data in applications using conceptual modelling tools such as ER Diagrams
			Unit-3:Database design	To learn designing database schemas based on models.
			Unit-4:Transaction processing	To apply and relate the concept of transaction, concurrency control and recovery in database
		SEMESTER - 4 CC10 [Database Management System] PRACTICAL (FM-20)		To use a desktop database package and use SQL to create, populate, maintain and query a database.

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		SEMESTER – 4 SEC - E1: Android Programming [FM-60]	Unit 1:Introduction	In the introductory part students will gain an understanding of the Android operating system and its architecture.
			Unit 2:Overview of object oriented programming using Java	Students will learn the basics of Java programming language and how it is used in the context of Android development.
			Unit 3:Development Tools	Students will learn how to create and run Android projects, debug applications using breakpoints and the debugger, and use the Android emulator to test their applications.
			Unit 4:User Interface Architecture	Students will be introduced to the different types of layouts and views that can be used to create interactive and visually appealing user interfaces.
			Unit 5:User Interface Design	Students will learn how to design and implement user interfaces for Android applications using various layout and widget components, as well as how to handle user input and navigation within the app.
			Unit 6:Database	Students will learn how to work with SQLite databases in Android applications, including creating, updating, and querying databases.
		SEMESTER – 4 SEC - E2: Programming in MATLAB [FM-60]	Unit 1: Introduction to Programming	Students will be introduced to the MATLAB environment and its features for scientific computing and data analysis.
			Unit 2: Programming Environment	Students will be introduced to basic programming concepts such as variables, data types, control structures, and functions.
			Unit 3:Graph Plots	Students will learn how to create and customize various types of graphs using MATLAB
			Unit 4: Procedures and Functions	Students will gain knowledge of how to use and create functions in MATLAB.
			Unit 5: Control Statements	Students will learn to use conditional statements and loops to control programs.

			Unit 6: Manipulating Text	Students will learn how to use string functions to manipulate text data in MATLAB. This includes techniques for searching, replacing, and formatting text strings
			Unit 7: GUI Interface	The built-in tools and functions of MATLAB will be used by students to create interactive graphical user interfaces.
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		SEMESTER – 4 SEC - E3: VB.NET Programming [FM-60]	Unit 1: Introduction to .NET Framework	Students will gain knowledge of the.NET Framework's foundations and architecture
			Unit 2: Using .NET Components	Students will learn how to use pre-built .NET components such as controls, classes, and libraries to create efficient and effective applications
			Unit 3: Introduction to VB.NET	Students will learn how to build Windows applications with graphical user interfaces using Visual Basic.NET.
			Unit 4: Application Development and Deployment using VB.NET	Students will gain knowledge of using VB.NET to develop, test, and deploy applications. Additionally, they will learn how to create user-friendly interfaces.
		SEMESTER - 5 CC11 : Internet Technologies [FM-40]	Unit 1:Java	Students will review key Java programming concepts in this section. The review will cover topics such as object-oriented programming, data types, control structures, and arrays.
			Unit 2:JavaScript	Students will learn the JavaScript programming language for creating interactive and dynamic web pages.
			Unit 3:JDBC	Students will learn how to connect to databases, run SQL commands, and work with data in Java applications using JDBC. They will also gain an understanding of database design principles and how to integrate databases into software development projects.

			Unit 4:JSP	Students will learn about JSP, which is used to create dynamic web pages that can interact with databases and other server-side technologies.
			Unit 5:Java Beans	Through Java Beans, which are quickly integrated into a variety of Java applications, students will gain knowledge of reusable software components.
		SEMESTER - 5 CC11 PRACTICAL [FM-20]	Internet Technologies Lab	They will gain hands-on experience in building web applications and designing user interfaces. Additionally, they will learn about industry-standard tools and technologies used in web development, such as HTML, CSS, JavaScript, and JSP.
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		Semester-5 CC12 [Theory of Computation] (Theory FM-60)		
			Unit-1:Languages	To get familiar with basic elements and operations of computing language.
			Unit-2:Finite automata and regular languages	To get knowledge of formal computation and it's relationship to languages and to make students able to design and analyze finite automata machine.
			Unit-3:Context free languages	To make students able to generate strings/sentences of a given CFL using its grammar and design a push down automata machine for given CF language.
			Unit-4: Turing machine and models of computations.	To make students able to design Turing machine for given any computational problem.
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		SEMESTER – 5 DSE-1 –E1	Unit-1:Microprocessor architecture	To get familiar with internal and bus architecture of microprocessor (8085)

		[Microprocessor] (Theory-FM 40)	Unit-2:Microprocessor programming	T o learn assembly language programming
			Unit-3:Interfacing	To develop concept of interfacing external devices with microprocessor.
		SEMESTER – 5 DSE-1 –E1 [Microprocessor] (Practical-FM 20)		To make students able to write and run some assembly language programs using kit or simulator software.
		SEMESTER – 5 DSE-1 –E2 [Information security] (Theory-FM 40)	Unit-1:Introduction	To get introduced with concept, terminology, principles and methods of information security mechanisms .
			Unit-2:Cryptography	To understand cryptography (encryption-decryption) as an information security mechanism.
			Unit-3:Program security	To learn how to secure user-programs from attacks (virus, malwares, spyware etc.)
			Unit-4:Threats	To understand how threats to an organization are discovered, analyzed and dealt with.
			Unit-5:Database security	To learn how to protect database from intruders.
			Unit-6:Security in networks	To understand the needs of users in the field of developing information system and building secure computer networks.
			Unit-7:Administrating security	To formulate information security governance, and related legal and regulatory issues.
		SEMESTER – 5 DSE-1 –E2 [Information security] (PRACTICAL-FM 20)		To learn to implement cryptography algorithms and the use of network security tools.

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		SEMESTER – 5 DSE-1 –E3 [Modeling and simulation] (Theory-FM 40)	Unit-1:System models and system study	To understand a system before going for modeling it.
			Unit-2:What is simulation	To understand different techniques of simulation.
			Unit-3:Continuous system simulation	To make students able to enhance decision making process in a business analysis.
			Unit-4:Concepts in discrete event simulation	To understand how to quantify system performance in manufacturing systems
			Unit-5:Queuing models	To learn simulation of a queuing system to find out optimum service rate investing minimum cost.
			Unit-6:Simulation software	To get familiar with different simulation software packages.
			Unit-7:Random number, non-uniform random variate generation and Monte-Carlo method	To learn how to implement and test random number generators and Monte-Carlo method of simulation
			Unit-8:Analysis of simulation data	To develop concept of simulation data analysis to build models.
			Unit-9:Verification and validation of simulation models	To learn verification and validation of models, to check if the system meets requirements, for quality management
		SEMESTER – 5 DSE-1 –E3 [Modeling and simulation] (PRACTICAL-FM 20)		To enable students to design different simulation models using MATLAB.
		SEMESTER – 5 DSE - 2 - E1: Operational Research for Computer Science [FM-40]		
			Unit 1: Introductory Linear Algebra	Students will learn system of linear equation and matrix algebra
			Unit 2: Linear programming - I	Students will learn how to formulate and solve optimization problems that involve linear relationships among variables, subject to constraints
			Unit 3: Linear programming - II	students will learn Degeneracy and Bland's Anticycling rule (Definition), Simplex Algorithm without initial BFS, Artificial variable techniques – two phase

				method, M-Charnes method, special cases in LPP.
			Unit 4: Duality	students will learn how to model decision problems that involve trade-offs between conflicting objectives and how to find optimal solutions using mathematical optimization techniques.
			Unit 5: Transportation Models	Students will explore different transportation methods and their optimization techniques to minimize costs and maximize efficiency.
			Unit 6: Introduction to Queuing Models	Students will learn about the different types of queuing models and their applications in real-world scenario
			Unit 7: Introduction to Markov Chains	Students will learn how to model and analyze systems that evolve over time using the Markov property.
		SEMESTER – 5 DSE 2 : E1 (Operational Research for Computer Science PRACTICAL} [FM-20]		students will learn how to use mathematical models and algorithms to make optimal decisions in real-world situations, such as scheduling, inventory management, and transportation planning. They will also gain hands-on experience using software tools commonly used in the field, such as Excel Solver and MATLAB.
		SEMESTER – 5 DSE 2 : E2 (Combinatorial Optimization) [FM-40]	Unit 1: Introduction	Students will become familiar with the basic ideas and methods of combinatorial optimisation, including linear programming, network flows, and integer programming.
			Unit 2: Integer Linear Programming	Students will learn how to model and solve optimization problems using integer variables, and how to apply techniques such as branch and bound, cutting planes, and heuristics to find optimal or near-optimal solutions.
		SEMESTER – 5 DSE 2 : E2 (Combinatorial Optimization PRACTICAL) [FM-20]		Students will gain hands on experience of how to use software programmes like Gurobi and CPLEX to solve practical issues like network flow, scheduling, and resource allocation.

		SEMESTER – 5 DSE 2 : E3 (Numerical Methods) [FM-40]	Unit 1: Introduction	Students will learn the fundamental concepts and techniques used in numerical analysis, including root-finding, interpolation, differentiation, and integration. They will also gain an understanding of the sources of error and how to analyze the accuracy and stability of numerical algorithms.
			Unit 2: Iterative methods	Students will learn how to solve mathematical problems by repeatedly applying a chosen algorithm until a desired level of accuracy is achieved, with a focus on methods such as Jacobi, Gauss-Seidel.
			Unit 3: Interpolation	Students will learn how to estimate the value of a function at a point using the values of the function at nearby points, and how to construct polynomial functions that pass through given data points.
			Unit 4: Numerical integration	students will learn how to approximate the definite integral of a function using various numerical techniques, such as the trapezoidal rule, Simpson's rule.
			Unit 5: Extrapolation methods	Students will learn how to use mathematical models to predict values beyond the range of given data points and how to choose the appropriate method based on the characteristics of the data and the desired level of accuracy.
			Unit 6: Eigen-values & Eigen-vectors	Students will learn how to find the eigenvalues and eigenvectors of a matrix.
			Unit 7: Fitting	Students will learn how to find the best parameters for a mathematical model that fits a set of data points, using techniques such as least squares regression and nonlinear optimization.
		SEMESTER – 5 DSE 2 : E3 (Numerical Methods PRACTICAL) [FM-20]		Students will gain hands-on experience in programming and implementing different algorithms related to numerical methods using software tools such as MATLAB or Python.

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		SEMESTER - 6 CC13 : Artificial Intelligence [FM-60]	Unit 1:Introduction	In the introductory part students will learn about the history and evolution of AI, its current applications in various fields such as healthcare and finance, and the different types of AI systems such as expert systems.
			Unit 2: Problem Solving and Searching Techniques	Students will learn various problem-solving techniques such as heuristic search, constraint satisfaction, and optimization algorithms. They will also explore different search algorithms like depth-first search, breadth-first search, and A* search.
			Unit 3:Knowledge Representation	Students will explore different techniques such as semantic networks, frames, and ontologies to represent knowledge in AI.
			Unit 4: Dealing with Uncertainty and Inconsistencies	This part of the course will cover various techniques and approaches to handle uncertainty and inconsistencies in AI systems, such as probabilistic reasoning, fuzzy logic, and Bayesian networks. Students will also learn how to evaluate the performance of these techniques and their applications in real-world scenarios.
			Unit 5: Understanding Natural Languages	In this unit, students will learn about the challenges of understanding human language and how to use computational methods to analyze and generate text.
		SEMESTER - 6 CC13 - Artificial Intelligence PRACTICAL [FM-20]	Artificial Intelligence Lab	Students will solve simple problems using Prolog programming language.
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		SEMESTER - 6 CC14 [Computer Graphics] (Theory- FM 40)	Unit-1:Introduction	To get knowledge on basic elements and applications of computer graphics.
			Unit-2:Graphics Hardware	To get familiar with architecture of graphics hardware devices.
			Unit-3:Fundamental techniques in graphics	To learn different techniques and algorithms in computer graphics.
			Unit-4:Geometric modeling	To understand how to represent curve sand surfaces using graphics
			Unit-5:Visible surface determination	To learn how to make a part of a surface visible and which part is to be eliminated.
			Unit-6:Surface rendering	To learn models to create 3D image of an object on a computer and develop knowledge on computer animation.
		SEMESTER - 6 CC14 PRACTICAL		To do some hands-on programs on graphics such as drawing line, circle etc. transformation of objects.
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		COURSE		COURSE OUTCOME
		SEMESTER - 6 DSE- 3- [E1: Digital Image Processing] (FM 40)	Unit 1:Introduction	The fundamental concepts of image processing, such as image representation, enhancement, restoration, and compression methods, will be taught to the students.
			Unit 2:Spatial Domain Filtering	Students will learn how to use different filters on images to improve their quality or extract important information.
			Unit 3:Filtering in the Frequency domain	Students will learn how to manipulate the frequency content of an image using techniques such as low-pass, high-pass, and band-pass filtering. They will also explore

				the Fourier Transform and its applications in image processing.
			Unit 4:Image Restoration	Students will gain knowledge of various enhancement and restoration methods, including filtering, deblurring, and denoising
			Unit 5: Image Compression	Students will learn how to reduce the size of digital images while maintaining their quality using various techniques
			Unit 6:Wavelet based Image Compression	In order to reduce file sizes and speed up network transmission, students will learn how to use wavelet transforms to compress digital images while maintaining key image features.
			Unit 7:Morphological Image Processing	Students will learn how to process and analyze the shape and structure of objects in an image using mathematical operations such as erosion, dilation, and skeletonization.
			Unit 8: Image Segmentation	Students will learn how to partition an image into multiple segments or regions, based on various characteristics such as color, texture, and shape
		SEMESTER – 6 DSE 3 - E1: Digital Image Processing PRACTICAL (FM 20)		In the Image Processing lab students will learn how to manipulate digital images using various techniques such as filtering, segmentation, and feature extraction to extract useful information from images for further analysis and interpretation. They will also gain hands-on experience with popular image processing software such as MATLAB.
NAME OF THE PROGRAMME	YEAR OF INTRODUCTION			
		COURSE		COURSE OUTCOME
		SEMESTER - 6 DSE 3- E2: Introduction to Data Sciences]	Unit 1:Data Scientist's Tool Box	This module will provide an introduction to the essential tools and concepts that data scientists use to collect, analyze, and interpret data

		(FM 40)	Unit 2:R Programming Basics	R Programming Basics will provide students with a solid foundation in the R programming language, covering topics such as data types, functions, control structures, and data visualization.
			Unit 3:Getting and Cleaning Data	In this section students will learn how to collect, transform, and clean data from various sources to prepare it for analysis. They will also gain experience using popular tools and techniques for data cleaning and wrangling, such as dply and tidy in R programming language.
			Unit 4:Exploratory Data Analysis	Students will learn various techniques such as data visualization, summary statistics, and hypothesis testing to perform exploratory data analysis effectively.
			Unit 5:Reproducible Research	Students will learn how to document and share their research process in a way that allows others to reproduce their results. This includes using version control, organizing data and code, and creating clear and reproducible analyses.
		SEMESTER - 6 DSE3 -E2: Introduction to Data Sciences)-PRACTICAL (FM 20)		Students will have access to various tools and software for data analysis, visualization. They will also learn the R language, how to use Github, and how to create a repo using Github.
		SEMESTER - 6 DSE3 - E3: Data Mining (FM 40)	Unit 1: Introduction	Students will gain knowledge of the fundamental concepts and techniques used in discovering patterns and knowledge from large datasets, including data preprocessing, classification, clustering, association rule mining, and outlier detection.
			Unit 2: Data Mining Techniques	Students will learn how to apply various data mining techniques such as classification, clustering, association rule mining, and anomaly detection to real-world datasets

			Unit 3: Classification	Students will learn how to apply various classification algorithms such as decision trees, neural networks, and support vector machines to different datasets and evaluate their performance using metrics like accuracy, precision, and recall.
			Unit 4: Clustering	Students will learn how to apply various clustering algorithms to large datasets, how to evaluate the quality of clustering results, and how to interpret and visualize the clusters.
			Unit 5: Association Rules	Students will learn how to discover relationships between variables in large datasets, and how to use these relationships to make predictions or inform decision-making.
			Unit6: Advanced Techniques	Students will learn Web Mining, Spatial Mining, Temporal Mining
		SEMESTER - 6 DSE3 - E3: Data Mining PRACTICAL (FM 20)		The use of various data mining techniques on actual datasets, as well as how to effectively communicate and interpret the findings, will be taught to students. They will also get first-hand experience using well-known software and toolkits for data mining.
NAME OF THE PROGRAMME	YEAR OF INTRODUCTION			
		COURSE		COURSE OUTCOME
			Unit-1:Introduction	To get introduced with basics of machine learning i.e how to train a machine or system using AI concepts.
			Unit-2:Software for machine learning and Linear algebra overview	To get familiar with software such as MATLAB or PYTHON to implement different ML operations.
			Unit-3:Linear regression	To understand prediction process after training a system using linear regression approach.

			Unit-4:Logistic regression	To learn how to classify training data set and predict the class of a new test data using logistic regression approach
			Unit-5:Regularization	To understand regularization and its utility
			Unit-6:Neural networks	To get familiar with the concept of neural network, an implementation of human brain model, to train a system.
		SEMESTER - 6 DSE 4-E1 PRACTICAL (FM-20)		To do python or MATLAB programs to implement different machine learning approaches.
NAME OF THE PROGRAMME	YEAR OF INTRODUCTION			
		COURSE		COURSE OUTCOME
		SEMESTER - 6 DSE 4 –E2 [System Programming] (FM 40)	Unit-1: Assemblers, Loaders, Linkers	To get familiar with different types of system programs.
			Unit-2:Introduction	To get introduced with basics of compiler program and its different phases.
			Unit-3:Lexical Analysis	To learn lexical analysis phase of compiler
			Unit-4:Parsing	To learn different parsing methods.
			Unit-5:Intermediate representation	To understand how a low level language code is converted into intermediate code before getting converted into machine code.
			Unit-6:Storage organization	To understand storage organization and storage allocation.
			Unit-7:Code generation	To gain knowledge on concept of target code generation process.

		SEMESTER - 6 DSE 4 –E2 [System Programming] (PRACTICAL FM 20)		To able students to use compiler tools like LEX and YACC
NAME OF THE PROGRAMME	YEAR OF INTRODUCTION			
		COURSE		COURSE OUTCOME
		SEMESTER - 6 DSE 4 –E3 [Cloud Computing] (FM 40)	Unit-1:Overview of computer paradigm	To get familiar with different recent trends in computing.
			Unit-2:Cloud computing architecture	To understand difference between traditional computing and cloud computing, get architecture of different types of cloud computing.
			Unit-3:Case studies	To understand implementation of cloud computing technique through some case study.
			Unit-4:Service management in cloud computing	To gain knowledge on agreement detail related to the cloud computing service with provider.
			Unit-5:Cloud security	To learn different security levels related to cloud storage and data.
		SEMESTER - 6 DSE 4 –E3 [Cloud Computing] (PRACTICAL FM 20)		To able students to create virtual machines to demonstrate storage access and to work on tools used in cloud computing online.
		SEMESTER - 6 DSE 4 P [Project] (FM 60)		To able students to work on a real life project based on the concepts studied in any core /elective/SEC course. Students may choose project or any elective course.

COURSE OUTCOME – GE (CBCS SYSTEM)

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
BSC	2018	COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 GE 1 A [Digital Electronics] (Theory FM 60)	Unit-1:Fundamentals of Computer	To get familiar with basic architecture of a computer system, concept of computer languages and hardware devices.
			Unit-2:Logic gates	To have concept of digital electronic logic gates and Boolean algebra.
			Unit-3:Circuit,Adder,Flip Flops, Registers	To make students understand different electronics circuit (combinational and sequential) with their diagram and working principle.
			Unit-4:Number system and arithmetic	Learns different types of Number System, used in computer system and their representation types. Different basic arithmetic operations of number that are done within computer system are also learned.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 GE 1 PAPER 1 (Group-A) PRACTICAL	No practical	
		SEMESTER - 1 GE 1 B [Computer Networks] (Theory FM 60)	Unit-1:Introduction to Computer Networks	To get introduced with fundamental concepts of computer networks such as architecture, topologies, classification and protocols.
			Unit-2:Data Communication Fundamentals and Techniques	To learn basics of data communication such as data encoding, modulation, data multiplexing and data transmission techniques.

			Unit-3:Network Switching Techniques and Access Mechanism	To understand different types of switching techniques those are used during data transmission.
			Unit-4:Data Link Layer Functions and Protocol	To able students to understand different error detection and error correction techniques for the errors which may occur during data transmission.
			Unit-5:Multiple Access Protocol and Networks	To get knowledge on different network building devices and network layer protocols.
			Unit-6:Transport Functions and Protocols	To understand how connection is established between sender and receiver before data transmission and released after transmission, data flow control mechanism.
			Unit-7:Overview of Application Layer Protocol	To learn transmission protocols such as HTTP, WWW and domain name system.
NAME OF THE PROGRAMME	YEAR OF INTRODUCTIO N	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER - 1 GE 1B) PRACTICAL	No practical	

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 2 GE 2A [Programming in C] (Theory FM-40)	Unit-1:Introducton	To get introduced with concept of procedural programming, algorithm and flowchart
			Unit-2: Understanding compilation and execution in C	To understand how a C program is compiled and executed.
			Unit-3: Data types, variables, constant, operators and basics	To learn different elements of C program such as data types, variables, constants, operators, header file etc.

			Unit4: Expressions, conditional statements and Iterative statements	To learn how expressions and statements are used within a C program
			Unit-5: Understanding Functions	To make students understand concept of function and its types.
			Unit-6: Implementation of array and string	To able students to implement the concept of array and string within a C program
			Unit-7: User-defined data types	To learn user defined data types in C language and their implementation.
			Unit-8: Pointers and References in C	To understand the concept of pointer variable and use of reference.
			Unit-9: Memory allocation in C	To get knowledge on different memory allocation schemes, used in C programming language.
			Unit-10: File I/O	To learn file management in C
			Unit-11: Preprocessor Directives	To understand different preprocessor directives and macros, used in C
		SEMESTER – 2 GE 2A [Programming in C] (PRACTICAL FM-20)		To able students to write and execute C programs to solve some basic real life problems.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME

		SEMESTER – 2 GE 2B [Microprocessor] (Theory FM 40)	Unit-1 Microprocessor Architecture	To get familiar with internal and bus architecture of microprocessor (8085)
			Unit-2: Microprocessor Programming	To get knowledge on different types of registers, present in a microprocessor and to learn assembly language programming
			Unit-3:Interfacing	To develop concept of interfacing external devices with microprocessor.
		SEMESTER – 2 GE 2B [Microprocessor] (PRACTICAL FM 20)		To make students able to write and run some assembly language programs using kit or simulator software.
NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 3 GE 3A: Operating Systems (FM 40)	Unit 1: Introduction	In introductory part students will learn about the fundamental concepts of operating systems.
			Unit 2: Operating System Organization	Students will gain knowledge of the different layers and components that make up an operating system, such as the kernel, file system, and device drivers.
			Unit 3: Process Management	This includes topics such as process scheduling, synchronization, deadlock handling, and memory management. Students will gain a deep understanding of how these concepts are implemented in modern operating systems.
			Unit 4: Memory Management	This module will cover the various techniques used by operating systems to manage memory, including virtual memory, paging, and segmentation

			Unit 5: File and I/O Management	Students will learn about the different file systems and how they are managed by the operating system.
			Unit 6: Protection and Security	Students will learn about the different security mechanisms implemented in modern operating systems.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER GE 3B: Database Management Systems (FM 40)	Unit 1: Introduction	Students will learn about the fundamental concepts of data modeling, relational databases, database system architecture and data independence.
			Unit 2: Entity Relationship(ER) Modeling	In this segment students will learn how to design and represent data using ER diagrams. Additionally, they will learn how to convert ER diagrams into relational database schemas.
			Unit 3: Relation data model	Students will learn how to design and manage tables, keys, and relationships between tables in a relational database
			Unit 4: Database design	Students gain knowledge of how to create efficient and effective database structures, including entity-relationship diagrams and normalization techniques, to ensure data integrity and minimize redundancy.
			Unit 5: Transaction Processing	Students will learn how to manage and manipulate data in a transactional environment, ensuring the integrity and consistency of the database. They will also learn about concurrency control and recovery techniques to handle system failures.
			Unit 6: File Structure and Indexing	students will learn how to organize and store data efficiently using different file structures such as sequential, indexed sequential, and direct access. They will also learn about indexing techniques that improve query performance, including B-trees, hash indexes, and bitmap indexes.

		SEMESTER 4 GE 4A: Programming in JAVA (FM 40)	Unit 1: Introduction to Java	In this introductory part of the course students will learn about the basic syntax and structure of the JAVA programming language, as well as how to use variables, data types, and control structures to create simple programs.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
			Unit 2: Arrays, Strings and I/O	Students will learn how to manipulate arrays and strings in Java, as well as how to read and write data to files using input/output streams.
			Unit 3: Object-Oriented Programming Overview	Students will learn about the fundamental concepts of object-oriented programming, such as classes, objects, inheritance, polymorphism, and encapsulation.
			Unit 4: Inheritance, Interfaces, Packages, Enumerations, Auto boxing and Metadata	Students will learn how to define and implement interfaces, organize code into packages, use enumerations to represent a fixed set of constants, utilize auto boxing to convert primitive data types into objects, and annotate code with metadata for documentation and other purposes.
			Unit 5: Exception Handling, Threading, Networking and Database Connectivity	Students will learn how to handle errors and unexpected events in their code, how to create and manage multiple threads of execution, how to communicate between different devices over a network, and how to connect and interact with databases using Java programming language.
			Unit 6: Applets and Event Handling	Students will gain knowledge of how to create small Java applications called applets that can be embedded in web pages and how to handle events such as mouse clicks and keyboard inputs within these applets.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER GE 4AL: Programming in JAVA Lab (FM 20)		Students will learn how to design, implement, and test Java programs. They will also gain hands-on experience with Java development tools and techniques for debugging and troubleshooting code.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 4 GE 4B: Python Programming (FM – 40)	Unit 1: Planning the Computer Program	Students will gain knowledge of how to design and develop algorithms, write pseudocode, and translate it into Python code.
			Unit 2: Techniques of Problem Solving	Students will gain knowledge how to approach and break down complex problems into smaller, more manageable parts using algorithms and data structures
			Unit 3:Overview of Programming	Students will learn the fundamental concepts of programming.
			Unit 4: Introduction to Python	Students will learn the basics of Python programming language such as variables, data types, and control structures. They will also be introduced to the basics of Python syntax and how to write simple programs using these concepts.
			Unit 5: Creating Python Programs	Students will learn how to write Python programs from scratch, including how to use variables, data types, control structures, functions, and modules.
		SEMESTER 4 GE 4BL Software Lab Based on Python (FM 20)		Students will also gain hands-on experience in writing Python programs to solve real-world problems and develop their critical thinking skills.