

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A++' Grade, NAAC Accredited)

॥ योगस्थः कुरु कर्माणि ॥
समबुद्धि व योग युक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)



Syllabus of Examination (1st & 3rd Semester) for Under-Graduate Programmes

Subject: Computer Science

according to

Curriculum Framework for Under-Graduate Programmes

As per NEP-2020 (Multiple Entry-Exit, Internships and Choice Based Credit System)

**DEPARTMENT OF COMPUTER SCIENCE &
APPLICATIONS**

(For the Batches Admitted From 2023-2024)

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Problem Solving through C		
Course Code	B23-CSE-101		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-1/MCC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	None		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. learn the basics of C program, data types, and input/output statements. 2. understand different types of operators, their hierarchies, and also control statements of C. 3. implement programs using arrays and strings. 4. get familiar with advanced concepts like structures, union, etc. in C language. <hr style="width: 80%; margin-left: 0;"/> <p>5*. to implement the programs based on various concepts of C.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper-Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first</p>			

question will comprise short answer-type questions covering the entire syllabus. The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output: Formatted I/O Function-, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putchar(), puts().	11
II	Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression, Type Casting and Conversion. Decision making with if statement, if-else statement, nested if statement, else-if ladder, switch and break statement, goto statement, Looping Statements: for, while, and do-while loop, jumps in loops.	11
III	Arrays: One-dimensional arrays - Declaration, Initialization, and Memory representation; Two-Dimensional arrays -Declaration, Initialization, and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions. Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate, etc., Search for a Substring.	12
IV	Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers, and Arrays. User-defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; the difference between Structure and Union.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • To read the radius of a circle and to find the area and circumference • To read three numbers and find the biggest of three • To check whether the number is prime or not • To read a number, find the sum of the digits, reverse the number, and check it for palindrome • To read numbers from the keyboard continuously till the user 	30

	<p>presses 999 to find the sum of only positive numbers</p> <ul style="list-style-type: none"> • To read the percentage of marks and to display an appropriate message (Demonstration of else-if ladder) • To find the roots of the quadratic equation • To read marks scored by n students and find the average of marks (Demonstration of single-dimensional array) • To remove Duplicate Elements in a single dimensional Array • To perform addition and subtraction of Matrices • To find the factorial of a number • To generate Fibonacci series • To remove Duplicate Elements in a single dimensional Array • To find the length of a string without using the built-in function • To demonstrate string functions • To read, display, and add two m x n matrices using functions • To read a string and to find the number of alphabets, digits, vowels, consonants, spaces, and special characters • To Swap Two Numbers using Pointers • To demonstrate student structure to read & display records of n students • To demonstrate the difference between structure & union. 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination:</p> <p>A three-hour exam for both theory and practicum.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Gottfried, Byron S., Programming with C, Tata McGraw Hill. • Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill. • Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley. • Yashwant Kanetker, Let us C, BPB. • Rajaraman, V., Computer Programming in C, PHI. • Yashwant Kanetker, Working with C, BPB. 		

*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Computer Fundamentals		
Course Code	B23-CSE-102		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MCC-2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	None		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. understand the basics of computer 2. learn about I/O devices and operating systems 3. understand the Internet and its services 4. learn about the threats and security concepts on computers <hr style="width: 50%; margin-left: 0;"/> 5*. to understand the working of the operating system, internet, and security-related concepts.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. First			

question will be compulsory.
The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths, and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of Computers in Various Fields. Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Memory Systems: Concept of bit, byte, word, nibble, storage locations, and addresses, measuring units of storage capacity, access time, the concept of the memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.</p>	11
II	<p>I/O Devices: I/O Ports of a Desktop Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touchpad and trackball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, inkjet, dot-matrix. Plotter.</p> <p>Introduction to Operating System: Definition, Functions, Features of Operating System, Icon, Folder, File, Start Button, Task Bar, Status Buttons, Folders, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Panel.</p>	11
III	<p>The Internet: Introduction to networks and Internet, history, Internet, Intranet & Extranet, Working of Internet, Modes of Connecting to the Internet.</p> <p>Electronic Mail: Introduction, advantages and disadvantages, User IDs, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.</p>	11
IV	<p>Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keyloggers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking.</p> <p>Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery.</p>	12
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: Operating System:</p> <ul style="list-style-type: none"> • Starting with basics of Operating Systems and its 	30

	<p>functionalities</p> <p>Computer Basics:</p> <ul style="list-style-type: none"> • Identify the various computer hardware • Understanding the working of the computer • Understanding various types of software <p>Internet and E-mail:</p> <ul style="list-style-type: none"> • Using the Internet for various tasks • Creating and using e-mail. <p>Security:</p> <ul style="list-style-type: none"> • Understanding various threats • How to be safe from virus threats • Various software to get safe from virus attacks. 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination:</p> <p>A three-hour exam for both theory and practicum.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB. • Dromey, R.G., How to Solve it By Computer, PHI. • Norton, Peter, Introduction to Computer, McGraw-Hill. • Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World. • Rajaraman, V., Fundamentals of Computers, PHI. 		

*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Basics of Computer Science		
Course Code	B23-CSE-103		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-M1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	None		
Course Learning Outcomes (CLO):	<p>After learning this course students will be able:</p> <ol style="list-style-type: none"> 1. To introduce to the students, a basic understanding of the working of a computer system. 2. To familiarize the students with the concept of algorithms and flowcharts. 3. To familiarize the students with the various types of software. 4. To make the students familiar with the basic internet technology and concepts. 5. To understand the practical implementation of the basics of computer science. 		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	1	2	3
Max. Marks:50(30(T)+20(P)) Internal Assessment Marks:15(10(T)+5(P)) End Term Exam Marks:35(20(T)+15(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B-Contents of the Course			
<u>Instructions for Paper-Setter</u>			
The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal			

marks. First question will comprise of short answer type questions covering entire syllabus. The candidate must attempt five questions in all, selecting one question from each unit. The first question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Introduction to Computers: Definition of Computers, History and Generations of Computers, Characteristics of Computers, Classification of Computers. Fundamental Block diagram of Computer: CPU, Input & Output Unit.	4
II	Software: Definition of Software, Types of Software-System software, Application software, and Utility software. Types of Computer Languages, Assemblers, Interpreters, Compiler.	3
III	Introduction to Operating Systems: Types of Operating System, Functions of Operating System. Windows: Introduction to Windows, Starting Windows, Desktop, Task Bar, Opening and closing applications, icons-creating, renaming, and removing. Date and Time setting, Working with files and folders - creating, deleting, opening, finding, copying, moving, and renaming.	4
IV	Networking: Concept, Basic Elements of a Communication System, Data Transmission Media, LAN, MAN, WAN. Introduction of Internet and WWW, Basic working of a Web Browser, Introduction to popular web browsers.	4
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • Dismantling the system unit, recognizing all major components inside a PC, describing the function of each component, and defining the relationship between internal components • Explore and describe some system utilities like regedit, memory partitioning, control panel, and window tools. • Understanding the control panel • Date and Time setting. • Working with files and folders-creating, deleting, opening, finding, copying, moving, and renaming. 	30
Suggested Evaluation Methods		
Internal Assessment: > Theory <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 		End Term Examination: A three-hour exam for both theory and practicum.

<p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA 	
<p>Part C-Learning Resources</p>	
<p>Text /Reference Books:</p> <ul style="list-style-type: none"> • Fundamentals of Computers, V. Rajaraman 6th edition PHI Learning Private Limited 2014 • Peter Norton: Computing Fundamentals. 6th Edition, McGraw Hill-Osborne,2007 • Alexis Leon and Mathews Leon: Introduction to Computers, Leon Vikas,1999. • Internet Basics. E. Douglas Commer PHI. 	

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**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Fundamentals of Computer Science		
Course Code	B23-CSE-104		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MDC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	None		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. understand the basic concepts of operating systems 2. do the basic editing and formatting in a document 3. create basic spread-sheets for different purposes 4. create basic presentations for different applications <hr style="width: 50%; margin: 10px auto;"/> 5*. to understand the working of operating systems and various office tools practically.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:75(50(T)+25(P)) Internal Assessment Marks:20(15(T)+5(P)) End Term Exam Marks: 55(35(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper-Setter</u>			
<p>The examiner will set a total of nine questions. Out of which the first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.</p>			

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths, and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of Computers in Various Fields. Types of Software: System software, Application software, Utility Software.	8
II	Memory Systems: Concept of bit, byte, word, nibble, storage locations, and addresses, measuring units of storage capacity, access time, the concept of the memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory. I/O Devices: I/O Ports of a Desktop Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touchpad and trackball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, inkjet, dot-matrix. Plotter.	8
III	Introduction to Operating System: Definition, Functions, Features of Operating System, Icon, Folder, File, Start Button, Task Bar, Status Buttons, Folders, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Panel.	7
IV	The Internet: Introduction to networks and Internet, history, Internet, Working of the Internet, Modes of Connecting to the Internet. Electronic Mail: Introduction, advantages and disadvantages, User IDs, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.	7
V*	Operating System: <ul style="list-style-type: none"> • Starting with basics of Operating Systems and its functionalities Computer Basics: <ul style="list-style-type: none"> • Identify the various computer hardware • Understanding the working of computer • Understanding various types of software Internet and E-mail: <ul style="list-style-type: none"> • Using Internet for various tasks • Creating and using e-mail. 	30
Suggested Evaluation Methods		
Internal Assessment:		End Term

<p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 	<p>Examination: A three-hour exam for both theory and practicum.</p>
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB. • Dromey, R.G., How to Solve it By Computer, PHI. • Norton, Peter, Introduction to Computer, McGraw-Hill. • Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World. • Rajaraman, V., Fundamentals of Computers, PHI. 	

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**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	III		
Name of the Course	Operating Systems		
Course Code	B23-CSE-301		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-3/MCC-4		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Computer		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. understand the basic concepts of operating systems and their services along with process management. 2. understand the concept of process scheduling and acquire knowledge of process synchronization. 3. learn about memory management and virtual memory concepts. 4. learn to work with directory structure and security aspects. <hr/> <p>5*. to implement the programs based on operating systems.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The			

examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory. The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Introductory Concepts: Operating System, Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure. Types of Operating System: Real-time Multiprogramming, Multiprocessing, Batch processing. Operating System Services, Operating System Interface, Service System Calls, and System Programs. Process Management: Process Concepts, Operations on Processes, Process States, and Process Control Block. Inter-Process Communication.	11
II	CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling, Algorithm Evaluation. Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors. Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.	12
III	Memory Management Strategies: Memory Management of Single-User and Multiuser Operating Systems, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.	11
IV	Implementing File System: File System Structure, File System Implantation, File Operations, Type of Files, Directory Implementation, Allocation Methods, and Free Space Management. Disk Scheduling algorithm- SSTF, Scan, C- Scan, Look, C-Look. SSD Management.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • Working with various operating systems, and performing different operations using operating systems. • Write a program to print file details including owner access permissions, and file access time, where file name is given as argument. • Write a program to copy files using system calls. 	30

	<ul style="list-style-type: none"> • Write a program to implement the FCFS scheduling algorithm. • Write a program to implement the Round Robin scheduling algorithm. • Write a program to implement the SJF scheduling algorithm. • Write a program to implement a non-preemptive priority-based scheduling algorithm. • Write a program to implement a preemptive priority-based scheduling algorithm. • Write a program to implement the SRJF scheduling algorithm. • Write a program to calculate the sum of n numbers using the thread library. • Write a program to implement first-fit, best-fit, and worst-fit allocation strategies. 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination: A three-hour exam for both theory and practicum.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Silberschatz A., Galvin P.B.,and Gagne G., Operating System Concepts, John Wiley & Sons. • Godbole, A.S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi. • Deitel, H.M., Operating Systems, Addison- Wesley Publishing Company, New York. • Tanenbaum, A.S., Operating System- Design and Implementation, Prentice Hall of India, New Delhi. 		

*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	III		
Name of the Course	Quantitative Foundation of Computer Science		
Course Code	B23-CSE-302		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MCC-5		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Must have studied mathematics at 10+2 level		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Define mathematical structures (relations, functions, sets) and use them to model real-life situations 2. Solve puzzles based on counting principles. 3. Organize, manage, present, and Analyze Statistical data using measures of central tendency 4. Analyze Statistical data using measures of dispersion and Study the relationship between variables using techniques of correlation <hr style="width: 20%; margin-left: 0;"/> <p>5*. to implement the programs based on various mathematical and statistical functions.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper-Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The</p>			

examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory. The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Sets, relations, and functions: Operations on sets, relations, and functions, binary relations, partial ordering relations, equivalence relations, principles of mathematical induction.	11
II	Introduction to counting: Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.	11
III	Data Types and Data Presentation: Data types: Attribute, Variable, Discrete and Continuous variable, Univariate and Bivariate distribution. Types of Characteristics, Different types of scales: nominal, ordinal, interval, and ratio. Data presentation: Frequency distribution, Histogram, Ogive curves. Measures of Central tendency: Concept of average/central tendency, characteristics of a good measure of central tendency. Arithmetic Mean (A.M.), Median, Mode - -definition, examples for ungrouped and grouped data, the effect of the shift of origin and change of scale, merits, and demerits. Combined arithmetic mean. Partition Values: Quartiles, Deciles, and Percentiles - examples for ungrouped and grouped data	11
IV	Measures of dispersion: Concept of dispersion, Absolute and Relative measure of dispersion, characteristics of good measure of dispersion. Range, Semi-interquartile range, Quartile deviation, Standard deviation - Definition, examples for ungrouped and grouped data, the effect of the shift of origin and change of scale, merits, and demerits. Combined standard deviation, Variance. Coefficient of range, Coefficient of quartile deviation, and Coefficient of variation (C.V.) Correlation: Concept of correlation, Types, and interpretation, Measure of Correlation: Scatter diagram and interpretation; Karl Pearson's coefficient of correlation (r): Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, properties; Spearman's rank correlation coefficient: Definition, examples of with and without repetition. Concept of Multiple Correlation.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: Functions:	30

	<ul style="list-style-type: none"> • Identify if the given mapping is a function • Finding domain and range of a given function • Check if the given function is injective/surjective/bijective • Find the inverse of a given function • Operations on functions • Graphs of functions using any online tool <p>Sets:</p> <ul style="list-style-type: none"> • Performing various set operations <p>Relations:</p> <ul style="list-style-type: none"> • Representation of relations • Determine if the given relation satisfies equivalence relation/partial order relation • Draw Hasse diagrams • Find maximal, minimal, greatest, least element in a poset • Determine if a given poset is a lattice <p>Counting Principles:</p> <ul style="list-style-type: none"> • Sum and product rule • Pigeonhole Principle • Inclusion-Exclusion Principle <p>Permutations and Combinations:</p> <ul style="list-style-type: none"> • Permutations • Permutations with repetitions • Combinations • Combinations with repetitions <p>Frequency distribution and data presentation</p> <ul style="list-style-type: none"> • Frequency Distribution (Univariate data/ Bivariate data) • Diagrams • Graphs <p>Measures of Central Tendency</p> <ul style="list-style-type: none"> • Arithmetic Mean • Median • Mode • Partition Values <p>Measures dispersion</p> <ul style="list-style-type: none"> • Range and Coefficient of range • Quartile deviation and Coefficient of quartile deviation • Standard deviation, Variance, and Coefficient of variation (C.V.) <p>Correlation</p> <ul style="list-style-type: none"> • Karl Pearson's correlation coefficient • Spearman's Rank correlation 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 	<p>End Term Examination:</p> <p>A three-hour exam for both</p>	

<ul style="list-style-type: none"> • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>theory and practicum.</p>
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill. • C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill. • Norman L. Biggs, Discrete Mathematics, Oxford University Press. • Kenneth Bogart, Clifford Stein and Robert L. Drysdale, Discrete Mathematics for Computer Science, Key College Publishing. • Thomas Koshy, Discrete Mathematics with Applications, Elsevier. • Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Asia. • Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta. • Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi • Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, New Delhi. • Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, NewDelhi. • Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi. • Schaum`s Outline Of Theory And Problems Of Beginning Statistics, Larry J. Stephens, Schaum`s Outline Series Mcgraw-Hill 	

*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	III		
Name of the Course	Programming with C		
Course Code	B23-CSE-303		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MDC-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	None		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. understand the concepts of problem-solving on computer 2. understand the basics of C programming along with various I/O functions 3. understand various operators and branching statements in C 4. understand loops, functions, and arrays in C <hr style="width: 50%; margin-left: 0;"/> 5*. to design programs based on theoretical concepts of C.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:75(50(T)+25(P)) Internal Assessment Marks:20(15(T)+5(P)) End Term Exam Marks: 55(35(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.			

The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output: Unformatted & Formatted I/O Function, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putchar(), puts().	7
II	Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy & Associativity. Arithmetic Expressions, Evaluation of Arithmetic Expression, Type Casting and Conversion.	7
III	Decision making with if statement, if-else statement, nested if statement, else-if ladder, switch, break and continue statement, goto statement Looping: for, while, and do-while loop, jumps in loops.	8
IV	Functions: definition, prototype, function call, passing arguments to a function: call by value, call by reference, recursive functions. Arrays: Definition, types, Initialization, multidimensional arrays, Processing on Arrays.	8
V*	The following activities be carried out/ discussed in the lab during the initial period of the semester. Programming Lab: <ul style="list-style-type: none"> • Write a C Program to read the radius and find the area and volume of a sphere • Write a C Program to read three numbers and find the biggest of three • Write a C Program to demonstrate library functions in math.h (at least 5) • Write a C Program to read a number, find the sum of the digits, reverse the number, and check it for palindrome • Write a C Program to read numbers from the keyboard continuously till the user presses 999 and to find the sum of only positive numbers • Write a C Program to read the percentage of marks and to display the appropriate grade (using a switch case) • Write a C Program to find the roots of a quadratic equation (if else ladder) 	30

	<ul style="list-style-type: none"> • Write a C program to read marks scored in 3 subjects by n students and find the average of marks and result (Demonstration of single dimensional array) • Write a C Program to remove Duplicate Element in a single dimensional Array • Program to perform addition and subtraction of Matrices • Write a C Program to generate n prime number by defining isprime () function • Write a C Program to find the trace of a square matrix using function • Write a C Program to read, display and multiply two matrices using functions 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 	<p>End Term Examination: A three-hour exam for both theory and practicum.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Gottfried, Byron S., Programming with C, Tata McGraw Hill. • Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill. • Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley. • Yashwant Kanetker, Let us C, BPB. • Rajaraman, V., Computer Programming in C, PHI. • Yashwant Kanetker, Working with C, BPB 		

*Applicable for courses having practical component.

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A++' Grade, NAAC Accredited)

॥ योगस्थः कुरु कर्माणि ॥
समबुद्धि व योग युक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)



Syllabus of Examination (5th and 6th Semester) for Under-Graduate Programmes
Subject: Computer Science
according to
Curriculum Framework for Under-Graduate Programmes
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice Based Credit System)
DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
(For the Batches Admitted From 2023-2024)

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	Computer Science		
Semester	V		
Name of the Course	Data Structures		
Course Code	B23-CSE-501		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-5/MCC-9		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. learn the basics of data structure and algorithm complexities. 2. acquire knowledge of arrays and strings. 3. understand the idea of implementation for linked lists and stacks. 4. learn various searching and sorting techniques along with the implementation of queues. 5* develop the project with data structures. 		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:30(20(T)+10(P))			
End Term Exam Marks: 70(50(T)+20(P))			
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.</p> <p>Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.</p> <p>Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.</p>			

Unit	Topics	Contact Hours
I	<p>Data Structure Definition, Data Type vs. Data Structure, Classification of Data Structures, Data Structure Operations, Applications of Data Structures.</p> <p>Algorithm Specifications: Performance Analysis and Measurement (Time and Space Analysis of Algorithms- Average, Best and Worst Case Analysis).</p> <p>Arrays: Introduction, Linear Arrays, Representation of Linear Array in Memory, Two Dimensional and Multidimensional Arrays, Sparse Matrix and its Representation, Operations on Array: Algorithm for Traversal, Selection, Insertion, Deletion and its implementation.</p>	11
II	<p>String Handling: Storage of Strings, Operations on Strings viz., Length, Concatenation, Substring, Insertion, Deletion, Replacement, Pattern Matching</p> <p>Linked List: Introduction, Array vs. linked list, Representation of linked lists in Memory, Traversing a Linked List, Insertion, Deletion, Searching into a Linked list, Type of Linked List.</p>	11
III	<p>Stack: Array Representation of Stack, Linked List Representation of Stack, Algorithms for Push and Pop, Application of Stack: Polish Notation, Postfix Evaluation Algorithms, Infix to Postfix Conversion, Infix to Prefix Conversion, Recursion.</p> <p>Introduction to Queues: Simple Queue, Double Ended Queue, Circular Queue, Priority Queue, Representation of Queues as Linked List and Array, Applications of Queue. Algorithm on Insertion and Deletion in Simple Queue and Circular Queue. Priority Queues.</p>	12
IV	<p>Tree: Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, postorder, preorder), Binary Search Trees – Definition, Operations viz., searching, insertions and deletion; Searching and Sorting Techniques, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching.</p>	11
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <ul style="list-style-type: none"> • Write a program that uses functions to perform the following operations on an array i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on strings i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on a singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on a doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal • Write a program that implement stack (its operations) using i) Arrays ii) Linked list(Pointers). 	30

	<ul style="list-style-type: none"> • Write a program that implements Queue (its operations) using i) Arrays and ii) Linked lists (Pointers). • Write a program that implements the following sorting i) Bubble sort ii) Selection sort iii) Quick sort. • Write programs for various types of tree traversals. 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End-Term Examination:A three-hour exam for both theory and practicum.</p> <p>End Term Exam Marks: 70(50(T)+20(P))</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Seymour Lipschutz, Data Structures, Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines. • Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Data Structures Using C, Pearson Education. • Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures with Applications, McGraw-Hill. • Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison- Wesley. <p>* Applicable for courses having practical components.</p>		

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	V		
Name of the Course	Software Engineering		
Course Code	B23-CSE-502		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MCC-10		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Knowledge of any Programming language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. learn the various models for software development. 2. understand how to analyze software. 3. plan a software design and the risks associated with software. 4. test and validate software 5*. Implement the various tools and techniques used in software engineering. 		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:30(20(T)+10(P))			
End Term Exam Marks: 70(50(T)+20(P))			
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.</p> <p>Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.</p> <p>Practicum will be evaluated by an external and an internal examiner. Examination will be of</p>			

three-hour duration.		
Unit	Topics	Contact Hours
I	Introduction: Program vs. Software, Software Engineering, Programming paradigms, Software Crisis – problem and causes, Phases in Software development: Requirement Analysis, Software Design, Coding, Testing, Maintenance, Software Development Process Models: Waterfall, Prototype, Evolutionary and Spiral models, Role of Metrics.	11
II	Feasibility Study, Software Requirement Analysis and Specifications: SRS, Need for SRS, Characteristics of an SRS, Components of an SRS, Problem Analysis, Information gathering tools, Requirement specification, validation and metrics. Structured Analysis and Tools: Data Flow Diagram, Data Dictionary, Decision table, Decision trees, Structured English, Entity-Relationship diagrams	11
III	Software Project Planning: Cost estimation: COCOMO model, Project scheduling, Staffing, and personnel planning, team structure, Software configuration management, Quality assurance plans, Project monitoring plans, Risk Management. Software Design: Design fundamentals, problem partitioning, and abstraction, design methodology, Cohesion & Coupling.	12
IV	Software testing strategies: unit testing, integration testing, Validation testing, System testing, Alpha and Beta testing. Software Maintenance: Type of maintenance, Management of Maintenance, Maintenance Process, maintenance characteristics.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • Development of 0 level DFD • Development of 1 level DFD • Development of 2 level DFD • data dictionary, • E-R diagram for Student Teacher Relationship • E-R diagram for Library Management, • Draw ER Diagram for Hospital Management System. • ER diagram for (ANY 5) <ul style="list-style-type: none"> • Student Result Management System • Library management system • Inventory control system • Accounting system • Fast food billing system • Bank loan system • Blood bank system • Railway reservation system • Automatic teller machine • Video library management system • Hotel management system • Hostel management system 	30

	<ul style="list-style-type: none"> • E-ticking • Share online trading • Hostel management system • Resource management system • Court case management system 	
Suggested Evaluation Methods		
Internal Assessment: <ul style="list-style-type: none"> ➤ Theory <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	End-Term Examination: A three-hour exam for both theory and practicum. End Term Exam Marks: 70(50(T)+20(P))	
Part C-Learning Resources		
Recommended Books/e-resources/LMS: <ul style="list-style-type: none"> • Pressman R. S., “Software Engineering – A Practitioner’s Approach”, Tata McGraw Hill. • Jalote P., “An Integrated Approach to Software Engineering”, Narosa. • Sommerville, “Software Engineering”, Addison Wesley. • Fairley R., “Software Engineering Concepts”, Tata McGraw Hill. • James Peter, W Pedrycz, “Software Engineering”, John Wiley & Sons. 		

*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	V		
Name of the Course	Foundations of Server-Side Development		
Course Code	B23-CSE-503		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-2		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	B23-CSE-201		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the principles of server-side development. 2. Gain proficiency in server-side programming languages and frameworks. 3. Learn to design and manage databases. 4. Develop skills to create server-side applications. <hr style="width: 20%; margin-left: 0;"/> <p>5*. to equip with the knowledge of server-side frameworks.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:75(50(T)+25(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:20(15(T)+5(P))			
End Term Exam Marks: 55(35(T)+20(P))			
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.</p> <p>Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.</p> <p>Practicum will be evaluated by an external and an internal examiner. Examination will be of</p>			

three-hour duration.		
Unit	Topics	Contact Hours
I	<p>Introduction to Server-Side Development: Definition and importance of server-side development, Client-Server architecture, Overview of server-side technologies</p> <p>Server-Side Programming Languages: Introduction to server-side languages (e.g., Node.js), Syntax and semantics of chosen server-side language</p>	11
II	<p>Server-Side Programming Languages: Setting up the development environment, Writing and executing basic server-side scripts</p> <p>Web Servers: Understanding web servers (e.g., Apache, or Nginx), Installing and configuring a web server, Handling HTTP requests and responses, Serving static and dynamic content</p>	11
III	<p>Database Management: Introduction to databases and DBMS (SQL and NoSQL), Designing a database schema, CRUD operations (Create, Read, Update, Delete), Connecting server-side applications to a database</p>	11
IV	<p>Server-Side Frameworks: Overview of popular server-side frameworks (e.g., Express.js), Building a simple application using a framework, Routing and middleware, Template engines</p>	12
V*	<p>The following activities be carried out/ discussed in the lab during the initial period of the semester.</p> <p>Programming Lab:</p> <ul style="list-style-type: none"> • Setting up the development environment • Hands-on practice with server-side programming languages • Building and deploying a simple web application • Connecting and managing a database • Implementing user authentication 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.:5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.:10 • Mid-Term Exam: NA 		<p>End Term Examination:</p> <p>A three-hour exam for both theory and practicum.</p>
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

- "Node.js Design Patterns" by Mario Casciaro and Luciano Mammino
- "Learning PHP, MySQL & JavaScript" by Robin Nixon
- Online documentation and tutorials for the chosen programming language and frameworks

*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	V		
Name of the Course	Cloud Computing		
Course Code	B23-CSE-504		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-2		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Basic Knowledge of computer		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the basic concepts and principles of cloud computing. 2. Describe the architecture and components of cloud computing systems. 3. Evaluate different cloud deployment models and service models. 4. Analyze the benefits, challenges, and risks associated with cloud computing. <hr/> <p>5*. Apply cloud computing principles to solve real-world problems.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:30(20(T)+10(P))			
End Term Exam Marks: 70(50(T)+20(P))			
<u>Instructions for Paper-Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p> <p>The candidate must attempt five questions in all, selecting one question from each unit. First question will be compulsory.</p> <p>Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.</p>			

Part B- Contents of the Course		
Unit	Topics	Contact Hours
I	<p>Introduction to Cloud Computing: Definition and characteristics of cloud computing, Historical evolution of cloud computing</p> <p>Cloud Computing Architecture: Cloud service models: IaaS, PaaS, SaaS, Cloud deployment models: Public, private, hybrid, community clouds</p>	11
II	<p>Key Technologies and Concepts: Virtualization and containerization, Scalability, elasticity, and resilience, Service-oriented architecture (SOA), and microservices</p> <p>Cloud Infrastructure: Data centers and virtualization technologies. Network fundamentals for cloud computing</p> <p>Major Cloud Platforms: Overview of leading cloud service providers (e.g., AWS, Azure, Google Cloud), Hands-on experience with deploying applications on a cloud platform</p>	12
III	<p>Cloud Security and Privacy: Security challenges and issues in cloud computing, Authentication, authorization, and encryption in the cloud</p> <p>Managing Cloud Services: Monitoring and managing cloud resources, Cost management and optimization strategies</p>	11
IV	<p>Emerging Trends in Cloud Computing: Serverless computing and Function as a Service (FaaS), Edge computing, and Internet of Things (IoT) integration with cloud</p>	11
V*	<p>The following activities be carried out/ discussed in the lab during the semester.</p> <p>Programming Lab:</p> <ul style="list-style-type: none"> • Setting up a basic cloud environment using a free tier service (e.g., AWS, Google Cloud, Azure). • Exploring different cloud service models using practical examples. • Creating and managing virtual machines using virtualization software (e.g., VirtualBox, VMware). • Deploying and managing infrastructure on a cloud platform (e.g., creating VMs, storage, and networking in AWS). • Developing and deploying applications using a PaaS platform (e.g., Google App Engine, AWS Elastic Beanstalk). • Exploring popular SaaS applications and understanding their architecture. • Implementing and managing cloud storage solutions (e.g., AWS S3, Google Cloud Storage). • Implementing security measures in a cloud environment (e.g., setting up IAM, encryption). 	30
Suggested Evaluation Methods		

<p>Internal Assessment:</p> <ul style="list-style-type: none"> ➤ Theory <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination: A three-hour exam for both theory and practicum. End Term Exam Marks: 70(50(T)+20(P))</p>
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood. • "Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti. • "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis. • "Mastering Cloud Computing" by Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi. 	

*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	V		
Name of the Course	Programming in Python		
Course Code	B23-CSE-505		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. understand the basic concepts of Python programming 2. learn various data structures used in Python programming. 3. develop the simple programs of Python using arrays and functions. 4. illustrate the process of data file manipulations using python 5* develop the programs using Python. 		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:30(20(T)+10(P))			
End Term Exam Marks: 70(50(T)+20(P))			
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory. Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.</p>			
Unit	Topics		Contact Hours

I	Introduction to Python: Python Interpreter, Python as calculator, Python shell, Indentation, identifier and keywords, literals, strings, Operators: Arithmetic, Relational, Logical, comparison, Bitwise, Assignment, Identity operator and Membership operator; Input & output statements; Control statements: Branching, looping, Conditional statement, Exit function	11
II	String Manipulations: Subscript operator, indexing, slicing a string, other functions on strings, string module. Strings and number system: Format functions, converting strings to numbers & Vice Versa. List, Tuples, Sets, Dictionaries: Basic list operators, replacing, inserting, removing an element, searching, Sorting lists, dictionary literals, adding & removing keys, accessing & replacing values, traversing dictionaries.	11
III	Array in Python, Design with Functions: hiding redundancy, complexity, arguments & return values; Formal/Actual arguments, named arguments, program structure and design, Recursive functions, scope & Global statements, Importing modules, Math modules & Random modules.	11
IV	Exception Handling: Exceptions, except clause, try and finally clause, user-defined exceptions. File Handling: Manipulating files & directories, OS & SYS modules, Reading, writing text & numbers from/to file. Graphics: "Turtle" module, drawing colors, shapes, digital images, image file formats.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • WAP to find the roots of a quadratic equation. • WAP to accept a number 'n' and (a). Check if 'n' is prime (b). Generate all prime numbers till 'n' (c). Generate first 'n' prime numbers (d). This program may be done using functions. • WAP that accepts a character and performs the following: (a). print whether the character is a letter or numeric digit or a special character (b). if the character is a letter, print whether the letter is uppercase or lowercase (c). if the character is a numeric digit, print its name in the text (e.g., if the input is 9, the output is NINE) • WAP to perform the following operations on a string (a). Find the frequency of a character in a string. (b). Replace a character by another character in a string. (c). Remove the first occurrence of a character from a string. (d). Remove all occurrences of a character from a string. • WAP to swap the first n characters of two strings. • Write a function that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1. • WAP to create a list of the cubes of only the even integers appearing in the input list (may have elements of other types also) using the following: (a). 'for' loop (b). list comprehension 	30

	<ul style="list-style-type: none"> • WAP to read a file and (a). Print the total number of characters, words, and lines in the file. (b). Calculate the frequency of each character in the file. Use a variable of dictionary type to maintain the count. (c). Print the words in reverse order. (d). Copy even lines of the file to a file named 'File1' and odd lines to another file named 'File2'. • Write a function that prints a dictionary where the keys are numbers between 1 and 5 and the values are cubes of the keys. • Consider a tuple t1= (1, 2, 5, 7, 9, 2, 4, 6, 8, 10). WAP to perform the following operations: (a). Print half the values of the tuple in one line and the other half in the next line. (b). Print another tuple whose values are even numbers in the given tuple. (c). Concatenate a tuple t2= (11,13,15) with t1. (d). Return maximum and minimum values from this tuple • WAP to accept a name from a user. Raise and handle the appropriate exception(s) if the text entered by the user contains digits and/or special characters. 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End-Term Examination: A three-hour exam for both theory and practicum.</p> <p>End Term Exam Marks: 70(50(T)+20(P))</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Sheetal Taneja, Naveen Kumar, Python Programming: A Modular approach, 5th Impression, Pearson. • Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press. • Mark Lutz, Learning Python (available online at pdf derive). • Gutttag John V, Introduction to Computation and Programming Using Python with Application to Understanding Data, PHI. • Charles Diiorbach, Introduction to Computer Science using Python, Wiley. • Balaguruswamy E., Introduction to Computing and Problem Solving using Python, 2nd edition, McGraw Hill Education, 2018. • Brown, Martin C., Python: The Complete Reference, 2nd edition, McGraw Hill Education, 2018. <p>* Applicable for courses having practical components.</p>		

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	V		
Name of the Course	Programming in R		
Course Code	B23-CSE-506		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-3		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Understand R programming structures 2. Recognize and make appropriate use of different types of data structures, vectors, and list. 3. Learn Matrices, arrays, and data frames in R. 4. Gain knowledge on input/output operations and learn to install packages in R. 5* develop the various programs using R.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.			

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Introduction to R: Installing R and running commands/scripts R, Functions, Start-up Files, Reading and Writing R, and Arithmetic operations in R.</p> <p>R Programming Structures: Control Statements, Loops, If-Else, Arithmetic and Boolean Operator values, Type Conversions-Functions.</p>	11
II	<p>R Data Structures: Lists Creation, Accessing List Elements, Adding or Deleting List Elements, Recursive Lists, Data Frames.</p> <p>Vectors: Declaration, Arithmetic and logic operations, Indexing, Vector Operations on vectors, Filtering, Matrices, Math Functions, and Set operations.</p>	11
III	<p>Matrices and Arrays: Creating Matrices, Applying Functions to Matrix Rows and Columns, Adding and Deleting Matrix Rows and Columns, Naming Matrix Rows and Columns, Higher-Dimensional Arrays.</p> <p>Data Frames: Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames, Factors and Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, and Other Factor- and Table-Related Functions.</p>	12
IV	<p>Input /Output: Reading from the keyboard, Reading and Writing to a File, reading a Matrix or Data Frame from a file, accessing files on Remote Machines, String Manipulations, Interfacing R from other languages.</p> <p>Packages in R, Installation process of various packages in R, Data science packages in R, Building R packages.</p>	11
V*	<p>Practicum:</p> <p>Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <p>Introduction to R and RStudio</p> <ul style="list-style-type: none"> • Installing R and RStudio • Overview of RStudio interface • Basic R syntax and commands • Writing and executing R scripts <p>Data Types and Structures</p> <ul style="list-style-type: none"> • Vectors, lists, matrices, and data frames • Indexing and subsetting data • Applying basic functions on data structures <p>Data Import and Export</p> <ul style="list-style-type: none"> • Reading data from CSV, Excel, and other formats • Writing data to files • Working with APIs to fetch data • Data cleaning and preprocessing 	30

Suggested Evaluation Methods	
<p>Internal Assessment:</p> <ul style="list-style-type: none"> ➤ Theory <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination: A three-hour exam for both theory and practicum.</p>
Part C-Learning Resources	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • Norman Matloff, The Art of R Programming A Tour of Statistical Software Design, No Starch Press • W. N. Venables, D. M. Smith, and the R Core Team, An Introduction to R. • "R for Data Science" by Hadley Wickham and Garrett Grolemund • "Hands-On Programming with R" by Garrett Grolemund 	

*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	Computer Science		
Semester	VI		
Name of the Course	Computer Networks		
Course Code	B23-CSE-601		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-6/MCC-11		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Basic understanding of computer systems and programming.		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the fundamental concepts of computer networks. 2. learn about network protocols, architectures, and applications. 3. develop skills for designing and managing networks. 4. learn about network security and wireless networks. 5*. Understand the practical aspects of computer networks.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Internal Assessment Marks:30(20(T)+10(P))			
End Term Exam Marks: 70(50(T)+20(P))			
Part B- Contents of the Course			
<u>Instructions for Paper-Setter</u>			
<p>The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p> <p>The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory.</p>			

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Introduction to Computer Networks: Overview of computer networks, types of networks (LAN, WAN, MAN), network topologies, and network models (OSI and TCP/IP). Physical Layer: Data transmission methods, signal encoding techniques, transmission media, and network devices (hubs, switches, routers).	11
II	Data Link Layer: Error detection and correction, flow control, MAC protocols, Ethernet, and switching. Network Layer: IP addressing and subnetting, routing algorithms, IPv4 vs. IPv6, and ARP.	11
III	Transport Layer: Transport layer protocols (TCP, UDP), congestion control, and quality of service (QoS). Application Layer: Application layer protocols (HTTP, FTP, DNS, SMTP), web services, and network applications.	11
IV	Network Security: Fundamentals of network security, cryptography, firewalls, VPNs, and intrusion detection systems (IDS). Wireless Networks: Wireless communication principles, Wi-Fi, Bluetooth, mobile networks, and ad hoc networks.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> • Setting up a basic LAN • Implementing error detection and correction algorithms. • Analyzing signal encoding techniques • Configuring routers and switches, subnetting exercises. • Implementing and analyzing TCP and UDP protocols. • Developing simple client-server applications. • Setting up and configuring firewalls and VPNs. • Setting up and securing a wireless network. 	30

Suggested Evaluation Methods

Internal Assessment:

➤ **Theory**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 10

➤ **Practicum**

- Class Participation: NA
- Seminar/Demonstration/Viva-voce/Lab records etc.: 10
- Mid-Term Exam: NA

End-Term Examination:

A three-hour exam for both theory and practicum.

End Term Exam Marks: 70(50(T)+20(P))

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross.
- "Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall.
- "Data and Computer Communications" by William Stallings.
- "Network Security Essentials" by William Stallings.

*Applicable for courses having practical components.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	VI		
Name of the Course	Essentials of Computer Architecture and Design		
Course Code	B23-CSE-602		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	MCC-12		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Must have basic knowledge of computer		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. understand basic computer organization and architecture. 2 learn various register transfer and micro-operations. 3 acquire knowledge of CPU working. 4 understand and make effective use of memory organization <hr style="width: 50%; margin-left: 0;"/> 5*. to implement the programs based on computer organization using assembly language.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper-Setter</u>			
The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.			

Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.

Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Basic Computer Organization and Design: Instruction Codes, Computer registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instructions, Input-Output and Interrupt, Design of Basic computer, Design of accumulator logic	11
II	Register Transfer and Micro operations: Register Transfer Language (RTL), register transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit, Microprogrammed Control: Control memory; address sequencing, microprogram sequencer, Design of Control Unit	11
III	Central Processing Unit: General registers Organization, Stack Organization, Instruction formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, RISC, CISC.	11
IV	Memory Organization: Memory hierarchy, Auxiliary Memory, Associative Memory, Interleaved memory, Cache memory, Virtual Memory, Memory Management Hardware, Input Output Organization: Peripheral devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access(DMA), Input-Output Processor(IOP).	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: Assembly Language Programming <ul style="list-style-type: none"> • Introduction to assembly language • Writing simple programs • Understanding and using different instructions Data Path and Control Unit Design <ul style="list-style-type: none"> • Designing a simple data path • Implementing control signals Input/output System Design <ul style="list-style-type: none"> • Implementing interrupt handling mechanisms 	30
Suggested Evaluation Methods		
Internal Assessment: > Theory <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 > Practicum <ul style="list-style-type: none"> • Class Participation: NA 		End Term Examination: A three hour exam for both theory and practicum.

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| <ul style="list-style-type: none">• Seminar/Demonstration/Viva-voce/Lab records etc.: 10• Mid-Term Exam: NA | |
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Part C-Learning Resources	
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Recommended Books/e-resources/LMS:	
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| <ul style="list-style-type: none">• "Computer Organization and Design" by David A. Patterson and John L. Hennessy• "Structured Computer Organization" by Andrew S. Tanenbaum | |
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*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	VI		
Name of the Course	Developing Modern Web Applications using React		
Course Code	B23-CSE-603		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-4		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Must have basic knowledge of JavaScript		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Understand the fundamentals of React and its ecosystem. 2. Learn to create and manage React components. 3. Explore state management and React hooks. 4. Develop skills in routing, form handling, and API integration. <hr style="width: 50%; margin-left: 0;"/> 5*. Gain practical experience in building, testing, and deploying React applications.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.			

Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Introduction to React: Overview of React and its features, setting up the development environment, Introduction to JSX, Creating and rendering React components.</p> <p>Components and Props: Functional and class components, Passing and accessing props, Component composition, Best practices for component design</p>	11
II	<p>State and Lifecycle: Understanding state in React, managing state with class components, Lifecycle methods, and their use cases, Introduction to React Hooks (useState, useEffect)</p> <p>Handling Events: Handling events in React, Synthetic events, Passing arguments to event handlers, Event handling best practices</p>	11
III	<p>React Router: Introduction to React Router, setting up routing in a React application, Navigating between routes, Dynamic routing and route parameters</p> <p>Managing State with Redux: Introduction to Redux, Setting up Redux in a React application, Actions, reducers, and the store, Connecting React components to Redux</p>	12
IV	<p>Form Handling: Controlled vs. uncontrolled components, Handling form inputs and submissions, Validation and error handling</p> <p>Fetching Data from APIs: Introduction to RESTful APIs, Fetching data using fetch and axios, Handling loading states and errors, Displaying data in components</p>	11
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <p>Setting Up the Environment</p> <ul style="list-style-type: none"> • Installing Node.js and npm • Setting up a React project with Create React App • Overview of project structure and configuration <p>Building Basic Components</p> <ul style="list-style-type: none"> • Creating functional and class components • Using props and state • Building a simple to-do list application <p>Working with Events and Forms</p> <ul style="list-style-type: none"> • Handling button clicks and form submissions • Building a contact form with validation • Using controlled components <p>Implementing Routing</p> <ul style="list-style-type: none"> • Setting up React Router • Creating navigation menus • Building a multi-page application with dynamic routes 	30

	<p>State Management with Redux</p> <ul style="list-style-type: none"> • Setting up Redux in a React project • Creating actions and reducers • Connecting Redux to components • Building a simple shopping cart application <p>Fetching and Displaying Data</p> <ul style="list-style-type: none"> • Fetching data from a public API • Displaying data in lists and tables • Handling loading states and errors 	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>End Term Examination:</p> <p>A three hour exam for both theory and practicum.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • "React - The Complete Guide" by Maximilian Schwarzmüller • "Learning React" by Alex Banks and Eve Porcello • React official documentation and tutorials 		

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	VI		
Name of the Course	Data Storage Technologies and Networks using AWS		
Course Code	B23-CSE-604		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-4		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	B23-CSE-504		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Understand fundamental concepts of data storage and networking. 2. Learn basic AWS storage and networking services. 3. Develop practical skills in using AWS for data storage and network setup. <hr style="width: 20%; margin-left: 0;"/> 4* Apply knowledge to real-world scenarios and simple projects.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p> <p>The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.</p>			

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Introduction to Data Storage: Overview of data storage technologies, Storage types: Block storage, file storage, and object storage, Basic storage performance metrics</p> <p>AWS Storage Services Basics: Introduction to Amazon S3 (Simple Storage Service): Creating and managing buckets, Uploading and retrieving data; Introduction to Amazon EBS (Elastic Block Store): Creating and managing EBS volumes; Hands-on: Setting up and using S3 and EBS</p>	12
II	<p>Introduction to Networking: Basic networking concepts, Understanding IP addressing, Introduction to network protocols</p> <p>AWS Networking Services Basics: Introduction to Amazon VPC (Virtual Private Cloud): Creating a VPC, Configuring subnets;</p>	11
III	<p>AWS Networking Security: Basic network security: Security groups and NACLs, Hands-on: Setting up a simple VPC and configuring basic security</p> <p>Data Security and Management: Introduction to data encryption, Basic backup and recovery strategies, Hands-on: Implementing basic data security and backup in AWS</p>	11
IV	<p>Introduction to Scalable and Resilient Design: Basics of scalability and resilience, Simple load balancing concepts, Hands-on: Setting up a basic load balancer in AWS</p>	11
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <ul style="list-style-type: none"> • Setting up Amazon S3 and managing buckets • Configuring a basic Amazon EBS volume • Creating a simple VPC and configuring subnets • Setting up security groups and basic network ACLs • Implementing basic data encryption and backup solutions • Configuring a simple load balancer in AWS 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <ul style="list-style-type: none"> ➤ Theory <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 		<p>End Term Examination: A three hour exam for both theory and practicum.</p>
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

- AWS Documentation and Basic Tutorials
- "AWS Certified Cloud Practitioner Study Guide" by Ben Piper and David Clinton

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	VI		
Name of the Course	Data Analytics using Python		
Course Code	B23-CSE-605		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-5		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	B23-CSE-505		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Understand the fundamentals of data analytics. 2. Learn to use Python for data analysis and visualization. 3. Develop the ability to apply data analytics techniques to various domains. 4. Learn the basics of machine learning using case studies. <hr style="width: 20%; margin-left: 0;"/> 5* Gain practical skills in handling real-world data sets.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p>			

The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Introduction to Data Analytics: Overview of data analytics, Importance and applications of data analytics, Data analytics process: Collecting, cleaning, analysing, and interpreting data</p> <p>Introduction to Python for Data Analytics: Basics of Python programming, Python libraries for data analytics: NumPy, pandas, matplotlib, and seaborn, Hands-on: Setting up the Python environment and basic scripting</p>	12
II	<p>Data Collection and Cleaning: Methods of data collection, Handling missing data, Data cleaning techniques, Hands-on: Collecting and cleaning data using pandas</p> <p>Exploratory Data Analysis (EDA): Descriptive statistics, Data visualization techniques, Identifying patterns and trends, Hands-on: Performing EDA using matplotlib and seaborn</p>	11
III	<p>Data Manipulation with pandas: Data frames and series, Data manipulation techniques, Merging, joining, and concatenating data, Hands-on: Manipulating data using pandas</p> <p>Statistical Analysis: Introduction to statistical concepts, Hypothesis testing, Correlation, and regression analysis, Hands-on: Conducting statistical analysis with Python</p>	11
IV	<p>Machine Learning Basics: Introduction to machine learning, Supervised vs. unsupervised learning, Basic machine learning algorithms, Hands-on: Implementing simple machine learning models using scikit-learn</p> <p>Case Studies and Real-World Applications: Analysis of real-world data sets, Best practices, and challenges in data analytics, Applying data analytics techniques to a chosen data set</p>	11
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <ul style="list-style-type: none"> • Setting up Python and installing necessary libraries • Collecting and cleaning data with pandas • Exploratory data analysis using matplotlib and seaborn • Data manipulation techniques with pandas • Conducting basic statistical analysis • Implementing a simple linear regression model 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 		<p>End Term Examination: A three hour</p>

<ul style="list-style-type: none"> • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	<p>exam for both theory and practicum.</p>
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • "Python for Data Analysis" by Wes McKinney • "Data Science from Scratch" by Joel Grus 	

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	VI		
Name of the Course	Data Analytics using R		
Course Code	B23-CSE-606		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/ VAC)	DSE-5		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	B23-CSE-506		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the fundamentals of data analytics. 2. Learn to use R for data analysis and visualization. 3. Develop the ability to apply data analytics techniques to various domains. 4. Learn the basics of machine learning using case studies. <hr style="width: 50%; margin-left: auto; margin-right: 0;"/> <p>5* Gain practical skills in handling real-world data sets.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p> <p>The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.</p>			

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<p>Introduction to Data Analytics: Overview of data analytics, Importance and applications of data analytics, Data analytics process: Collecting, cleaning, analysing, and interpreting data</p> <p>Introduction to R for Data Analytics: Basics of R programming, RStudio setup and basics, Key R packages for data analytics: dplyr, ggplot2, tidyr, and readr, Hands-on: Setting up R and RStudio, and basic scripting</p>	12
II	<p>Data Collection and Cleaning: Methods of data collection, Handling missing data, Data cleaning techniques, Hands-on: Collecting and cleaning data using dplyr and tidyr</p> <p>Exploratory Data Analysis (EDA): Descriptive statistics, Data visualization techniques, Identifying patterns and trends, Hands-on: Performing EDA using ggplot2</p>	11
III	<p>Data Manipulation with dplyr: Data frames and tibbles, Data manipulation techniques, Merging, joining, and concatenating data, Hands-on: Manipulating data using dplyr</p> <p>Statistical Analysis: Introduction to statistical concepts, Hypothesis testing, Correlation, and regression analysis, Hands-on: Conducting statistical analysis with R</p>	11
IV	<p>Machine Learning Basics: Introduction to machine learning, supervised vs. unsupervised learning, Basic machine learning algorithms, Hands-on: Implementing simple machine learning models using caret</p> <p>Case Studies and Real-World Applications: Analysis of real-world data sets, Best practices, and challenges in data analytics, Applying data analytics techniques to a chosen data set</p>	11
V*	<p>Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems:</p> <ul style="list-style-type: none"> • Setting up R and RStudio, and installing necessary packages • Collecting and cleaning data with dplyr and tidyr • Exploratory data analysis using ggplot2 • Data manipulation techniques with dplyr • Conducting basic statistical analysis • Implementing a simple linear regression model 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 		<p>End Term Examination:</p> <p>A three hour exam for both theory and practicum.</p>

<p>➤ Practicum</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA 	
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ul style="list-style-type: none"> • "R for Data Science" by Hadley Wickham and Garrett Grolemund • "Hands-On Programming with R" by Garrett Grolemund 	

*Applicable for courses having practical component.