SCHEME OF EXAMINATION AND PROGRAM OF STUDY

For Subject

Computer Science

Under

National Education Policy of India 2020 (NEP 2020)

PROGRAMME

Bachelor of Science

(Computer Science)

Duration

Full Time

(1/2/3/4 Years)

(w.e.f. Session 2023- 24)

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF SCIENCE

Gurukula Kangri (Deemed to be University), Haridwar

MAY, 2023

DEPARTMENT OF COMPUTER SCIENCE

LEARNING OUTCOMES

PROGRAM OUTCOMES

After completing B.Sc. (Computer Science) Program students will be able:

PO1	To enhance problem-solving skills through the use of a computer.
PO2	To build the knowledgebase required for computer science research and development.
PO3	To understand the basic principles and methods of computer science for solving complex computing problems.
PO4	To develop Ability to function effectively as an individual or a team member engaged in accomplishing common goal.
PO5	To develop the skill set, Mathematical and analytical capabilities required for creating solutions for problems encountered in real life.
PO6	To develop good communication skills in both written and verbal form to convey technical information effectively and accurately.
PO7	To recognize ethical principles and moral values for the computing profession in global economic environment.

PROGRAM SPECIFIC OUTCOMES

PSO1	Computer Science: Provide effective and efficient solutions to real life problems using acquired knowledge in Data Structure, graph Theory, DBMS and other Computer Science concepts for continued professional development.
PSO2	Information Technology: Explore and provide software solutions for complex problems using information technology concepts.

DEPARTMENT OF COMPUTER SCIENCE

Regulations, Curricula, Syllabus and Scheme of Examinations
Under
National Education Policy of India 2020 (NEP 2020)

B.Sc. (Computer Science)
(with effect from session 2023-2024)

1. **Duration:** Duration of the B.Sc. (CS) programme shall be 4 Years/8 Semester with the flexibility to exit after 1/2/3/4 Years.
2. **Eligibility for admission:** Intermediate (10+2) with Mathematics from any recognized Board.

All other ordinances related to examination and result declaration will be as per the ordinances framed by University for UG Courses.

Four Year Undergraduate Programme B.Sc. (Computer Science)

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF SCIENCE
PROGRAMME STRUCTURE

Semester	DSC	DSE	GE	AECC	SEC/ VoC/ CoC (Qualifying)	VAC/ ISRD	Total Credits
I	DSC(4+2) DSC(4+2) DSC(4)	-	-	From AECC Pool (4)	From CoC Pool (Qualifying)	From VAC Pool (2)	22
II	DSC(4+2) DSC(4+2) DSC(4)	-	-	From AECC Pool (4)	From CoC Pool (Qualifying)	From VAC Pool (2)	22
AWARD OF CERITIFICATE (COMPUTER SCIENCE) (AFTER 1 YEAR: 44 CREDITS)							
III	DSC(4+2) DSC(4) DSC(4)	-	-	-	SEC-1 (4)	From VAC Pool (2+2)	22
IV	DSC(4+2) DSC(4) DSC(4)	-	-	-	SEC-2 (4)	From VAC Pool (2+2)	22
AWARD OF DIPLOMA (COMPUTER SCIENCE) (AFTER 2 YEARS: 88 CREDITS)							
V	DSC(4)	DSE(4)	GE(6)	-	SEC-3 (4)	From VAC Pool (2) Project(2)	22
VI	DSC(4)	DSE(4)	GE(6)	-	SEC-4 (4)	From VAC Pool (2) Project(2)	22
AWARD OF DEGREE BACHELOR OF SCIENCE (COMPUTER SCIENCE) (AFTER 3 YEARS: 132 CREDITS)							
VII	DSC(4+2)	DSE(4) DSE(4)	-	-	VoC(2)	Dissertation (6)	22
VIII	DSC(4+2)	DSE(4) DSE(4)	-	-	VoC(2)	Dissertation (6)	22
AWARD OF BACHELOR OF SCIENCE (HONS./RESEARCH IN COMPUTER SCIENCE) (AFTER 4 YEARS: 176 CREDITS)							
Credits	**88**	**24**	**12**	**8**	**20**	**24**	**176**

Note: Credits are in parenthesis. SEC papers should be at least 50% hands-on/interactive.

DSC - Discipline Specific Core
DSE - Discipline Specific Elective
SEC - Skill Enhancement Course
GE - Generic Elective
AECC - Ability Enhancement Compulsory Course
VAC - Value addition course
VoC - Vocational Courses
CoC - Co-Curricular
ISRD - Industrial Training/Survey and Field Work/ Research Project/ Dissertations

DEPARTMENT OF COMPUTER SCIENCE

PROGRAMME STRUCTURE

COURSE TYPE	PAPER CODE	PAPER NAME	COURSE HOURS			C	EVALUTION SCHEME		
			L	T	P		CIA	ESE	TOTAL
SEMESTER – I									
DSC	HCS-C101	Problem solving using C Programming	4	-	-	4	40	60	100
	HCS-C151	C Programming - Lab	-	-	4	2	40	60	100
	HCS-C102	Fundamental of Computer	4	-	-	4	40	60	100
	HCS-C152	Windows & UNIX - Lab	-	-	4	2	40	60	100
	HCS-C103	Discrete Mathematics	4	-	-	4	40	60	100
AECC		From AECC Pool	4	-	-	4	40	60	100
VAC		From VAC Pool	2	-	-	2	40	60	100
CoC		From CoC Pool (Qualifying)	-	-	-	-	40	60	100
						TOTAL CREDITS	22		
SEMESTER – II									
DSC	HCS-C201	Data Structure	4	-	-	4	40	60	100
	HCS-C251	Data Structure using C - Lab	-	-	4	2	40	60	100
	HCS-C202	Object Oriented Programming using Java	4	-	-	4	40	60	100
	HCS-C252	Object Oriented Programming using Java - Lab	-	-	4	2	40	60	100
	HCS-C203	Computer System Architecture	4	-	-	4	40	60	100
AECC		From AECC Pool	4	-	-	4	40	60	100
VAC		From VAC Pool	2	-	-	2	40	60	100
CoC		From CoC Pool (Qualifying)	-	-	-	-	40	60	100
						TOTAL CREDITS	22		
SEMESTER – III									
DSC	HCS-C301	Database Management System	4	-	-	4	40	60	100
	HCS-C351	Database Management System - Lab	-	-	4	2	40	60	100
	HCS-C302	Computer Networks	4	-	-	4	40	60	100
	HCS-C303	Operating System	4	-	-	4	40	60	100
SEC	HCS-S301	Cyber Law and Information Security	2	-	-	2	40	60	100
	HCS-S351	Information Security - Lab	-	-	4	2	40	60	100
VAC		From VAC Pool	2	-	-	2	40	60	100
		From VAC Pool	2	-	-	2	40	60	100
						TOTAL CREDITS	22		
SEMESTER – IV									
DSC	HCS-C401	Software Engineering	4	-	-	4	40	60	100
	HCS-C451	Software Engineering - Lab	-	-	4	2	40	60	100
	HCS-C402	Design and Analysis of Algorithm	4	-	-	4	40	60	100
	HCS-C403	Artificial Intelligence	4	-	-	4	40	60	100
SEC	HCS-S401	Graph Theory	2	-	-	2	40	60	100
	HCS-S451	Graph Theory - Lab	-	-	4	2	40	60	100
VAC		From VAC Pool	2	-	-	2	40	60	100
		From VAC Pool	2	-	-	2	40	60	100
						TOTAL CREDITS	22		

SEMESTER – V									
DSC	**HCS-C501**	Theory of Computer Science	4	-	-	**4**	40	60	100
DSE	**HCS-E50X**	From the List of Electives in Comp. Sc.	4	-	-	**4**	40	60	100
GE		From GE Pool	-	-	-	**6**	40	60	100
SEC	**HCS-S501**	Client Side Web Technology	2	-	-	**2**	40	60	100
	HCS-S551	Client Side Web Technology - Lab	-	-	4	**2**	40	60	100
VAC		From VAC Pool	2	-	-	**2**	40	60	100
ISRD	**HCS-C561**	Project 1	-	-	4	**2**	-	-	100
					TOTAL CREDITS	**22**			
SEMESTER – VI									
DSC	**HCS-C601**	Compiler Design	4	-	-	**4**	40	60	100
DSE	**HCS-E60X**	From the List of Electives in Comp. Sc.	4	-	-	**4**	40	60	100
GE		From GE Pool	-	-	-	**6**	40	60	100
SEC	**HCS-S601**	Server Side Web Technology	2	-	-	**2**	40	60	100
	HCS-S651	Server Side Web Technology - Lab	-	-	4	**2**	40	60	100
VAC		From VAC Pool	2	-	-	**2**	40	60	100
ISRD	**HCS-C661**	Project 2	-	-	4	**2**	-	-	100
					TOTAL CREDITS	**22**			
SEMESTER – VII									
DSC	**HCS-C701**	Python Programming	4	-	-	**4**	40	60	100
	HCS-C751	Python Programming - Lab	-	-	4	**2**	40	60	100
DSE	**HCS-E70X**	From the List of Electives in Comp. Sc.	4	-	-	**4**	40	60	100
	HCS-O701	Online Course*	4	-	-	**4**	40	60	100
VoC	**HCS-V701**	From VoC Pool	2	-	-	**2**	40	60	100
ISRD	**HCS-761**	Dissertation	-	-	12	**6**	-	-	100
					TOTAL CREDITS	**22**			
SEMESTER – VIII									
DSC	**HCS-C801**	Machine Learning	4	-	-	**4**	40	60	100
	HCS-C851	Machine Learning - Lab	-	-	4	**2**	40	60	100
DSE	**HCS-E80X**	From the List of Electives in Comp. Sc.	4	-	-	**4**	40	60	100
	HCS-E80Y	From the List of Electives in Comp. Sc.	4	-	-	**4**	40	60	100
VoC	**HCS-V801**	From VoC Pool	2	-	-	**2**	40	60	100
ISRD	**HCS-C861**	Dissertation	-	-	12	**6**	-	-	100
					TOTAL CREDITS	**22**			

***** This course has to be completed by the students from NPTEL/SWAYAM/MOOCs/etc. online platform. They should undergo the online course completely, submit assignments, projects, etc. and appear for the final exam conducted by the online instructor. The student can select the course from the approved list of online courses by the Department of Computer Science for that semester. **The awarded certificate must be submitted for the award of credits in this course.**

L- Lecture **T** – Tutorial **P** - Practical **C**- Credits

DSC - Discipline Specific Core
DSE - Discipline Specific Elective
SEC - Skill Enhancement Course
GE - Generic Elective
AECC - Ability Enhancement Compulsory Course
VAC - Value addition course
VoC - Vocational Courses
CoC - Co-Curricular
ISRD - Industrial Training/Survey and Field Work/ Research Project/ Dissertations
CIA - Continuous Internal Assessment
ESE - End Semester Examination

LIST OF ELECTIVES								
PAPER CODE	PAPER NAME	COURSE HOURS			C	EVALUTION SCHEME		
		L	T	P		CIA	ESE	TOTAL
SEMESTER V								
	ELECTIVE - I (Choose any ONE)	**4**	-	-	**4**	40	60	100
HCS-E501	Internet of Things							
HCS-E502	Computer Graphics							
HCS-E503	Cloud Computing							
HCS-E504	Data Mining and Warehousing							
SEMESTER VI								
	ELECTIVE - I (Choose any ONE)	**4**	-	-	**4**	40	60	100
HCS-E601	Big Data Analytics							
HCS-E602	Digital Image Processing							
HCS-E603	Research Methodology and Publication Ethics							
HCS-E604	Management Information System							
SEMESTER VII								
	ELECTIVE - I (Choose any ONE)	**4**	-	-	**4**	40	60	100
HCS-E701	Advanced Computer Architecture							
HCS-E702	Fuzzy Sets and Logic							
HCS-E703	Cyber Security							
HCS-E704	Probability and Statistics for Computing							
SEMESTER VIII								
	ELECTIVE - I (Choose any ONE)	**4**	-	-	**4**	40	60	100
HCS-E801	Parallel Processing							
HCS-E802	Data Science							
HCS-E803	Blockchain Technology							
HCS-E804	Mathematics for Computing							
	ELECTIVE - II (Choose any ONE)	**4**	-	-	**4**	40	60	100
HCS-E805	Quantum Computing							
HCS-E806	E-Commerce							
HCS-E807	Cryptography							
HCS-E808	Optimization Techniques							

HCS-C101	PROBLEM SOLVING USING C PROGRAMMING	L	T	P	C
		4	0	0	4

Prerequisite: NIL

Course Objectives:

1. To provide complete knowledge of C language.
2. Students will be able to develop logics which will help them to create programs, applications in C.
3. By learning the basic programming constructs they can easily switch over to any other language in future

Course Outcomes:

CO1. To develop C programs using operators

CO2. Develop conditional and iterative statements to write C programs

CO3. Inscribe C programs that use arrays, strings and pointer.

CO4. Exercise user defined functions to solve real time problems

CO5. Exercise user defined data types including structures and unions to solve problems

CO6. Exercise files concept to show input and output of files in

Overview of C: History and importance of C, Basic structure of C program, executing a C program.

Constants, Variable and Data Types: Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants.

Managing Input and Output Operations: Reading a Character, Writing a Character, Formatted Input, Formatted Output.

Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity.

Decision Making and Branching: Introduction, Decision Making with IF Statement, Simple IF Statement, the IF-ELSE Statement, Nesting of IF-ELSE Statements, The ELSE IF Ladder, The Switch statement, The ? : Operator, The goto statement.

Decision Making and Looping: Introduction, while Statement, do statement, for statement, Jumps in LOOPS.

Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays.

Character Arrays and Strings: Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, String-handling Functions, Example Programs (with and without using built-in string functions)

User-defined Functions: Need for functions, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return values, Arguments with Return Values, No Arguments but Returns a Value, Passing Arrays to Functions, Recursion, The Scope, Visibility and Lifetime of variables.

Pointers: Introduction, Declaring Pointer Variables, Initialization of Pointer variables, accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor.

Structures: Introduction, Defining a structure, declaring structure variables, accessing structure members, structure initialization, array of structures.

File Management in C: Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files.

Recommended Books:

1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.
2. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
3. K.N. King, C Programming: A Modern Approach, W W Norton & Company, Inc

HCS-C151	C PROGRAMMING LAB	L	T	P	C
		0	0	4	2

Prerequisite: NIL

Lab Objectives:

1. To introduce students to the basic knowledge of programming fundamentals of C language.
2. To impart writing skill of C programming to the students and solving problems.
3. To impart the concepts like looping, array, functions, pointers, file, structure.

Lab outcomes:

LO1. Know the steps involved in compiling, linking and debugging C code.

LO2. Understand the logic for a given problem and implement the logic using C program.

LO3. Learn the methods of iteration or looping and branching.

LO4. Make use of different data-structures like arrays, pointers, structures and files.

LO5. Understand how to access and use library functions.

List of Experiments:

1. Sequence constructs.
2. Iterative construct.
3. Nested for loops.
4. Functions
5. Recursive functions.
6. One dimensional and two-dimensional arrays.
7. Pointers and functions.
8. Pointers and Arrays.
9. Structure and Union.
10. File Processing.

HCS-C102	FUNDAMENTAL OF COMPUTER	L	T	P	C
		4	0	0	4

Prerequisite: NIL

Course Objectives:

1. Skill enhancement related to IT basics, computer applications, programming, interactive Medias, Internet basics etc.
2. Have a basic understanding of personal computers and their operations.
3. It builds the foundation of the computer application.

Course Outcomes:

CO1. Understand a computer system that has hardware and software components, which controls and makes them useful.

CO2. Comprehend the operating system as the interface to the computer system.

CO3. Understand the operating system as the interface to the computer system. Outline various application of IT Differentiate between assembly and high-level language

CO4. Identify various web browser, Use the Internet to send mail and surf the World Wide Web

CO5. Evaluate ethical concerns involved in the use of technology and also identify issues related to information security.

Fundamentals of Computer: Historical evolution of computers, Generations of computers, Classification of computers - based on size, processor, Usefulness of Computers. Applications of computers, Block Diagram along its components and characteristics, Interaction between the CPU.

Memory Input/output devices, function of CPU and major functional parts of CPU. Recognize the current family of CPUs used in Computers, Types of Memory- RAM ROM, Monitor, Mouse, Keyboard, Disk, joysticks, Storage Devices, floppy disk, CD, DVD, Pen drive, trackballs, Printers Types of printers, Scanner, Modem, Video, Sound cards, Speakers.

Data Representation: Definition of Information, difference between data and information, importance of Binary Number System, various number systems, Conversion from Decimal to Binary, Conversion from Binary to Decimal, binary number into hexadecimal number, hexadecimal number into binary number System, Memory Addressing and its Importance, ASCII and EBCDIC coding System.

Fundamentals of Internet: Concepts of computer Network, Client Server Model, Peer to Peer Model, Networking Devices: Switch, Router, Hub, Bridge, Gateway, LAN, MAN, WAN, Topology, Internet, Intranet, Extranet.

Data Communication: Communication Process, Data Transmission speed, Communication Types (modes), Data Transmission Medias, Modem and its working, characteristics, Types of Networks, LAN Topologies, Computer Protocols, Concepts relating to networking,

Business Data Processing: Introduction, data storage hierarchy, Method of organizing data, File Types, File Organization, File Utilities.

Security: Define basic security threats, define security best practices, explain confidentiality, integrity and availability (CIA), Describe authentication, authorization and accounting.

Recommended Books:

1. Computers Fundamentals, PK Sinha, BPB Publications, 6th Edition.
2. Introduction to Computers, Peter Norton, Tata McGraw-Hill, 6th Edition.
3. The UNIX Programming Environment, Kernighan, Pearson, 2nd Edition.
4. Digital Design, Morris Mano, PHI, 2nd Edition.
5. Data communication & Networking, A.B. Forouzan, Tata McGraw-Hill, 4th Edition.

HCS-C152	WINDOWS & UNIX - LAB	L	T	P	C
		0	0	4	2

Prerequisite: NIL

Lab Objectives:

1. To Introduces fundamentals of Windows.
2. To Introduces fundamentals of UNIX.
3. To introduces basic of Shell script.

Lab Outcomes:

LO1. Students will be able to explain, analyze and interpret the basic concepts and features of Microsoft Windows.

LO2. Students will be able to understand the basic concepts and features of UNIX.

LO3. Students will be able to write shell script.

List of Experiments:

1. Basic of Windows, Basic component of Windows, Icons, Types of Icons, Taskbar, activating Windows, Using Desktop
2. Title Bar, running application, Exploring Computer. Managing Files and Folder, Copying and moving files and folders.
3. Control panel- Display properties, Adding and removing software and hardware, setting date and time, screen saver and appearance.
4. UNIX introduction: Study the following commands :

   cal date ls mkdir rmdir cat cd cp mv echo exit who sort clear pwd chmod vi
5. Log into the system, Use vi editor to create a file called **"myfile.txt"** which contains some text. Correct typing errors during creation, Save the file, logout of the system. Open the file **"myfile.txt",** Add some text, Change some text, Delete some text, Save the Changes, Logout of the system
6. Use the cat command to create a file containing the following data. Call it **"mytable"** use tabs to separate the fields.

a. 1235 Raju 15.65

b. 4320 Remu 26.27

c. 5830 Soha 36.15

d. 1530 Ravi 21.86

7. Use the cat command to display the file **"mytable",** Use the sort command to sort the file **"mytable",**
8. Write a shell script to find the addition of two numbers.
9. Write a shell script to find the largest and smallest of three numbers.
10. Write a shell script to check entered string is palindrome or not.
11. Write a shell script to find the average of the three numbers.
12. Write a shell script to print first five odd numbers.
13. Write a shell script to reverse a number supplied by a user.
14. Write a program to calculate the factorial of a number.
15. Write a script to find the value of one number raised to the power of another. Two numbers are entered through the keyboard.
16. Write a shell program to find the sum of the series sum=1+1/2+……1/n.
17. Write a shell script to make a menu driven calculator using case.

Recommended Books:

1. Paul Cassel & Michael, Hart Sams Teach Yourself Windows 98 in 21 Days, Techmedia
2. Faithe Wempen, Office 2000 Fast & Easy.
3. Das, Sumitabha, Unix Concepts And Applications, McGraw-Hill Education (India) Pvt Limited

HCS-C103	DISCRETE MATHEMATICS	L	T	P	C
		4	0	0	4

Prerequisite: NIL

Course Objectives:

1. To introduce the concepts of mathematical logic
2. To introduce the concepts of sets, relations, and functions.
3. To perform the operations associated with sets, functions, and relations.
4. To introduce generating functions and recurrence relations.

Course Outcomes:

CO1. Ability to apply mathematical logic to solve problems

CO2. Understand sets, relations, functions and discrete

CO3. Able to use logical notations to define and reason about fundamental mathematical concepts such as sets relations and functions

CO4. Discriminate, identify and prove the properties of groups and subgroups.

CO5. Apply the concepts of generating functions to solve the recurrence relations.

CO6. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

Sets, Relations and Functions: Definition of Sets and subsets, De Morgan's law, Cardinality, Mathematical induction; Propositions; Equivalence relations; Binary, Equivalence and partial ordering relations, chains and anti chains, Job sequencing problem, Pigeonhole principle.

Introduction to Algebra: Groups, Subgroups, Cosets, Lagrange's Theorem, Permutation Group, Isomorphism and Homomorphism, Normal Subgroups, Rings, Integral Domain, Fields.

Mathematical Logic : Notation; Connectives; Normal forms; Principal Normal Forms; Theory of Inference for Statement Calculus; Predicate calculus; Inference theory of the Predicate Calculus.

Permutation &Combinations: Introduction, Rules sum & products, Permutations, Combinations, Generation of permutation & combinations, Discrete probability, Conditional probability.

Discrete Numeric Functions and Generating Functions: Manipulation, Asymptotic behaviour; Generating Functions. Recurrence Relations.

Boolean Algebra : Lattices and Algebra Systems; Principle of Duality; Basic Properties of Algebraic System defined by Lattice; Distributive and Complemented Lattices; Boolean Lattices and Boolean Algebra; Uniqueness of Finite Boolean algebra; Boolean Functions and Boolean Expressions; Propositional Calculus

Recommended Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw Hill
2. B. Colman and R.C. Busby, Discrete Mathematical Structure for Computer Science, PHI
3. P. Trembley and R. P. Manohar, Discrete Mathematical Structures with applications to Computer Science, McGraw Hill