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

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

Scheme of Examination 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)

Kurukshetra University Kurukshetra
Scheme of Examination for Undergraduate programmes
Subject: Computer Science
According to
Curriculum Framework for Undergraduate Programmes
as per NEP 2020 (Multiple Entry-Exit, Internships and Choice Based Credit System)

Sem	Course Type	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T + P
1	CC-1 MCC-1	B23-CSE-101	Problem Solving through C	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-2	B23-CSE-102	Computer Fundamentals	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M1	B23-CSE-103	Basics of Computer Science	1	1	10	20	30	3
			Practical	1	2	5	15	20	3
	MDC 1	B23-CSE-104	Fundamentals of Computer Science	2	2	15	35	75	3
			Practical	1	2	5	20	25	3
2	CC-2 MCC-3	B23-CSE-201	Web Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSEC-1	B23-CSE-202	Programming with C++	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M2	B23-CSE-203	Programming Methodologies	1	1	10	20	30	3
			Practical	1	2	5	15	20	3
	MDC 2	B23-CSE-204	Web Technologies Fundamentals	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
3	CC-3 MCC-4	B23-CSE-301	Operating Systems	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-5	B23-CSE-302	Quantitative Foundations of Computer Science	3	3	20	50	70	3

			Practical	1	2	10	20	30	3
	MDC 3	B23-CSE-303	Programming with C	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
4	CC-4 MCC-6	B23-CSE-401	Data Management with DBMS	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-7	B23-CSE-402	Introduction to Computer System Design and Organization	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-8	B23-CSE-403	Object-Oriented Programming with Java	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSE-1	B23-CSE-404	Front-end Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
		Or							
		B23-CSE-405	Linux and Shell Programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
5	CC-5 MCC-9	B23-CSE-501	Data Structures	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-10	B23-CSE-502	Software Engineering	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSE-2	B23-CSE-503	Foundations of Server-Side Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
		Or							
		B23-CSE-504	Cloud Computing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSE-3	B23-CSE-	Programming in Python	3	3	20	50	70	3

		505	Practical	1	2	10	20	30	3
			Or						
		B23-CSE-506	Programming in R	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
6	CC-6 MCC-11	B23-CSE-601	Computer Networks	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	MCC-12	B23-CSE-602	Essentials of Computer Architecture and Design	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSE-4	B23-CSE-603	Developing Modern Web Applications using React	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
			Or						
		B23-CSE-604	Data Storage Technologies and Networks using AWS	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	DSE-5	B23-CSE-605	Data Analytics using Python	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
			Or						
		B23-CSE-606	Data Analytics using R	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
7	CC-H1	B23-CSE-701	Principles & Paradigms of Programming Languages	4	4	30	70	100	3
	CC-H2	B23-CSE-702	Software Testing	4	4	30	70	100	3

	CC-H3	B23-CSE-703	Data Mining and Warehousing	4	4	30	70	100	3
	DSE-6	B23-CSE-704	NoSQL Databases	4	4	30	70	100	3
		Or							
		B23-CSE-705	Artificial Intelligence	4	4	30	70	100	3
	PC-H1	B23-CSE-706	Practical	4	8	30	70	100	6
8	CC-H4	B23-CSE-801	Emerging Trends in Information Security	4	4	30	70	100	3
	CC-H5	B23-CSE-802	Principles of Design and Analysis of algorithms	4	4	30	70	100	3
	CC-H6	B23-CSE-803	Software Project Management	4	4	30	70	100	3
	DSE-7	B23-CSE-804	Big Data	4	4	30	70	100	3
		Or							
		B23-CSE-805	Machine Learning	4	4	30	70	100	3
	PC-H2	B23-CSE-806	Practical (Advanced Web Frameworks)	4	8	30	70	100	6
	OR								
	CC-H4	B23-CSE-801	Emerging Trends in Information Security	4	4	30	70	100	3
	CC-H5	B23-CSE-802	Principles of Design and Analysis of algorithms	4	4	30	70	100	3
	Research	B23-CSE-807	Project/ Dissertation	12				300	

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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

Session: 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		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 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. _____ 5*. to implement the programs based on various concepts of C.		
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			
Instructions for Paper- Setter 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.

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(), putch(), putchar(), puts().	10
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.	10
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.	10
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; difference between Structure and Union.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: • To read radius of a circle and to find 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 keyboard continuously till the user presses 999 and to find the sum of only positive numbers • To read percentage of marks and to display appropriate message (Demonstration of else-if ladder) • To find the roots of quadratic equation • To read marks scored by n students and find the average of marks (Demonstration of single dimensional array)	25

- To remove Duplicate Element in a single dimensional Array
- To perform addition and subtraction of Matrices
- To find factorial of a number
- To generate Fibonacci series
- To remove Duplicate Element in a single dimensional Array
- To find the length of a string without using 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

Internal Assessment:	End Term Examination: A three hour exam for both theory and practicum.
➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- 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

Session: 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
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the basics of computer 2. learn about I/O devices and operating systems 3. understand internet and its services 4. learn about the threats and security concepts on computers _____ 5*. to understand the working of 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

Instructions for Paper- Setter

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.

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, Shareware, Freeware, Firmware, Free Software. Memory Systems: Concept of bit, byte, word, nibble, storage locations and addresses, measuring units of storage capacity, access time, concept of memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.	10
II	I/O Devices: I/O Ports of a Desk Top Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touch pad and track ball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, ink jet, dot-matrix. Plotter. 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.	10
III	The Internet: Introduction to networks and internet, history, Internet, Intranet & Extranet, Working of Internet, Modes of Connecting to Internet. Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.	10
IV	Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keylogers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking. Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: Operating System: • Starting with basics of Operating Systems and its functionalities Computer Basics: • Identify the various computer hardware • Understanding the working of computer • Understanding various types of software Internet and E-mail: • Using Internet for various tasks	25

	• Creating and using e-mail.
	Security:
	   • Understanding various threats
	   • How to be safe from virus threats
	   • Various software to get safe from virus attacks.	

Suggested Evaluation Methods

Internal Assessment:
➢ **Theory**
   • Class Participation: 5
   • Seminar/presentation/assignment/quiz/class test etc.: 5
   • Mid-Term Exam: 10
 	
➢ **Practicum**
   • Class Participation: 5
   • Seminar/Demonstration/Viva-voce/Lab records etc.: 5
   • Mid-Term Exam: NA
	End Term Examination: A three hour exam for both theory and practicum.

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- 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

Session: 2023-24	
PartA - Introduction	
Subject	COMPUTER SCIENCE/ COMPUTER APPLICATIONS
Semester	I
Name of the Course	Basics of Computer Science
Course Code	B23-CSE-103 (Common with B23-CAC-103)
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	
Course Learning Outcomes (CLO):	After learning this course student will be able: 1. To introduce to the students, the basic understanding of the working of a computer system. 2. To familiarize the students with the concept of algorithms and flowchart. 3. To familiarize the students with the various types of software. 4. To make the students familiar with the basic internet technology and concepts.

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)**
PartB-Contentsofthe Course	
Instructions for Paper- Setter	

Unit	Topics	Contact Hours
I	Introduction to Computers: Definition of Computers, History and Generations of Computers, Characteristics of computer, 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.	4
III	Introduction to OperatingSystems: Types of Operating System, Functions of Operating System. Windows: Introduction to Windows, Starting Windows, Desk Top, 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: • Dismantling the system unit, recognize all major components inside a PC, describe function of each component and define the relationship of internal components • Explore and describe some system utility like regedit, memory portioning, control panel, window tools. • Understanding control panel • Date and Time setting. • Working with files and folders-creating, deleting, opening, finding, copying, moving, and renaming.	25

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	**End Term Examination:** **A three hour exam for both theory and practicum.**
PartC-Learning Resources	
Text /Reference Books: • 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 Marthews Leon: Introduction to Computers, Leon Vikas,1999.
- Internet Basics. E.DouglasCommer PHI.

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE/ COMPUTER APPLICATIONS
Semester	I
Name of the Course	Fundamentals of Computer Science
Course Code	B23-CSE-104 (Common with B23-CAC-104)
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 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 _____ 5*. to understand the working of operating system 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
Instructions for Paper- Setter 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.

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.	7
II	Memory Systems: Concept of bit, byte, word, nibble, storage locations and addresses, measuring units of storage capacity, access time, concept of 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 Desk Top Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touch pad and track ball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, ink jet, dot-matrix. Plotter.	7
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.	5
IV	The Internet: Introduction to networks and internet, history, Internet, Working of the Internet, Modes of Connecting to Internet. Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.	6
V*	Operating System: • Starting with basics of Operating Systems and its functionalities Computer Basics: • Identify the various computer hardware • Understanding the working of computer • Understanding various types of software Internet and E-mail: • Using Internet for various tasks • Creating and using e-mail.	25
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 2 • Seminar/Demonstration/Viva-voce/Lab records etc.:3	**End Term Examination:** A three hour exam for both theory and practicum.	

• Mid-Term Exam: NA	
Part C-Learning Resources	
Recommended Books/e-resources/LMS: • 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

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	III
Name of the Course	Operating Systems
Course Code	B23-CSE-301 (Common with B23-CAC-102)
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	Basic Knowledge of Computer
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the basic concepts of operating systems and its services along with process management. 2. understand 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. _____ 5*. to implement the programs based on operating systems.

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	

Instructions for Paper- Setter

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.

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, System Programs. Process Management: Process Concepts, Operations on Processes, Process States and Process Control Block. Inter-Process Communication.	10
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.	10
III	Memory Management Strategies: Memory Management of Single-User and Multiuser Operating System, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.	10
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.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: • Working with various operating systems, and performing different operations using operating system. • Write a program to print file details including owner access permissions, file access time, where file name is given as argument. • Write a program to copy files using system calls. • Write a program to implement FCFS scheduling algorithm. • Write a program to implement Round Robin scheduling algorithm. • Write a program to implement SJF scheduling algorithm. • Write a program to implement non-preemptive priority based scheduling algorithm.	25

	• Write a program to implement preemptive priority based scheduling algorithm. • Write a program to implement SRJF scheduling algorithm. • Write a program to calculate sum of n numbers using thread library. • Write a program to implement first-fit, best-fit and worst-fit allocation strategies.	
Suggested Evaluation Methods		

Internal Assessment:
➢ **Theory**
  • Class Participation: 5
  • Seminar/presentation/assignment/quiz/class test etc.: 5
  • Mid-Term Exam: 10
 	
➢ **Practicum**
  • Class Participation: 5
  • Seminar/Demonstration/Viva-voce/Lab records etc.: 5
  • Mid-Term Exam: NA
		End Term Examination: A three hour exam for both theory and practicum.

Part C-Learning Resources		
Recommended Books/e-resources/LMS: • 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

Session: 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)	CC
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	Must have studied mathematics at 10+2 level
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 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 5*. to implement the programs based on various mathematical and statistical function.

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

Instructions for Paper- Setter

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.		

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.	10
II	Introduction to counting: Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.	10
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 good measure of central tendency. Arithmetic Mean (A.M.), Median, Mode - Definition, examples for ungrouped and grouped data, effect of 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	10
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, effect of 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.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: Functions: • 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 Sets:	25

• Performing various set operations Relations: • 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 Counting Principles: • Sum and product rule • Pigeonhole Principle • Inclusion Exclusion Principle Permutations and Combinations: • Permutations • Permutations with repetitions • Combinations • Combinations with repetitions Frequency distribution and data presentation • Frequency Distribution (Univariate data/ Bivariate data) • Diagrams • Graphs Measures of Central Tendency • Arithmetic Mean • Median • Mode • Partition Values Measures dispersion • Range and Coefficient of range • Quartile deviation and Coefficient of quartile deviation • Standard deviation, Variance and Coefficient of variation (C.V.) Correlation • Karl Pearson''s correlation coefficient • Spearman''s Rank correlation	

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	**End Term Examination:** A three hour exam for both theory and practicum.

Part C-Learning Resources	
Recommended Books/e-resources/LMS: • 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, NewDelhi.
- 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

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE/ COMPUTER APPLICATIONS
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
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 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 _____ 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	
Instructions for Paper- Setter	

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.	6

	Input/output: Unformatted & Formatted I/O Function, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putch(), putchar(), puts().	
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.	6
III	Decision making with if statement, if-else statement, nested if statement, else-if ladder, switch and break statement, goto statement Looping: for, while, and do-while loop, jumps in loops.	6
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.	6
V*	The following activities be carried out/ discussed in the lab during the initial period of the semester. Programming Lab: • Write a C Program to read radius and find 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 keyboard continuously till the user presses 999 and to find the sum of only positive numbers • Write a C Program to read percentage of marks and to display appropriate grade (using switch case) • Write a C Program to find the roots of quadratic equation (if else ladder) • 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	25

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 2 • Seminar/Demonstration/Viva-voce/Lab records etc.:3 • Mid-Term Exam: NA	**End Term Examination:** **A three hour exam for both theory and practicum.**
Part C-Learning Resources	
Recommended Books/e-resources/LMS: • 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.