Name of the Course - B.Sc(H) Computer Science

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	Paper Name	Paper No.	Learning Outcome of Paper
Semester 1	Core	Programming Using Python	DSC-1	1. Understand the basics of programming language. 2. Develop, document, and debug modular Python programs. 3. Apply suitable programming constructs and built-in data structures to solve a problem. 4. Use and apply various data objects in Python. 5. Use classes and objects in application programs and handle files.
		Computer System Architecture	DSC-2	1. Design Combinational Circuits using basic building blocks, simplify these circuits using Boolean algebra and Karnaugh maps, differentiate between combinational circuits and sequential circuits. 2. Represent data in binary form, convert numeric data between different number systems and perform arithmetic operations in binary 3. Determine various stages of instruction cycle and describe interrupts and their handling. 4. Explain how CPU communicates with memory and I/O devices and distinguish between different types of processors. 5. Simulate the design of a basic computer using a software tool.
		Mathematics For Computing	DSC-3	1. Perform operations on matrices and sparse matrices. 2. Compute the determinant, rank and eigenvalues of a matrix. 3. Perform diagonalization. 4. Perform operations on vectors, the dot product and cross product. 5. Represent vectors geometrically and calculate the gradient, divergence, curl. 6. Apply linear algebra and vector calculus to solve problems in sub-disciplines of computer science.
	Course Type (Core/AECC/GE/DSE/Langua	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 2	Core	Object Oriented Programming	DSC-4	1. Write simple programs using built-in data types of C++.2. Implement arrays and user defined functions in C++. 2. Write programs using dynamic memory allocation, handling external files, interrupts and exceptions. 3. Solve problems spanning multiple domains using suitable programming constructs in C++. 4. Solve problems spanning multiple domains using the concepts of object oriented programming in C++.
		Discrete Mathematical Structures	DSC-5	1. Relate mathematical concepts and terminology to examples in the domain of Computer Science. 2. Model real world problems using various mathematical constructs. 3. Use different proofing techniques; construct simple mathematical proofs using logical arguments. 4. Formulate mathematical claims and construct counterexamples.
		Probability For Computing	DSC-6	1. Use probability theory to evaluate the probability of real-world events. 2. Describe discrete and continuous probability distribution functions and generate random numbers from the given distributions. 3. Find the distance between two probability distributions 4. Define and quantify the information contained in the data. 5. Perform data analysis in a probabilistic framework. 6. Visualize and model the given problem using mathematical concepts covered in the course.
	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**

Semester 3	Core	Data Structures	C-V	1. Implement and empirically analyse linear and non-linear data structures like Arrays, Stacks, Queues, Lists, Trees, Heaps and Hash tables as abstract data structures. 2. Write a program, choosing a data structure, best suited for the application at hand. 3. Re-write a given program that uses one data structure, using a more appropriate/efficient data structure. 4. Write programs using recursion for simple problems. Explain the advantages and disadvantages of recursion.
		Operating System	C-VI	1. Implement multiprogramming, multithreading concepts for a small operating system. 2. Create, delete, and synchronize processes for a small operating system. 3. Implement simple memory management techniques. 4. Implement CPU and disk scheduling algorithms.
		Computer Networks	C-VII	1. Describe the hardware, software components of a network and their interrelations. 2. Compare OSI and TCP/IP network models. 3. Describe, analyze and compare different data link, network, and transport layer protocols. 4. Design/implement data link and network layer protocols in a simulated networking environment.

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 4	Core	Design and Analysis ofAlgorithms	C-VIII	1. Given an algorithm, identify the problem it solves. 2. Write algorithms choosing the best one or a combination of two or more of the algorithm design techniques: Iterative, divide-n-conquer, Greedy, Dynamic Programming using appropriate data structures. 3. Write proofs for correctness of algorithms. 4. Re-write a given algorithm replacing the (algorithm design) technique used with a more appropriate/efficient (algorithm design) technique.
		Software Engineering	C-IX	1. Analyse and model customer's requirements and model its software design. 2. Use suitable software model for the problem at hand. 3. Estimate cost and efforts required in building software. 4. Analyse and compute impact of various risks involved in software development.
		Database Management Systems	C-X	1. Describe major components of DBMS and their functions 2. Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model. 3. Write queries in relational algebra / SQL 4. Normalize a given database schema to avoid data anomalies and data redundancy

	Course Type (Core/AECC/GE/DSE/Langua	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Theory of Computation		1. Design a finite automaton, pushdown automaton or a Turing machine for a problem at hand. 2. Apply pumping lemma to prove that a language is non-regular/non-context-free. 3. Describe limitations of a computing machine.
	Core	Internet Technology	C-XI	1. Describe Internet, its architecture, services and protocol. 2. Implement a simple search engine. 3. Implement a web crawler.

	Core	Internet Technology	C-XI	4. Use javascript technologies to make a website highly responsive, more efficient and user friendly
Semester 5	DSE	Data Analysis and Visualization	BHCS-15A	1. Use data analysis tools in the pandas library. 2. Load, clean, transform, merge and reshape data. 3. Create informative visualization and summarize data sets. 4. Analyze and manipulate time series data. 5. Solve real world data analysis problems.
		System Programming	BHCS-15B	1. Describe the working of assemblers and compilers. 2. Use Lex/ Yacc for building basic compiler. 3. Develop a two pass Assemblers. 4. Describe the role of the loaders, linkers and relocatable programs.
		Digital Image Processing	BHCD-16A	1. Describe the roles of image processing systems in a variety of applications; 2. Write programs to read/write and manipulate images: enhancement, segmentation, and compression, spatial filtering. 3. Develop Fourier transform for image processing in frequency domain. 4. Evaluate the methodologies for image segmentation, restoration

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 6	Core	Computer Graphics	C-XIV	1. Describe Standard raster and vector scan devices as well as Graphical Input and output devices 2. Implement algorithms for drawing basic primitives such as linecircle and ellipse. 3. Implement algorithms for line clipping and polygon clipping and filling. 4. Implement a 3D object representation scheme and carryout 2D and 3D Transformation, 3D projections 5. Implement visible surface determination algorithms, Illumination models and surface rendering methods, color models
		Artificial Intelligence	C-XIII	1. Identify problems that are amenable to solution by specific AI methods 2. Represent knowledge in Prolog and write code for drawing inferences. 3. Identify appropriate AI technique for the problem at hand
	DSE	Machine Learning	BHCS-18A	1. Differentiate between supervised and unsupervised learning tasks. 2. Differentiate between linear and non-linear classifiers. 3. Describe theoretical basis of SVM 4. Implement various machine learning algorithms learnt in the course.
		Information Security	BHCS-17A	1. Identify the major types of threats to information security 2. Describe the role of cryptography in security 3. Select appropriate error-detection and error-correction methods for an application 4. Discuss the strengths and weaknesses of private and public key crypto systems 5. Describe malwares and memory exploits 6. Discuss the need for security in IoT
		Data Mining	BHCS-17B	1. Pre-process the data, and perform cleaning and transformation. 2. Apply suitable classification algorithm to train the classifier and evaluate its performance. 3. Apply appropriate clustering algorithm to cluster data and evaluate clustering quality 4. Use association rule mining algorithms and generate frequent item-sets and association rules

Name of the Course - B.Sc Mathematical Science

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 1	Core	Programming Fundamentals using C++	DSC-1	1. Write simple programs using built-in data types of C++. 2. Implement arrays and user defined functions in C++. 3. Write programs using dynamic memory allocation, handling external files, interrupts and exceptions. 4. Solve problems spanning multiple domains using suitable programming constructs in C++. 5. Solve problems spanning multiple domains using the concepts of object oriented programming in C++.

Semester 2	Core	Data Structures using C++	DSC-2	1. Compare two functions for their rates of growth. 2. Understand abstract specification of data-structures and their implementation. 3. Compute time and space complexity of operations on a data-structure. 4. Identify the appropriate data structure(s) for a given application and understand the trade-offs involved in terms of time and space complexity. 5. Apply recursive techniques to solve problems.
Semester 3	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Operating System	Paper 3	1. Implement multiprogramming, multithreading concepts for a small operating system. 2. Create, delete, and synchronize processes for a small operating system. 3. Implement simple memory management techniques. 4. Implement CPU and disk scheduling algorithms.
Semester 4	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Computer System Architecture	Paper 4	1. Design Combinational Circuits using basic building blocks. Simplify these circuits using Boolean algebra and Karnaugh maps. Differentiate between combinational circuits and sequential circuits 2. Represent data in binary form, convert numeric data between different number systems and perform arithmetic operations in binary 3. Determine various stages of instruction cycle and describe interrupts and their handling. 4. Explain how CPU communicates with memory and I/O devices
Semester 5	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	DSE	Data Structures	BSCS-05A	1. demonstrate a thorough understanding of the behaviour of basic data structures. 2. implement data structures efficiently in programming language C++. 3. demonstrate an understanding of recursion by applying recursive techniques to solve problems.
		Digital Image Processing	BSCS-05B	1. describe general terminology of Digital Image Processing and the roles of image processing systems in a variety of applications. 2. describe the basic issues and the scope (or principal applications) of image processing. 3. explain representation and manipulation of digital images, image acquisition, reading, writing, enhancement, displaying and segmentation and image Fourier transform. 4. examine various types of images, intensity transformations and spatial filtering.
Semester 6	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	DSE-2	Internet Technologies	DSE-2	1. Describe major components of DBMS and their functions 2. Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model. 3. Write queries in relational algebra / SQL 4. Normalize a given database schema to avoid data anomalies and data redundancy

Name of the Course - All Hons. Courses : GE Computer science

Semester 1	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	GE	Programming Using C++	GE-1a	1. Write simple programs using built-in data types of C++. 2. Implement arrays and user defined functions in C++. 3. Solve problems in the respective domain using suitable programming constructs in C++. 4. Solve problems in the respective domain using the concepts of object oriented programming in C++.

		Programming with Python	GE-1b	1. Write simple programs using built-in data structures in Python. 2. Implement arrays and user defined functions in Python. 3. Solve problems in the respective domain using suitable programming constructs in Python. 4. Solve problems in the respective domain using the concepts of object oriented programming in Python
Semester 2	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	GE	Data Analysis and Visualization using Python	GE-2a	1. Apply descriptive statistics to obtain a deterministic view of data 2. Apply basic and advanced level statistical function on data 3. Perform data handling using Numpy arrays 4. Do data cleaning and transformation before extracting useful information 5. Visualize data for ease of understanding the revealed information
Semester 3	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	GE	Computer Networks and Internet technologies	GE-3	1. State the use of computer networks and different network topologies. 2. Distinguish between LAN, MAN, WAN, and between Intranet, Extranet and Internet. 3. Compare OSI and TCP/IP architectures 4. Enumerate different transmission media and describe the use of each of them. 5. Design web pages using HTML
Semester 4	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	GE	Information Security & Cyber laws	GE-4	1. Learn, structure, mechanics and evolution of various crime threats 2. Learn to protect information systems from external attacks by developing skills in enterprise security, wireless security and computer forensics. 3. Analyse the risks involved while sharing their information in cyber space and numerous related solutions like sending protected and digitally signed documents

Name of the Course - All Hons. Courses : SEC Computer science

Semester	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Learning Outcome of Paper**
Semester 1	SEC (All Courses)	Programming with Python	1. After studying this course, students will be able to interpret the basic representation of the data structures and sequential programming. 2. After studying this course, students will be able to gain knowledge of, and ability to use control framework terminologies. 3. After studying this course, students will be able to work out using the core data structures as lists, dictionaries, tuples, and sets. 4. After studying this course, students will be able to choose appropriate programming paradigms, interrupt and handle data using files to propose solutions through reusable modules. 5. After studying this course, students will be able to propose possible error-handling constructs for unanticipated states/inputs. 6. After studying this course, students will be able to implements exemplary applications on real-world problems.
		Basic IT Tools	1. By studying this course, students will be able to use word-processor to generate documents with appropriate formatting, layout, review and referencing. 2. By studying this course, students will be able to manage data in worksheets and workbooks and analyze it using spreadsheet functions and inbuilt formulas. 3. By studying this course, students will be able to draw analysis on data using spreadsheets to make decisions. 4. By studying this course, students will be able to make meaningful representations of data in the form of charts and pivot tables. 5. By studying this course, students will be able to manage data in database tables and use the same for generating queries, forms and reports.

		Front End Web Design and Development	1. After studying this course, students will be able to build websites using the elements of HTML. 2. After studying this course, students will be able to build interactive and stylish websites using client-side programming techniques with CSS and Javascript. 3. After studying this course, students will be able to learn to validate client-side data. 4. After studying this course, students will be able to define the structure and contents of the website using different features of CSS.
		Introduction to Cloud Computing (AWS)	1. After studying this course, students will be able to Understanding cloud computing platform. 2. After studying this course, students will be able to differentiate between on-premises, hybrid-cloud, and all-in cloud 3. After studying this course, students will be able to describe the basic global infrastructure of the AWS Cloud 4. After studying this course, students will be able to understanding the core AWS services, including compute, network, databases, and storage
Semester 2	SEC (All Courses)	Advanced Spreadsheet Tools	1. By studying this course, students will be able to make meaningful representations of data in the form of charts and pivot tables. 2. By studying this course, students will be able to draw analysis on data using spreadsheets and use interpretation to make decisions. 3. By studying this course, students will be able to generate word documents with appropriate formatting, layout, proofing. 4. By studying this course, students will be able to manage data for generating queries, forms and reports in a database.
		Analytics/Computing with Python	1. After studying this course, students will be able to learn about Python's main features and how they make Python a great tool for financial analysts. 2. After studying this course, students will be able to get familiarized with Anaconda and Jupyter Notebook. 3. After studying this course, students will be able to learn basics of Machine learning. 4. After studying this course, students will be able to to apply these techniques on data.
		Big Data Analytics - I	1. After studying this course, students will be able to identify Big Data and its Business Implications. 2. After studying this course, students will be able to list the components of Hadoop and Hadoop Eco-Systems. 3. After studying this course, students will be able to access and process data on distributed file system. 4. After studying this course, students will be able to manage job execution in Hadoop environment.
		Back-End Web Development	1. After studying this course, students will be able to build interactive and dynamic websites. 2. After studying this course, students will be able to write the server side programming techniques with Django for accessing the contents to/from the server 3. After studying this course, students will be able to learn to validate server-side/backend data. 4. After studying this course, students will be able to use GET and POST methods for sending data within client and server.
Semester 3	SEC (Mathematical Sciences)	Data Analysis Using Python Programming	1. develop a python script for data analysis and execute it. 2. install, load and deploy the required packages. 3. clean and prepare the data for accurate analysis. 4. analyse the data stored in files in different formats. 5. experiment with data visualization methods.
	SEC (Computer Science (H))	Android Programming	1. Describe the design of Android operating system. 2. Describe various components of Android applications. 3. Design user interfaces using various widgets, dialog boxes, menus. 4. Design application with interaction among various activities/applications using intents
Semester 4	SEC (Computer Science (H))	PHP Programming	1. Use different data types and control structures in PHP. 2. Handle arrays and strings in PHP. 3. Create dynamic interactive web pages with PHP. 4. Use PHP built-in functions as well as define custom functions. 5. Perform data validation in PHP. 6. Manipulate and manage a database using PHP
	SEC (Mathematical Sciences)	Programming in Java	1. develop and execute Java programs using iteration and selection. 2. create classes and their objects. 3. implement OOPS concepts to solve problems using JAVA
Semester 5	SEC (Mathematical Sciences)	Advanced Programming in Java	1. implement Exception Handling and File Handling. 2. implement multiple inheritance using Interfaces. 3. logically organize classes and interfaces using packages 4. use AWT classes to design GUI applications.
Semester 6	SEC (Mathematical Sciences)	Android Programming	1. Describe the design of Android operating system. 2. Describe various components of Android applications. 3. Design user interfaces using various widgets, dialog boxes, menus. 4. Design application with interaction among various activities/applications using intents

Name of the Course - B.A.(P) Discipline Course in Computer Applications

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	Paper Name	Paper No.	Learning Outcome of Paper
Semester 1	Core	Introduction to Programming Using C++	DSC-1	1. Write simple programs using built-in data types of C++. 2. Implement arrays and user defined functions in C++. 3. Solve problems spanning multiple disciplines using suitable programming constructs in C++. 4. Solve problems spanning multiple disciplines using the concepts of object oriented programming in C++.
		Programming Fundamentals Using Python	DSC-2	1. Write simple programs using built-in data types of Python. 2. Implement arrays and user defined functions in Python. 3. Solve problems spanning multiple disciplines using suitable programming constructs in Python. 4. Solve problems spanning multiple disciplines using the concepts of object-oriented programming in Python
Semester 2	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Data Structures	DSC - 2	1. Understand abstract specification of data-structures. 2. Implement data structures as ADT.. 3. Identify the appropriate data structure(s) for a given application. 4. Apply recursive techniques to solve problems.
		Data Interpretation and Visualization using Python	A2	1. Interpret Data. 2. Obtain a deterministic view of data 3. Perform data handling using Numpy arrays 4. Load, clean, transform, merge and reshape data using Pandas 5. Visualize data using Pandas and matplot libraries
Semester 3	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Computer Networks and Internet technologies	DSC 1C	1. Enumerate various network topologies and identify situations when different network topologies would be useful. 2. Distinguish between LAN, MAN, WAN. 3. Distinguish between Intranet, Extranet and Internet. 4. Describe client-server architecture. 5. Enumerate different transmission media and describe the use of each of them. 6. Design web pages using HTML.
	SEC	PHP Programming	SEC-1B	1. write PHP scripts to handle HTML forms. 2. write regular expressions including modifiers, operators, and meta-characters. 3. write PHP programs that use various PHP library functions, and that manipulate files and directories. 4. create a dynamic web site employing server side scripting.
Semester 4	**Course Type (Core/AECC/GE/DSE/Language AEEC)***	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
	Core	Multimedia Systems & Applications	DSC 1D	1. Enumerate and describe the multimedia components. 2. Generate, manipulate and use images in multimedia projects using bitmap, vector and 3-D images. 3. Create basic animations.
	SEC-2	Web Designing Using HTML 5	BACS-08B	1. define the principle and basics of Web page design 2. visualize the basic concept of HTML. 3. recognize the elements of HTML. 4. apply basic concept of CSS.

				5. publish the web pages.

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 5	DSE	Programming with Python	DSE-1A	1. Describe the components of a computer and notion of an algorithm. 2. Apply suitable programming constructs and built-in data structures to solve a problem. 3. Develop, document, and debug modular python programs. 4. Use classes and objects in application programs and visualize data.
	SEC	Desktop Publishing	BACS-09B	1. write, edit and print documents using word processing and spreadsheet. 2. use tools for Desktop Publishing and would be able to create and design documents with text and graphics like newspaper ads, visiting cards, posters etc.
	GE-1	IT Fundamentals	GE 1	1. Develop a vocabulary of key terms related to the computer and to software program menus, identify the components of a personal computer system and use the interface ideftly. 2. Organize files and documents on storage devices. 3. Compose, format and edit a word document. 4. Use spreadsheet for storing data and performing preliminary analysis

	Course Type (Core/AECC/GE/DSE/Language AEEC)*	**Paper Name**	**Paper No.**	**Learning Outcome of Paper**
Semester 6	DSE	Project Work/Dissertation	BACS-06B	1. develop a project plan based on informal description of the project. 2. implement the project as a team. 3. write a report on the project work carried out by the team and defend the work done by the team collectively. 4. present the work done by the team to the evaluation committee
	SEC	Data Visualization using R	SEC 4A	1. import/export small data sets in and out of R environment. 2. draw different types of plots to aid analysis of datasets. 3. identify a suitable technique for analysis data for the given objective. 4. Interpret and use the results of analysis.
	GE-2	Multimedia	GE-2	1. Enumerate and describe the multimedia components. 2. Generate, manipulate and use images in multimedia projects using bitmap, vector and 3-D images. 3. Create basic animations.