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)

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

	End Term Examination: A three hour exam for both theory and practicum.
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	

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.

*Applicable for courses having practical component.

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.

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
Skill Enhancement Courses (SEC)
Offered by Department of Computer Science & Applications
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
Skill Enhancement Courses (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
I	SEC	B23-SEC-101	Office and Spreadsheet Tools Learning	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-102	Advance Spreadsheet Tools	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-103	Basic IT Tools	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-104	Essentials of Python	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-105	Introductory Course in R	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-106	Computer Programming in C	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
II	SEC	B23-SEC-201	Cloud Computing Skills	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
III	SEC	B23-SEC-301	Advance IT Skills	2	2	15	35	50	3
			Practical	1	2	5	20	25	3
	SEC	B23-SEC-302	Data Management	2	2	15	35	50	3
			Practical	1	2	5	20	25	3

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

Syllabus of Examination for Under-Graduate Programmes
SKILL ENHANCEMENT COURSES (SEC)
according to
Curriculum Framework for Under-Graduate Programmes
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice BasedCredit 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	Office and spreadsheet Tools Learning
Course Code	B23-SEC-101
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC
Level of the course (As per Annexure-I	
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	Operating System - Definition, Functions, Types of Operating System, Basics of Popular Operating Systems, The User Interface, Exploring Computer, Icons, taskbar, desktop, Using Menu and Menu-selection, managing files and folders, Control panel – display properties, add/remove software and hardware, Common utilities.	4
II	Word Processing - Introduction to Word Processing, Menus, Creating, Editing & Formatting Document, Spell Checking, Printing, Views, Tables, Word Art, Mail Merge, Macros, Inserting hyperlinks, Searching for text, Modifying page setup, Applying document themes, Applying document style sets, Inserting headers and footers.	7
III	Spread Sheet: Elements of Electronics Spread Sheet, Applications, Creating and Opening of Spread Sheet, Menus, Manipulation of cells: Enter texts numbers and dates, Cell Height and Widths, Copying of cells, Mathematical, Statistical and Financial function, Drawing different types of charts, Sort and Filter Data.	7
IV	Presentation Software: Creating, Modifying and enhancing a presentation, Type of presentation views, Using sound, Animation, Working with Objects, Printing.	7
V*	Practicum: Operating System: • Starting with basics of Operating Systems and its functionalities Word Processing: • Create and format word documents. • Use tables, word Art and other features in your documents. • Use macros to simplify the tasks in a document. • Use mail merge to write once for many. Spread Sheet: • Use spreadsheet for basic data handling • Apply formulas to sheet for automation. • Use Charts & Shapes for better visualization of the data. • Use sorting and filtering of the data Presentation Software: • Prepare and format presentations. • Apply slide transitions, animations and sequencing for slides. • Apply different formatting and insert options to make presentation better. • Appling sound and animation.	25

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7	End Term Examination: A three hour exam for both theory and

➢ **Practicum**
    • Class Participation: 2
    • Seminar/Demonstration/Viva-voce/Lab records etc.: 3
    • Mid-Term Exam: NA
	practicum.

Part C-Learning Resources

Recommended Books/e-resources/LMS:
    • Help files from Apache Open Office, https://wiki.openoffice.org/wiki/Documentation
    • Channelle Andy, "Beginning OpenOffice 3: From Novice to Professional", aPress Publications
    • Beginning OpenOffice 3: From Novice to Professional, Andichannele, Apress.
    • Microsoft Office 2016 Step by Step: MS Office 2016 Step by Step, By Joan Lambert, Curtis Frye
    • Computer Fundamentals - By Pradeep K. Sinha, Priti Sinha, BPB Publications, 6th Edition
    • Getting Started with LibreOffice 5.0, Friends of OpenDocuments Inc., Http://friendsofopendocument.com
    • Documentation from LibreOffice, https://documentation.libreoffice.org/en/english-documentation/

*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	Advance Spreadsheet Tools
Course Code	B23-SEC-102
CourseType: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. create and format spreadsheets 2. create and format tables and applying formulas in a spreadsheet 3. create charts and protect worksheets 4. create and use pivot charts and tables _____ 5*. to implement various spreadsheet 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	Manage Workbook Options and Settings: Create Worksheets and Workbooks, navigate in Worksheets and Workbooks, Format Worksheets and Workbooks, Customize Options and Views for Worksheets and Workbooks, Configure Worksheets and Workbooks for Distribution Apply Custom Data Formats and Layouts: Apply Custom Data Formats and Validation, Apply Advanced Conditional Formatting and Filtering, Create and Modify Custom Workbook Elements	6
II	Create Tables: Create and Manage Tables, Manage Table Styles and Options, Filter and Sort a Table Perform Operations with Formulas and Functions: Summarize Data by using Functions, Perform Conditional Operations by using Functions, Format and Modify Text by using Functions.	6
III	Create Charts and Objects: Create Charts, Format Charts, Insert and Format Objects Manage Workbook Options and Settings: Manage Workbooks, Manage Workbook Review Restrict editing	6
IV	Create Advanced Formulas: Apply Functions in Formulas, Look up data by using Functions, Apply Advanced Date and Time Functions, Perform Data Analysis and Business Intelligence, Define Named Ranges and Objects, Create Advanced Charts and Tables: Create and Manage PivotTables, Create and Manage Pivot Charts	6
V*	Practicum: Spread Sheet: • Use spreadsheet for basic data handling • Apply formulas to sheet for automation. • Use if-else to make certain decisions in a sheet. • Use Charts & Shapes for better visualization of data. • Use filters and data validation controls for control of data • Formatting data and spreadsheets • Creating and managing tables • Use Pivot table and charts • Use what-if analysis along with goal seek and scenarios	25

Suggested Evaluation Methods

Internal Assessment:	End Term Examination:
➢ **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 ➢ **Practicum** • Class Participation: 2	A three hour exam for both theory and practicum.

• Seminar/Demonstration/Viva-voce/Lab records etc.:3 • Mid-Term Exam: NA	

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- Help files from Apache Open Office, https://wiki.openoffice.org/wiki/Documentation
- Channelle Andy, "Beginning OpenOffice 3: From Novice to Professional", aPress Publications
- Beginning OpenOffice 3: From Novice to Professional, Andichannele, Apress.
- Microsoft Office 2016 Step by Step: MS Office 2016 Step by Step, By Joan Lambert, Curtis Frye
- Getting Started with LibreOffice 5.0, Friends of OpenDocuments Inc., Http://friendsofopendocument.com
- Documentation from LibreOffice, https://documentation.libreoffice.org/en/english-documentation/
- Walter Holland, Microsoft Office 2013 Digital Classroom
- Wayne L. Winston, Data Analysis and Business Modeling

*Applicable for courses having practical component.

Session: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Basic IT Tools		
Course Code	B23-SEC-103		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course (As per Annexure-I			
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Identify the basic components of computers and terminology 2. acquaint with Operating System and its applications for both desktop and mobile devices 3. Understand computer networks, and browse the internet, content search, email and collaborate with peers 4. Use e-Governance applications; and use computer to improve existing skills and learn new skills _____ 5*. to implement various spreadsheet 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	Introduction to Computer: Computer and Latest IT gadgets, Evolution of Computers & its applications, Basics of Hardware and Software, Application Software, Systems Software, Utility Software. Central Processing Unit, Input devices, Output devices, Computer Memory & storage, Mobile Apps.	6
II	Introduction to Operating System, Functions of the Operating system, Operating Systems for Desktop and Laptop, Operating Systems for Mobile Phone and Tablets, User Interface for Desktop and Laptop, Task Bar, Icons & shortcuts, Running an Application, Operating System Simple Setting, Changing System Date and Time, Changing Display Properties, To Add or Remove Program and Features, Adding, Removing & Sharing Printers, File and Folder Management.	6
III	Introduction to Internet and World Wide Web, Basic of Computer Networks, Local Area Network (LAN), Wide Area Network (WAN), Network Topology, Internet, Applications of Internet, Website Address and URL, Popular Web Browsers (Internet Explorer/Edge, Chrome, Mozilla Firefox, Opera etc.), Popular Search Engines, Searching on the Internet.	6
IV	E-mail: Using E-mails, Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E-mail, replying to an E-mail message, forwarding an E-mail message, searching emails, Attaching files with email, Email Signature. Social Networking: Facebook, Twitter, LinkedIn, Instagram, Instant Messaging (WhatsApp, Facebook Messenger, Telegram), Introduction to Blogs, Digital Locker.	6
V*	Practicum: • Identify the various parts of computer • Using computer/mobile software and hardware • Use of operating system for various tasks such as file creation, directory creation, shortcut creation, using control panel, etc. • Using Internet & various browsers. • Identify the various hardware/software required for Internet • How to create and use e-mail account • Using Facebook, WhatsApp, Instagram, LinkedIn, Telegram • Writing blogs	25
Suggested Evaluation Methods		

Internal Assessment: ➢ **Theory**	**End Term Examination:** A three hour ex-

	am for both theory and practicum.

• 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	

PartC-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 • Ram, B., Computer Fundamentals, Architecture & Organization, New Age International (P) Ltd.	

*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	Essentials of Python		
Course Code	B23-SEC-104		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course (As per Annexure-I			
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 Python 2.Learn the syntax and semantics of Python Programming Language. 3. Illustrate the process of structuring the data using lists, tuples and dictionaries. 4. Write Python functions to facilitate code reuse and manipulate strings. 5*. Understand the basic concepts of Python Programming 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

Unit	Topics	Contact Hours
	three-hour duration.	
I	Keywords and Identifiers; Comments: Purpose/use of comments, Single line comment/Multiline comment; Python Variables: Declaration of Variables, Assign Values to Variables, Initialization, Reading, Variable naming restrictions, and Types of Python Variables. **Python Data Types:** Implicit Declaration of Data Types, Python Numbers (Integers, floating-point numbers, and complex numbers), Python Strings, Python Boolean data type;	6
II	**Operators:** Arithmetic, Comparison/Relational Operators, Increment Operators, Logical operators, Identity Operators, and Operators Precedence. Python Control Flow Statement, Decision Making: Simple If Structure, if-else structure, if elif structure, and nested If Structure;	6
III	**Looping:** Python Loop Statements. Python while loop, Python for loop, Python range(), Python Nested Loop Structures, and Inserting conditions in Loops and vice versa; Python Branching Statements – break, continue, pass. **Python Lists:** Create Python Lists, Update Python Lists, Delete Elements from Python Lists, and Built-in Functions Methods for Python Lists.	6
IV	**Tuples:** create, update, join and methods; Sets: create, add/remove items, join sets, set methods; **Dictionary:** create, access, add/remove items, dictionary methods. Manipulating **Strings** - Working with Strings, Useful String Methods **Python Functions:** defining function, arbitrary arguments, keywords arguments, default parameter values, return value and return statements; Lambda; Arrays: looping through array elements, array methods;	7

V*	Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:
	 • Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
	 • Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
	 • Write a Program for checking whether the given number is an even number or not.
	 • Using for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, ..1/10.
	 • Create a list and perform the following methods
	     (a) insert() (b) remove() (c) append() (d) len() (e) pop() (f) clear()
	 • Create a dictionary and apply the followingmethods:
	     (a) Print the dictionary items (b) access items
		25

(c) useget() (d) change values (e) use len()

- Create a tuple and perform the following methods:
  (a) Add items (b) len() (c) check for item in tuple
  (d) Access items
- Write a python program to print a number is positive/negative using if-else.
- Write a python program to find largest number among three numbers.
- Write a python Program to read a number and display corresponding day using if_elif_else?
- Write a program to create a menu with the following options:
  (a) TO PERFORM ADDITITON (b) TO PERFORMSUBTRACTION (c) TO PERFORM MULTIPICATION (d) TOPERFORM DIVISION
- Accepts users input and perform the operation accordingly. Use functions with arguments.
- Write a python program to check whether the given string is palindrome or not.
- Write a python program to find factorial of a given number using functions
- Write a Python function that takes two lists and returns True if they are equal otherwise false.
- Demonstrate a python code to print try, except and finally block statements.
- Write a Python script that prints prime numbers less than 20.
- Write a python program to find factorial of a number.

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:
- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition,Green Tea Press, 2015, ISBN: 978-9352134755.
- Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, WileyIndia Pvt Ltd. ISBN-13: 978-8126556014.
- Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson EducationIndia, 2015. ISBN-13: 978-9332555365.
- ReemaThareja, "Python Programming using problem solving approach", Oxfor-

dUniversity press, 2017. ISBN-13: 978-0199480173
- Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3",1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278

*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	Introductory Course in R
Course Code	B23-SEC-105
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1.Describe the features of R Programming. 2. Use the various data structures in R. 3. Apply data frames, control statements and functions for the simulation. 4. Identify the statistical methods applied in R. 5*. understand the basic concepts of R Programming 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	Introducing to R, Installation of Libraries; Constants and Variables; Numbers; R Data Structures, Help functions in R. **Vectors:** Numeric Vectors, Scalars, Declarations **Vectorized operation:** Using all and any, NA and NULL values, Filtering, Vectorized if-then else, Vector Equality, Vector Element names, Arithmetic and Boolean operations, conditional and loop statement in R.	6
II	Functions and Recursions in R, Packages in R; Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns: Adding and deleting rows and columns, Higher Dimensional arrays; Vector/Matrix Distinction; Avoiding Dimension Reduction; Characters and Strings; String vector; String operations and functions.	6
III	**List:** Creating lists, General list operations, accessing list components and values, applying functions to lists, recursive lists, Different R operations using a List, matrix, Array; **Overview on Data Frames:** Create it in scratch, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames.	6
IV	**Factors and Tables:** factors and levels, Common functions used with factors, working with tables, Math and Simulations in R, reading a datafile directly into a dataframe, EDA using R, Reading different file formats. **Input/Output:** reading and writing files, String Manipulation. Statistical analysis: Basic Statistical function, Linear Model, R functions for statistical analysis	6
V*	Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: • Perform arithmetic operations in R. • Demonstrate the process of creating a user defined function in R. • Perform logical operations in R. • Implement Loops with different examples. • Learn the basics of functions in R and implement with examples. • Implement data frames in R. Write a program to join columns and rows in a dataframe using cbind() and rbind() in R. • Implement different String Manipulation functions in R. • Implement different data structures in R (Vectors, Lists, Data Frames) • Write a program to read a csv file and analyze the data in the file in R • Create a data set and do statistical analysis on the data using R	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:
  • Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011
  • Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data& Analytics Series, 2013.
  • Mark Gardener, "Beginning R – The Statistical Programming Language", Wiley, 2013
  • Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.	

*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 Programming in C		
Course Code	B23-SEC-106		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)	SEC		
Level of the course (As per Annexure-I			
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 C Programming 2. develop programming capability to design programs as well as real life applications using C language. 3. It also cover the concept of core programming like how to implement functions, arrays and how to manage data in files using different operations. 4.Understand various header Files. 5*. Understand the basic concepts of C Programming 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	**Introduction to C:** Data Types: Primitive Data types, Derived Data types, User-Defined Data Types; **Operators:** Different Types of Operators, Precedence of Operators, Expression and Statements; **Token:** Variables, Constants, Literals, Identifiers, Keyword, Escape Sequence; **Types of Conversion:** Typecasting, Conversion.	6
II	**Decision Control Statements:** IF, IF-ELSE, Nested IF, IF- ELSE ladder, Switch-case; **Iterative statements:** FOR loop, WHILE loop, DO-WHILE loop; **Jump Statements:** Break, Continue.	6
III	**Array:** Declaration of an Array, Initialization of Array, Type of Array: Single Dimension Array, Two-Dimensional Array; Address Calculation of an Element in Array. **Character Array and Strings:** Reading, writing, String Handling Functions: strcat(), strcmp(), strcpy(), strlen().	6
IV	**Functions:** User-Defined Functions; Function Declaration; Types of Arguments: Actual Arguments, Formal Arguments; Function Definition; Methods to Call a Function: Call by Value, Call by Reference; Passing Arrays as Parameters. **Storage classes:** Automatic, Register, Static, and External Structures; Unions; Enumerations.	6
V*	Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: • Given the values of the variables x, y and z, write a program to rotate their values such that x has the value of y, y has the value of z, and z has the value of x • The distance between two cities (in Km) is input through the keyboard. Write a C program to convert and print this distance in meter, feet, inches and centimeter. • If a five-digit number is input through the keyboard, write a C program to calculate the sum of its digits without using loop. • If a four-digit number is input through the keyboard, write a C program to obtain the sum of the first and last digit of this number. • Program to find largest and smallest number from four given number. • Program to find whether a year is leap or not. • Program to find out the grade of a student when the marks of 5 subjects are given. • A library charges a fine for every book returned late. For first 5 days the fine is 50 paise, for 6-10 days fine is one	25

rupee and above 10 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a program to access the number of days the member is late to return the book and display the fine or the appropriate message.

- Write a C program in which enter any number by the user and perform the operation of Sum of digits of entered number.
- Write a C Program to convert Decimal number to Binary number.
- WAP to compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……
- Write a C program to perform the factorial of given number.
- Write a C program to count the number of positive, negative and zero number in the given list of numbers.
- Suppose you need to generate a result table which consists of student id, student name, marks of three subject and total marks. Write a program which takes input for ten students and displays result table. Also display student information separately who got the highest total. USE STUCTURES.
- WAP to enter an integer array of size 10 and perform following operations on it.
  a) Display the Elements.
  b) Calculate the Sum and Average of Array.
  c) Find largest element.
  d) Find second largest element.
  e) Find the Smallest element.
  f) Display the Array in Reverse order.
  g) Exit
- WAP to display Fibonacci series (i)using recursion, (ii) using iteration
- Write a menu driven program to perform following operations on strings:
  a. Show address of each character in string
  b. Concatenate two strings without using strcat function.
  c. Concatenate two strings using strcat function.
  d. Compare two strings
  e. Calculate length of the string (use pointers)
  f. Convert all lowercase characters to uppercase
  g. Convert all uppercase characters to lowercase
  h. Calculate number of vowels
  i. Reverse the string

Suggested Evaluation Methods	

Internal Assessment:
➢ **Theory**
  • Class Participation: 4
  • Seminar/presentation/assignment/quiz/class test etc.:4
	End Term Examination:
	A three hour exam for both theory and

• Mid-Term Exam: 7	practicum.
➢ **Practicum** • Class Participation: 2 • Seminar/Demonstration/Viva-voce/Lab records etc.:3 • Mid-Term Exam: NA	

Part C-Learning Resources
Recommended Books/e-resources/LMS: • YashwantKanetkar, "Let us C", BPB Publications, 2002   • E. BalaGuruswamy, "Programming in ANSI C", TMH, 1999.   • Al Kelly and Ira Pohl, "A Book on C", (4th Ed.), Addison Wesley, 1999.   • B. Kernighan and D. Ritchie, "The ANSI C Programming Language", PHI, 2000.   • Kernighan & Ritchie, "The C Programming Language ANSI C Version", Prentice Hall Software Series   • Herbert Schildt "ANSI C - Made Easy", Osborne 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		
Semester	II		
Name of the Course	Cloud Computing Skills		
Course Code	B23-SEC-201		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course (As per Annexure-I			
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Get acquainted with the term Cloud computing. 2. Understand various types of free and commercial clouds. 3. Understands various types of cloud services like SaaS. PaaS and IaaS. 4. Know how the Cloud Computing is changing software industry _____ 5*. to create and use Cloud.		
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	Basic Concepts of Cloud Computing Computer Network Basics. Concepts of Distributed Systems. Concepts of Cloud Computing and its Necessity. Cloud Service Providers in use and their Significance.	6
II	Cloud Infrastructure Cloud Pros and Cons. Cloud Delivery Models. Cloud Deployment Models.	6
III	Cloud Storage Management Concept of Virtualization and Load Balancing. Overview on Virtualization used for Enterprise Solutions. Key Challenges in managing Information. Identifying the problems of scale and management in big data.	6
IV	Building Cloud Networks Designing and Implementing a Data Center-Based Cloud Installing Open Source Cloud service. Amazon Web Services (AWS). Google Cloud Platform.	6
V*	Practicum: • Creating & using Amazon(AWS) Account • Creating & using Google Account	25

Suggested Evaluation Methods

Internal Assessment:	End Term Examination:
➢ **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	A three hour exam for both theory and practicum.

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- Cloud Computing: Concepts, Technology & Architecture By Thomas Erl, Ricardo
- Cloud computing a practical approach Anthony T.Velte, Toby J.Velte Robert Elsenpeter, TATA McGraw-Hill, New Delhi– 2010
- Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online -Michael Miller-Que2008
- Moving to Cloud by Dinkar Sitaram, Geetha Manjunath, Publication: Syngress Elsevier Inc, 2014(2ndEdition)
- Cloud Computing Second Edition by Dr Kumar Saurabh, Publication Willy INDIA (2013)
- Cloud Computing Bible by Barrie Sosinsky, Publisher Willy INDAI (2014)
- Cloud computing for Dummies-Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Wiley Publishing, Inc, 2010
- Cloud Computing(Principles and Paradigms),Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

*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	Advance IT Skills
Course Code	B23-SEC-301
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Use e-Governance applications; and use computer to improve existing skills and learn new skills 2. Using internet for Digital Financial services 3. understand the concept of Cyber security and issues and challenges associated with it 4. Develop knowledge about Future Skills _____ 5*. to understand the various concepts in the syllabi 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

Unit	Topics	Contact Hours
	three-hour duration.	
I	WWW and E-Governance - Website Address and URL, Introduction to IP, Address, ISP and Role of ISP, Internet Protocol, Modes of Connecting Internet (HotSpot, Wifi, LAN Cable, BroadBand, USB Tethering), Identifying and uses of IP/MAC/IMEI of various devices, Downloading Web Pages, Printing Web Pages Introduction to Blogs, Basics of E-commerce, Netiquettes, Overview of e-Governance Services like Railway Reservation, Passport, eHospital [ORS], Accessing e-Governance Services on Mobile	5
II	Digital Financial Tools and Applications Digital Financial Tools, Understanding OTP [One Time Password]and QR [Quick Response] Code, UPI [Unified Payment Interface], AEPS [Aadhaar Enabled Payment System], USSD[Unstructured Supplementary Service Data], Card [Credit / Debit], eWallet, PoS [Point of Sale], Internet Banking, National Electronic Fund Transfer (NEFT), Real Time Gross Settlement (RTGS), Immediate Payment Service (IMPS), Online Bill Payment	5
III	Cyber Security: Cyber Security, Defining Cyberspace, Architecture of cyberspace, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security. Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India.	7
IV	Overview of Futureskills: Introduction to Internet of Things (IoT), Big Data Analytics, Cloud Computing, Virtual Reality, Artificial Intelligence, Social & Mobile, Blockchain Technology, 3D Printing/ Additive Manufacturing, Robotics Process Automation.	7
V*	Practicum: WWW and E-Governance: • Understanding the various devices related to Internet • Using e-governance services • Writing e-blogs. Digital Financial Tool: • Using digital financial tools. Cyber Security: • Checklist for reporting cyber-crime at Cybercrime Police Station • Checklist for reporting cybercrime online • Reporting phishing emails	25

- Demonstration of email phishing attack and preventive measures. Futuristic Technology: - Introducing various futuristic technologies.	
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: - Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010. - Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011) - Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001) - Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd. - Computer Fundamentals - By Pradeep K. Sinha, Priti Sinha, BPB Publications, 6th Edition	

*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	Data Management		
Course Code	B23-SEC-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	SEC		
Level of the course (As per Annexure-I			
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Describe major components of DBMS and their functions 2. Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model. 3. Write queries in relational algebra / SQL 4. Normalize a given database schema to avoid data anomalies and data redundancy. _____ 5*. to implement the concepts of databases using SQL.		
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	Database Management System – Introduction and Purpose, Database Architectures: Centralised, Client-Server, Parallel, Distributed, Web based system: Web architecture (2 tier, 3 tier, N-tier Architecture) Database Storage Structures: Introduction, Indexing, Hashing, Data Dictionary.	6
II	Data Models: Introduction to various data models, Cardinality Ratio & Relationships, Representation of entities, attributes, relationship attributes, relationship set, Generalization, aggregation, Structure of relational Database and different types of keys, Codd's rules and Relational data model	6
III	Relational Database design: Basic System Development Life Cycle, Database Design – ER to Relational, Functional dependencies, Normalization, Normal forms based on primary keys (1NF, 2NF, 3NF)	6
IV	**SQL queries:** SQL data definition, data types, specifying constraints, Queries for retrieval, insertion, deletion, updation, introduction to views.	6
V*	Practicum: Create and use the following database schema to answer the given queries. EMPLOYEE Schema: Field Type NULL KEY DEFAULT Eno Char(3) NO PRI NIL Ename Varchar(50) NO NIL Job_type Varchar(50) NO NIL Manager Char(3) Yes FK NIL Hire_date Date NO NIL Dno Integer YES FK NIL Commission Decimal(10,2) YES NIL Salary Decimal(7,2) NO NIL DEPARTMENT Schema: Field Type NULL KEY DEFAULT Dno Integer No PRI NULL Dname Varchar(50) Yes NULL Location Varchar(50) Yes New Delhi Query List 1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first. 2. Query to display unique Jobs from the Employee Table. 3. Query to display the Employee Name concatenated by a Job separated by a comma.	25

4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.

5. Query to display the Employee Name and Salary of all the employees earning more than $2850.

6. Query to display Employee Name and Department Number for the Employee No= 7900.

7. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.

8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.

9. Query to display Name and Hire Date of every Employee who was hired in 1981.

10. Query to display Name and Job of all employees who don't have a current Manager.

11. Query to display the Name, Salary and Commission for all the employees who earn commission.

12. Sort the data in descending order of Salary and Commission.

13. Query to display Name of all the employees where the third letter of their name is 'A'.

14. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manger's Employee No = 7788.

15. Query to display Name, Salary and Commission for all employees whose Commission amount is 14 greater than their Salary increased by 5%.

16. Query to display the Current Date.

17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.

18. Query to display Name and calculate the number of months between today and the date each employee was hired.

19. Query to display the following for each employee earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.

20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.

21. Query to display Name, Hire Date and Day of the week on which the employee started.

22. Query to display Name, Department Name and Department No for all the employees.

23. Query to display Unique Listing of all Jobs that are in Department # 30. 24. Query to display Name, Dept Name of all employees who have an 'A' in their name.

25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.

26. Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.

27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.

	28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies $100.	
	29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees	
	30. Query to display the number of employees performing the same Job type functions.	
	31. Query to display the no. of managers without listing their names.	
	32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department. 33. Query to display Name and Hire Date for all employees in the same dept. as Blake.	
	34. Query to display the Employee No. And Name for all employees who earn more than the average salary.	
	35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.	
	36. Query to display the names and salaries of all employees who report to King.	
	37. Query to display the department no, name and job for all employees in the Sales department	

Suggested Evaluation Methods

Internal Assessment:	**End Term Examination:**
➢ **Theory**	A three hour exam for both theory and practicum.
• 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	

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- Elmasri, R., & Navathe, S.B. (2015). Fundamentals of Database Systems. 7th edition. Pearson Education.
- Date, C. J. (2004). An Introduction to database systems. 8th edition. Pearson Education.
- Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). Database System Concepts. 6th edition. McGrawHill.

*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)

Scheme of Examination for Under-Graduate Programmes
Vocational Courses (VOC)
Offered by Department of Computer Science & Applications
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
Vocational Courses (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
IV	VOC	B23-VOC-101	Animation	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	VOC	B23-VOC-106	Web Designing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
V	VOC	B23-VOC-201	Graphic Designing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	VOC	B23-VOC-206	3-D Graphics	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	VOC	B23-VOC-216	Software Testing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
VI	VOC	B23-VOC-301	Mobile App Designing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	VOC	B23-VOC-305	Analytics with Python	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	VOC	B23-VOC-306	Data Analytics with R	3	3	20	50	70	3
			Practical	1	2	10	20	30	3

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

Syllabus of Examination for Under-Graduate Programmes
VOCATIONAL (VOC)
according to
Curriculum Framework for Under-Graduate Programmes
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice BasedCredit System)
DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
(For the Batches Admitted From 2023-2024)

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	I
Name of the Course	Animation
Course Code	B23-VOC-101
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)	VOC
Level of the course (As per Annexure-I	
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 idea of 2-D animation. 2. Using Photoshop for animation. 3. Using Corel-Draw and paint for animation 4. Using Macromedia Flash for animation 5*. Implementing the animation using Photoshop, Corel-Draw, Paint and Flash.

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		

Unit	Topics	Contact Hours
I	Introduction to 2D Animation: Basic of sketching, still life and assignment of basic drawing, Composition of basic elements, Creating Digital Layout, Working with visual images, Paint & animate (scanning, tracing, ink & Paint)	10
II	Drawing concept, Work in different media, such as drawing, collage, and painting, Professional image editing (PHOTOSHOP), Story Boarding, Understanding Background	10

4

	composition	
III	Colour theory & basics, Explore the relationship between elements and principal, Advertising and relevant case ,Graphics and illustration (Corel Draw, Paint), Titles and Credit Making, Basic Understanding of 2D animation and technique.	10
IV	Incorporating sound into 2D animation, Pixel and resolution: Vector and Bitmap Graphics, Vector Composition , 2D animation (Macromedia Flash), Stop motion animation, Animation with flash, Portfolio Making	10
V*	• Drawing fundamentals using lines • Sketching of cartoon characters • 2D Logo designing • Storyboarding of a 30 seconds film • Portfolio making of an organization	25

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:
- The Illusion of Life: Disney Animation, Ollie Johnston and Frank Thomas, Disney Editions.
- Blender Production Creating Short Animations from Start to Finish, Roland Hess, Routledge.
- Animating with Blender: Creating Short Animations from Start to Finish, Roland Hess, Focal Press
- Simplified Drawing for Planning Animation, Wayne Gilbert, Anamie Entertainment Ltd.
- Creating Characters with Personality: For Film, TV, Animation, Video Games, and Graphic Novels, Tom Bancroft, Watson-Guptill
- Force: Dynamic Life Drawing for Animators, Mike Mattesi, Focal Press

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	I		
Name of the Course	Web Designing		
Course Code	B23-VOC-106		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I			
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the fundamental concepts of web development 2. understand the basic tags of HTML 3. understand the Concepts of CSS 4. create static web pages with different positioning elements _____ 5*. to understand the designing of a static websites.		
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	Web Programming Introduction: Architecture of a website, Different technologies in making the website; Introduction to HTML: History of HTML, Basic structure of an HTML document, Introduction to Static and Dynamic Websites, HTML Tag vs Element, HTML Attributes; HTML-Basic Formatting Tags; Grouping Using Div and Span, HTML-Lists: Unordered Lists, Ordered Lists, Definition list; Image and Image Mapping, Hyperlink.	10
II	HTML-Table: < table >, < th >, < tr >, < td >, < caption >, < thead >, < tbody >, < tfoot >, < colgroup >, <col>; Colspan & Rowspan HTML-Iframe: Iframe attributes, Using Iframe as the Target; HTML-Form: Form attributes, Form elements: < input >, < textarea >. < button >, < select >, < label >, <fieldset>, <legend> etc.	10
III	CSS: Introduction, Benefits of CSS, CSS Syntax, Types of CSS, CSS Selectors: Element selector, ID Selectors, Class Selectors, Grouping Selectors, Universal Selector, CSS - Pseudo Classes, pseudo element; Text Fonts: color, background-color, text-decoration, text-align, vertical-align, text-indent, text-transform, white space, letter-spacing, word-spacing, line-height; font properties: font-family, font-size, font-style, font-variant, font-weight.	10
IV	Lists: list-style-type, list-style-position, list-style-image, list-style Tables: border, width & height, text-align, padding, colour; CSS Box Model: Border, Margin & Padding, width & height; CSS Positioning properties: Static Positioning, Fixed Positioning, Relative Positioning, Absolute Positioning.	10
V*	Practicum Web Designing: • Starting with introduction to WWW HTML: • Write a HTML document to print "Hello World" in bold and Italic Format. • Design a page having suitable background colour and text colour with title "My First Web Page" using all the attributes of the Font tag. • Write HTML code to design a page containing some text in a paragraph by giving suitable heading style. • Write HTML code to display three images at LEFT, RIGHT and CENTER respectively in web browser. • Write HTML code which contains Hyperlinks. • Program based on HTML form and frames • Design a HTML table with the use of colspan and row	25

	span. CSS: • Practical based on CSS	
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:
     • Deitel H.M., Deitel P.J., Internet & World wide Web: How to program, Pearson Education.
     • Jackson, Web Technologies, Pearson Education		

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24			
Part A - Introduction			
Subject	COMPUTER SCIENCE		
Semester	II		
Name of the Course	Graphic Designing		
Course Code	B23-VOC-201		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)	VOC		
Level of the course (As per Annexure-I			
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Perform basic to intermediate image correction to existing images 2. Enhance images using advance editing tools to create magazine covers 3. Work with the Type tools and panels to type, insert and manage text 4. Work with layers and masks to manage your projects efficiently 5. Design various types of documents/cards/logos/etc. _____		
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	Elements of design- Types of Lines, Line Compositions, Different types of Shapes-Geometric, Organic, Free-form, Natural, and Shape, composition, Positive &Negative. Textures- Physical &Visual, Texture Composition, Form Space-Positive &Negative	10
II	**Introduction to Photoshop**: The Photoshop Interface, setting up a new Photoshop document, Saving a new document, The Default Palettes, Working with Photoshop Palettes, The Photoshop Toolbox and Options bar, Using Guides and Ruler, Supported import in export image formats, Opening an Image in Photoshop, Creating Images in Photoshop, Saving Images in Photoshop, Basic Image Editing, Changing Image Size, Cropping an Image, Changing Color/Bit Depth, Optimizing Images using Save for Web, Working with Color in Photoshop.	10
III	**Photoshop Tools** Move tool, Crop tool, Slice tools, Pencil, Paintbrush, Eraser tools, History brushes, Clonetamp-Pattern stamp, healing brush tool, Retouch tool, Gradient, Paint bucket, Burn- DodgeSponge, Blur-Sharpen-Smudge, Shapes-Line rectangle- polygon-custom shapes, Path, selection tool, Pen tool, Type tools, Notes Tool-Audio annotation, Eyedropper-Color sampler Measure tool, Hand-Zoom, Quick Mask-Screen modes, Jump to Image Ready, Back ground and Foreground.	10
IV	**Photoshop Layers** About Layers-Fill and adjustment layers, The Layer Palette, Naming Layers, Creating Layers, Deleting Layers, Viewing Layers, Moving Layers, Layer Opacity, Locking Layers, Merging Layers, Layer modes and blending options, Image composting using layers.	10
V*	Apply Photoshop skills to demonstrate following: - Use basic selection tools and edge refinement to isolate and edit parts of an image. - Manipulate layers through ordering, positioning, scaling, rotation, and adjustments. - Create composite images that demonstrate advanced selection and layering techniques. - Prepare images for Web and print output with appropriate sizing and resolution. - Apply painted masks, selection-based masks, gradient masks, and blend modes to create sophisticated image effects.	25

	• Create adjustment layers for editable, non-destructive changes to image coloration and exposure. • Set and modify typography using the full range of type tools, the Character panel, and the Paragraph panel. • Apply special effects to typography using masks, paths, and layer styles. • Use preset brushes and custom brushes to colorize images, enhance images, and build illustrations.	
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: • Adobe Photoshop Bible, Dayley and Dayley, Wiley India Publication. • Photoshop in Easy Steps 1st Edition (Paperback), Robert Shufflebotham, Tata McGraw-Hill Publication. • Adobe Photoshop-Classroom in a Book 1st Edition, Adobe Creative Team, Pearson Publication		

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	II
Name of the Course	3-D Graphics
Course Code	B23-VOC-206
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the fundamental concepts of computer graphics 2. understand the 3-D transformation of images 3. understand the Concepts of viewing in 3-D 4. determine the visible surface in an image _____ 5*. to implement the various graphics elements.

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	**Introduction to Computer Graphics:** Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays.	10
II	**Three-Dimensional Transformations:** Three-Dimensional Scaling, Three-Dimensional Shearing, Three- Dimensional Rotation, Three-Dimensional Reflection, Three- Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections.	10
III	**Viewing in 3D:** Stages in 3D viewing, Canonical View Volume (CVV), Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar Geometric Projections, Combined transformation matrices for projections and viewing, Coordinate Systems and matrices, camera model and viewing pyramid.	10
IV	**Visible-Surface Determination:** Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods.	10
V*	Practicum Study and enlist the basic functions used for graphics in C / C++ / Python language. Give an example for each of them. • Draw a co-ordinate axis at the center of the screen. • Divide your screen into four regions, draw circle, rectangle, ellipse and half ellipse in each region with appropriate message. • Draw a simple hut on the screen. • **Draw the following basic shapes in the center of the screen** **i** Circle ii. Rectangle iii. Square iv. Concentric Circles v. Ellipse vi. Line • Program to create a house like figure and perform the following operations. i. Scaling about the origin followed by translation. ii. Scaling with reference to an arbitrary point. iii. Reflect about the line y = mx + c. • Develop a simple text screen saver using graphics functions.	25

	• Perform smiling face animation using graphic functions.	
	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:
    • Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Pearson
    • Fundamentals of Computer Graphics, Steve Marschner, Peter Shirley, CRC press
    • Computer Graphics, Hearn, Baker, Pearson
    • Principles of Interactive Computer Graphics, William M. Newman and Robert F. Sproull, TMH
    • Mathematical Elements for CG, D. F. Rogers, J. A. Adams, TMH		

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	II
Name of the Course	Software Testing
Course Code	B23-VOC-216
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	On the completion of the course students will: 1.To understand the basic terminologies and types of testing 2.Understand different testing methods 3.Understand the testing process 4.Manage the tests, plan testing process and create reports 5. Testing the software/projects using various techniques

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	Introduction: Definition of Software Testing and its Role, Terms: - Failure, Error, Fault, Defect, Bug, Goals of Testing, Principles of Testing, Software Testing Life Cycle, Verification and Validation: - V-testing Life cycle	10
II	Types of Testing: Black Box Testing: Overview: What is & When? Techniques: Boundary Value Analysis, Equivalence class testing, Decision Table White Box Testing: What is white box Testing, Need of white box Testing, Classification , Structural : Coverage, Path testing	10
III	Levels of Testing Unit Testing : Overview, Integration Testing : Overview, Techniques: Graph based & Path based, Functional Testing, System Testing : Overview, Categories: Reliability Security Performance Recovery, Acceptance Testing : Overview, Types of Acceptance Testing	10
IV	Test Planning: Preparing a Test plan, Scope management, Decide Test Approach, Setting Up Criteria, for testing, Identifying responsibilities, Staffing, training needs, Resource requirements, Test deliverables, Testing Tasks	10
V*	Practicum: 1. Prepare a small project and submit SRS, design, coding and test plan. 2. Study of any one of the testing tools. (e.g win runner, test direct, etc) **3. MANUAL TESTING for the project** a. Whitebox Testing b. Blackbox Testing **4. Functional Testing** a. Boundary value Testing b. Equivalence class testing **5. Structural Testing** a. Path testing b. Data-flow testing	25

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: • Software Testing: Principles and Practice by Srinivasan Desikan, Gopalaswamy Ramesh,

Pearson Publication
- Software Testing: Principles and Practice by Naresh Chauhan, Oxford
- Software Testing: Easy Learning Approach by Shubha Agarwal Kundlas

*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	Mobile App Designing
Course Code	B23-VOC-301
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. know the components and structure of mobile application development frameworks for Android based mobiles; 2. design and implement the user interfaces of mobile applications. 3. understand the concept of Intents 4. implement fragments in Android application; 5. _____ 5*. understand the designing of a mobile application.

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	Introduction: Mobile Applications, Characteristics and Benefits, Application Models, Mobile devices Profiles. Basics of Android, Importance and scope, Android Versions, Features of Android, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager, DDMS, LogCat.	10
II	Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers, List View, Spinner View.	10
III	Event Handling – Handling clicks or changes of various UI components. Intents and Broadcasts: Intent – Using intents to launch Activities, explicitly starting new Activity, Implicit Intents Services- Callbacks and Override in application, Application Signing, API keys for Google Maps, Publishing application to the Android Market.	10
IV	Fragments – Creating fragments, Lifecycle of fragments, Fragment states, adding fragments to Activity, adding, removing and replacing fragments with fragment transactions; Introduction to SQLite database	10
V*	Practical List: 1. Create "Hello World" application. That will display "Hello World" in the middle of the screen in the emulator. Also display "Hello World" in the middle of the screen in the Android Phone. 2. Create an application with three buttons (increment, decrement and reset) and a textView aligned vertically. On clicking, increment/decrement button, the value of the textview should increment/decrement by 1while selecting reset button, the value of textview should become zero. 3. Create an application with login module. (Check username and password). 4. Create an application to display various activity life cycle methods. 5. Create an application using explicit Intents. 6. Create an application using implicit Intents. 7. Create an application to display various fragment life cycle	25

	methods.	
	8. Create an application with 2 fragments, one to set the background and other to set the fore-color of the text.	

Suggested Evaluation Methods

Internal Assessment:	**End Term**
➢ **Theory**	**Examination:**
• Class Participation: 5	A three hour
• Seminar/presentation/assignment/quiz/class test etc.: 5	exam for both
• Mid-Term Exam: 10	theory and
	practicum.
➢ **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:
- Zigurd Mednieks, Laird Dornin, G,BlakeMeike and Masumi Nakamura, Programming Android, O'Reilly Publications.
- Wei-Meng Lee, Beginning Android Application Development, Wiley India Ltd.
- James C.S., Android Application development for Java Programmer, CENGAGE Learning.
- Pradeep Kothari, Android Application Development: Black Book, Wiley India Ltd.
- Gargenta M., Nakamura M., Learning Android, O'Reilly Publications.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	III
Name of the Course	Analytics with Python
Course Code	B23-VOC-305
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	Students must know basics of Python
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Learn basic statistics needed for data analytics 2. Use data analysis tools in the pandas library. 3. Load, clean, transform, merge and reshape data. 4. Create informative visualization and summarize data sets. 5*. Solve real world data analysis problems.

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	Introduction to basic statistics and analysis: Fundamentals of Data Analysis, Statistical foundations for Data Analysis, Types of data, Descriptive Statistics, Python Libraries: NumPy, Pandas, Matplotlib Correlation and covariance, Linear Regression, Statistical Hypothesis Generation and Testing	10
II	Array manipulation using NumPy: NumPy array: Creating NumPy arrays, various data types of NumPy arrays, Indexing and slicing, swapping axes, transposing arrays, data processing using Numpy arrays	10
III	Data Manipulation using Pandas: Data Structures in Pandas: Series, Data Frame, Index objects, loading data into Panda's data frame, Working with Data Frames: Arithmetic, Statistics, Binning, Indexing, Reindexing, Filtering, Handling missing data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping	10
IV	Plotting and Visualization: Using Matplotlib to plot data: figures, subplots, markings, color and line styles, labels and legends, Plotting functions in Pandas: Lines, bar, Scatter plots, histograms, stacked bars, Heatmap	10
V*	Practical List: Use data set of your choice from Open Data Portal (https://data.gov.in/) for the following exercises, wherever datasets are not mentioned explicitly. 1. Make visual representations of data using libraray Matplotlib and apply basic principles of data graphics to create rich analytic graphs for available datasets. 2. Use boston house-prices dataset avaiable with sklearn library to do the following for: i. Generate box whisker plots for price and age of the owner ii. Identify outliers, if any iii. Display 5-point summary of data distribution for all attributes iv. Find if there is any missing value in data or not v. Find pairwise correlation between attributes vi. Use scatterplot to show relationship between each feature w.r.t target class in a single panel for comparison 3. Create a CSV file having employee data records. Each employee record has three features viz. age, home city and salary. Import employee file and: i. Draw scatter plot for age vs salary ii. Plot histogram for features age and salary iii. Plot Pie chart for the qualitative attribute city iv. Generate box plots for salary and age 4. Import iris data using sklearn library to: i. Compute mean, mode, median, standard deviation, confidence interval and standard error for each feature ii. Compute correlation between length and width of sepal feature	25

	iii. Find covariance between length of sepal and petal	
	iv. Build contingency table for class feature	
	5. Download datasets Hepatitis and automobile from UCI repository	
	i. Find the number of records which are noise free	
	ii. Clean data after removing noise	
	iii. Normalize quantitative features in range of [0,1]	
	iv. Compare frequency distribution for any two columns by plotting histograms for any two columns in the same plot	
	6. Do the following using iris CSV file (use of Pandas/NumPy/SciPy)	
	i. Find total number of records and columns in a csv file	
	ii. Find correlation and contingency table for any two variables	
	iii. Find the coulmn with maximum variance	
	iv. Draw scatter plot for any two columns and also write their correlation in the caption of scatter plot	
	7. Use car dataset from UCI repository (https://archive.ics.uci.edu/ml/machine-learning-databases/car/)	
	i. Find the most popular car and draw appropriate plot to justify your answer	
	ii. Plot barchart to compare capacity of any two cars alongwith their cost iii. Draw word cloud for car names and export to a file	

Suggested Evaluation Methods

		End Term
Internal Assessment:		**Examination:**
➢ **Theory**		A three hour
• Class Participation: 5		exam for both
• Seminar/presentation/assignment/quiz/class test etc.: 5		theory and
• Mid-Term Exam: 10		practicum.
➢ **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:
- Mckinney, W. (2017). Python for Data Analysis. Second edition, O'reilly (SPD).
- Grus, J. (2016). Data Science from scratch. First edition, O'reilly (SPD).
- VanderPlas, J. (2016). Python Data Science Handbook: Essential Tools for Working with Data. Second edition, O'reilly (SPD).
- Mode: use mode function of pandas (https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.mode.html)
- Contigency table using crosstab function : use crosstab function https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.crosstab.html
- Links for Examples on Word clouds: https://www.datacamp.com/community/tutorials/wordcloud-python https://www.tutorialspoint.com/create-word-cloud-using-python https://www.geeksforgeeks.org/generating-word-cloud-python/
- Links for Examples on Contigency table:

https://www.geeksforgeeks.org/contingency-table-in-python/
https://www.tutorialspoint.com/contingency-table-in-python

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24	
Part A - Introduction	
Subject	COMPUTER SCIENCE
Semester	III
Name of the Course	Data Analytics with R
Course Code	B23-VOC-306
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC
Level of the course (As per Annexure-I	
Pre-requisite for the course (if any)	Students must know basics of R
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. develop an R script for data analysis and execute it. 2. install, load and deploy the required packages. 3. analyse the data stored in files in different formats. 4. identify suitable data visualization and exploration methods to answer a business question. _____ 5*. interpret the results of analysis.

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	Introduction to Programming Structures: R interpreter, Introduction to major R data structures like vectors, matrices, arrays, list and data frames, Flow control and loops, looping over list and array, user-defined functions	10
II	File Handling: Installing, loading and using packages for reading data from file Data Preprocessing and Transformation: Handling of missing data, Data cleaning and transformation	10
III	Data Exploration: Exploring data using statistical methods: mean, median, mode, quantiles. Building contingency table, correlation, co-variance.	10
IV	Plotting Data: Data visualization using Scatter plot, Line graph, Histogram, Boxplot, and other plots in R used for data visualization	10
V*	Practical List: 1. Find measures of central tendencies for the given data. 2. Draw the box plot for the given data and analyse skewness. 3. Randomly generate 30 numbers in the range of 1 to 40 and do the following a) Generate box plot b) Identify outliers, if any c) Display 5-point summary of data distribution Use data set of your choice from Open Data Portal (https://data.gov.in/) for the following exercises. • Read the all rows from the CSV file, with header. Write an R script to: a) create a subset of the data records that satisfy a condition. b) find suitable descriptive statistics for each column. c) draw boxplot for the numeric attributes and identify outliers, if any d) find correlation for each pair of numeric attributes, and draw scatter plot matrix. e) draw histograms, pie charts for categorical attributes. f) draw the probability density curve for numeric attributes. • Read the CSV file, without headers and a. Find the number of records which are noise free b. Clean data after removing noise c. Normalize quantative features in range of [0,1] • Practical based on vectors, arrays and lists, data frames • Practical based on reading/writing data from/to files. • Practical based on data cleaning and transformation • Practical based on linear regression • Practical based on visualizing data as Scatter Plot, line graph, histogram, boxplot, line plots regression, word clouds, and exporting plots as images	25
Suggested Evaluation Methods		

Internal Assessment:
➢ **Theory**
  • Class Participation: 5
  • Seminar/presentation/assignment/quiz/class test etc.: 5
	End Term Examination: A three hour exam for both theory and

• Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	practicum.

Part C-Learning Resources

Recommended Books/e-resources/LMS:
- Cotton, R. (2017). Learning R, A step by step function guide to data analysis. O'reilly (SPD).
- Gardener, M. (2017). Beginning R, The statistical programming language. WILEY.
- Teetor, P. (2017). R Cookbook (10th Edition reprint). O'reilly (SPD).
- Web Resources
  https://jrnold.github.io/r4ds-exercise-solutions/index.html
  https://www.r-project.org/
  https://cran.r-project.org/