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
Bachelor of Computer Applications (BCA): SCHEME D
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: BCA

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-A1	B23-CAP-101	Problem Solving through C	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B1	B23-CAP-102	Foundations of Computer Science	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C1	B23-CAP-103	Logical Organization of Computer	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M1	B23-CAP-104	Mathematical Foundations for Computer Science-I	1	1	10	20	30	3
			Practical	1	2	5	15	20	3
	MDC1	To be taken from other department							
	SEC1	To be taken from SEC Pool							
	VAC1	To be taken from VAC Pool							
	AEC1	To be taken from AEC Pool							
2	CC-A2	B23-CAP-201	Object Oriented Programming using C++	3	3	20	50	70	3
			Practical	1	2	10	20	30	3

	CC-B2	B23-CAP-202	Introduction to Web Technologies	3	3	20	50	70	3
			Practical	1	3	10	20	30	3
	CC-C2	B23-CAP-203	Concepts of Operating Systems	3	3	20	50	70	3
			Practical	1	2	5	15	20	3
	CC-M2	B23-CAP-204	Mathematical Foundations for Computer Science-II	1	1	10	20	30	3
			Practical	1	2	5	15	20	3
	MDC-2	To be taken from other department							
	SEC-2	To be taken from SEC Pool							
	VAC-2	To be taken from VAC Pool							
	AEC-2	To be taken from AEC Pool							
3	CC-A3	B23-CAP-301	Java OOP Foundations	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B3	B23-CAP-302	Linux and Shell programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C3	B23-CAP-303	Data Base Technologies	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M3	B23-CAP-304	Basics of Data Science Using Excel	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
		OR							

		To be taken from other department							
	MDC-3	To be taken from other department							
	SEC-3	To be taken from SEC Pool							
	AEC-3	To be taken from AEC Pool							
4	CC-A4	B23-CAP-401	Data Structures and Applications	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B4	B23-CAP-402	Front-end Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C4	B23-CAP-403	Computer Graphics	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	AEC-4	To be taken from AEC Pool							
	VAC-3	To be taken from VAC Pool							
	CC-M4(V)	To be taken from VOC Pool							
5	CC-A5	B23-CAP-501	Software Engineering	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B5	B23-CAP-502	Back-end Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C5	B23-CAP-503	Network Infrastructure and Data Communication Technologies	3	3	20	50	70	3

			Practical	1	2	10	20	30	3
	CC-M5(V)	To be taken from VOC Pool							
	SEC-4	Internship @ 4 Credits							
6	CC-A6	B23-CAP-601	Programming using Python	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B6	B23-CAP-602	Advanced Web Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C6	B23-CAP-603	Artificial Intelligence	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M6	B23-CAP-604	Basics of Data Science Using Python	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
		OR							
		To be taken from other department							
	CC-M7(V)	To be taken from VOC Pool							
7	CC-H1	B23-CAP-701	Principles & Paradigms of Programming Languages	4	4	30	70	100	3
	CC-H2	B23-CAP-702	Software Testing	4	4	30	70	100	3
	CC-H3	B23-CAP-703	Data Mining and Warehousing	4	4	30	70	100	3
	DSE-H1	B23-CAP-704	NoSQL Databases	4	4	30	70	100	3
		Or							
		B23-CAP-705	Cyber Security	4	4	30	70	100	3
	PC-H1	B23-CAP-706	Practical	4	8	30	70	100	6

	CC-HM1	B23-CAP-707	Cloud Computing	4	4	30	70	100	3
8	CC-H4	B23-CAP-801	Design & Analysis of Algorithms	4	4	30	70	100	3
	CC-H5	B23-CAP-802	Software Project Management	4	4	30	70	100	3
	CC-H6	B23-CAP-803	Emerging Trends in Information Security	4	4	30	70	100	3
	DSE-H2	B23-CAP-804	Big Data	4	4	30	70	100	3
		Or							
		B23-CAP-805	Machine Learning	4	4	30	70	100	3
	PC-H2	B23-CAP-806	Practical	4	8	30	70	100	6
	CC-HM2	B23-CAP-807	Internet of Things (IoT)	4	4	30	70	100	3
	OR								
	CC-H4	B23-CAP-801	Design & Analysis of Algorithms	4	4	30	70	100	3
	CC-H5	B23-CAP-802	Software Project Management	4	4	30	70	100	3
	CC-HM2	B23-CAP-807	Internet of Things (IoT)	4	4	30	70	100	3
	Research	B23-CAP-808	Project/ Dissertation	12				300	

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

<table>
<tr><th colspan="4">Scheme: 2023-24, Syllabus: 2023-24</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">I</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Problem Solving through C</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-101</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-A1</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">None</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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, unions, etc. in C language.
5*. to implement the programs based on various concepts of C.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u></td></tr>
</table>

The examiner will set a total of nine questions. Out of which first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.
The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output: Formatted I/O Function-, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putch(), putchar(), puts().	11
II	Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression, Type Casting and Conversion. Decision making with if statement, if-else statement, nested if statement, else-if ladder, switch and break statement, goto statement, Looping Statements: for, while, and do-while loop, jumps in loops.	11
III	Arrays: One-dimensional arrays - Declaration, Initialization, and Memory representation; Two-Dimensional arrays -Declaration, Initialization and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions. Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate, etc., Search for a Substring.	12
IV	Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers, and Arrays. User-defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; the difference between Structure and Union.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:	30

	• To read the radius of a circle and to find the area and circumference • To read three numbers and find the biggest of three • To check whether the number is prime or not • To read a number, find the sum of the digits, reverse the number, and check it for palindrome • To read numbers from the keyboard continuously till the user presses 999 to find the sum of only positive numbers • To read the percentage of marks and to display an appropriate message (Demonstration of else-if ladder) • To find the roots of the quadratic equation • To read marks scored by n students and find the average of marks (Demonstration of the single dimensional array) • To remove Duplicate Elements in a single dimensional Array • To perform addition and subtraction of Matrices • To find the factorial of a number • To generate Fibonacci series • To remove Duplicate Elements in a single dimensional Array • To find the length of a string without using the built-in function • To demonstrate string functions • To read, display, and add two m x n matrices using functions • To read a string and to find the number of alphabets, digits, vowels, consonants, spaces, and special characters • To Swap Two Numbers using Pointers • To demonstrate student structure to read & display records of n students • To demonstrate the difference between structure & union.	

Suggested Evaluation Methods

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

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
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<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">I</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Foundations of Computer Science</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-102</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-B1</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">None</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">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 the Internet and its services
4. learn about the threats and security concepts on computers
5*. to understand the working of the operating system, internet, and security-related concepts.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u>
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The</td></tr>
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examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.
The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of Computers in Various Fields. Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Memory Systems: Concept of bit, byte, word, nibble, storage locations, and addresses, measuring units of storage capacity, access time, the concept of the memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.	11
II	I/O Devices: I/O Ports of a Desktop Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touchpad and trackball, joystick, magnetic stripes, scanner, digital camera, and microphone Output Devices: speaker, monitor, printers: classification, laser, inkjet, dot-matrix. Plotter. 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.	12
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.	11
IV	Threats: Physical & non-physical threats, Viruses, worms, Trojans, 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.	11

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 • Creating and using e-mail. Security: • Understanding various threats • How to be safe from virus threats • Various software to get safe from virus attacks.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA		**End Term Examination:** A three-hour exam for both theory and practicum.
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.

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<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">I</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Logical Organization of Computer</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-103</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-C1</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Basic Knowledge of Mathematics (10th Level)</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand number systems, error detecting correcting code, and representations of numbers in a computer system.
2. understand computer arithmetic and Boolean algebra and simplification of Boolean expressions.
3. understand the working of logic gates and design various combinational circuits using these logic gates.
4. understand the working of different types of flip-flops and design different types of registers.
5*. to understand the practical aspects of the logical organization of computers.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><td colspan="4">Part B- Contents of the Course</td></tr>
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Instructions for Paper-Setter

The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.

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

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

Unit	Topics	Contact Hours
I	Number Systems: Binary, Octal, Hexadecimal, etc. Conversions from one number system to another, BCD Number System. BCD Codes: Natural Binary Code, Weighted Code, Self-Complimenting Code, Cyclic Code. Error Detecting and Correcting Codes. Character representations: ASCII, EBCDIC, and Unicode. Number Representations: Integer numbers - sign-magnitude, 1's & 2's complement representation. Real Numbers normalized floating point representations.	11
II	Binary Arithmetic: Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division using 1's and 2's Compliment representations, Addition and subtraction with BCD representations. Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates & Theorems, Kaurnaugh-Maps (upto four variables), Handling Don't Care conditions.	11
III	Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR, etc. Their symbols, truth tables, and Boolean expressions. Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.	11
IV	Sequential Circuits: Basic Flip-Flops and their working. Synchronous and Asynchronous Flip–Flops, Triggering of Flip-Flops, Clocked RS, D Type, JK, T type, and Master-Slave Flip-Flops. State Table, State Diagram, and State Equations. Flip-flops characteristics & Excitation Tables. Sequential Circuits: Designing registers –Serial-In Serial-Out (SISO),	12

	Serial-In Parallel-Out (SIPO), Parallel-In Serial-Out (PISO) Parallel-In Parallel-Out (PIPO) and shift registers.	
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: Number System: • Problems based on Number System and their conversion. • Programs based on Number System conversion. Binary Arithmetic • Problems based on Binary Arithmetic. • Programs based on Binary Arithmetic. • Problems based on Boolean Expression and their simplification Logic Gates • Understanding working of logic Gates. Combinatorial Circuits: • Designing and understanding various combinational circuits. Sequential Circuits: • Designing and understanding various sequential circuits.	30

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

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.
- V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.
- Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.
- Nicholas Carter, Schaum's Outlines Computer Architecture, Tata McGraw-Hill.

*Applicable for courses having practical component.

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KURUKSHETRA UNIVERSITY, KURUKSHETRA

<table>
<tr><th colspan="4">Scheme: 2023-24, Syllabus: 2023-24</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">I</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Mathematical Foundations for Computer Science-I</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-104</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-M1</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">None</td></tr>
<tr><td>Course Learning Outcomes (CLO):</td><td colspan="3">After learning this course students will be able to:
1. Gain knowledge of set theory, types of sets, and operations on sets. Understand various concepts of matrices and determinants, and acquire the cognitive skills to apply different operations on matrices and determinants.
2. Know the basic concepts of complex numbers and acquire skills to solve linear quadratic equations.
3. Gain the knowledge of the concepts of Arithmetic progression, Geometric progression, and Harmonic progression, and find A.M., G.M., and H.M. of given numbers.
4. Understand the concept of differentiation
5. * Attain the skills to make use of the learned concepts of Introductory Mathematics in multidisciplinary learning contexts and to know their applications</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>1</td><td>1</td><td>2</td></tr>
<tr><td>Contact Hours</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td colspan="2">Max. Marks:50(30(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
</table>

Internal Assessment Marks:15(10(T)+5(P)) End Term Exam Marks:35(20(T)+15(P))	

Part B-Contents of the Course

Instructions for Paper-Setter

The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units, selecting two questions from each. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.

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

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

Unit	Topics	Contact Hours
I	Sets and their representations, Empty sets, Finite and infinite sets, Subsets, Equal sets, Power sets, Universal sets, Union and intersection of sets, Difference of two sets, Complement of a set, Venn diagram, De-Morgan's laws, and their applications.	4
II	An introduction to matrices and their types, Operations on matrices, Symmetric and skew-symmetric matrices, Minors, and Co-factors. Determinant of a square matrix, Adjoint and inverse of a square matrix, Solutions of a system of linear equations up to order 3.	4
III	Quadratic equations, Solution of quadratic equations. Arithmetic progression, Geometric progression, Harmonic progression, Arithmetic mean (A.M.), Geometric mean (G.M.), Harmonic mean (H.M.), Relation between A.M., G.M. and H.M.	3
IV	The concept of differentiation, differentiation of simple functions, and Use of differentiation for solving problems related to real-life situations. Differentiation of simple algebraic, trigonometric, and exponential functions.	4
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: **Problem Solving**- Questions related to the practical problems based on the following topics will be worked out and a record of those will be maintained in the Practical Note Book: • Problems related to union, intersection, difference and complement of sets.	30

	• Problems based on De Morgan's Laws. • Problems related to Venn diagrams. • Problems to find the inverse of a matrix. • Problems to find the determinant of a square matrix of order 3. • Problems to find the nth term of A.P., G.P., and H.P. • Problems to find the sum of n terms of A.P., G.P., and H.P. • Problems to find A.M., G.M., and H.M. of given numbers. • Problems involving formulation and solution of quadratic equations in one variable. • Problems to find the first derivatives of functions.	

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.**

Part C-Learning Resources

Text /Reference Books:

- C. Y. Young (2021). *Algebra and Trigonometry*. Wiley.
- S.L. Loney (2016). *The Elements of Coordinate Geometry (Cartesian Coordinates)* (2nd Edition). G.K. Publication Private Limited.
- Seymour Lipschutz and Marc Lars Lipson (2013). *Linear Algebra.* (4th Edition) Schaum's Outline Series, McGraw-Hill.
- C.C. Pinter (2014). *A Book of Set Theory*. Dover Publications.
- J. V. Dyke, J. Rogers and H. Adams (2011). *Fundamentals of Mathematics* (10th Edition), Brooks/Cole.
- A. Tussy, R. Gustafson and D. Koenig (2010). *Basic Mathematics for College Students* (4th Edition). Brooks Cole

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

<table>
<tr><td colspan="4">Session: 2023-24</td></tr>
<tr><td colspan="4">Part A - Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">II</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Object Oriented Programming using C++</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-201</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">B23-CAP-101</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. learn the input/output statements and functions in C++.
2. get familiar with OOPS concepts along with constructors and destructors in C++ language.
3. Learn the various concepts of operator overloading and inheritance.
4. get familiar with concepts of virtual functions and exception handling in C++ language.
5*. implement the programs based on various concepts of C++.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><td colspan="4">Part B- Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
The examiner will set a total of nine questions. Out of which, the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate will have to attempt five questions, selecting one from each unit. First</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	**Input Output in C++**: Unformatted and Formatted I/O Operations. I/O using insertion and extraction operators and streams in C++. **Functions**: Declaration and Definition, return values, arguments, passing parameters by value, call by reference, call by pointer, Recursion, Inline Functions, Function overloading. Pointers, structures, and union in C++.	11
II	**Object-oriented features of C++**: Class and Objects, Data hiding & encapsulation, abstraction, Data Members and Member Functions, accessing class members, empty class, local class, global class, Scope Resolution Operator and its Uses, Static Data Members, Static Member Functions, Structure vs Class, Friend function and friend class. **Constructors and Destructors**: Constructors, Instantiation of objects, Default constructor, Parameterized constructor, Copy constructor and its use, Destructors, Dynamic initialization of objects.	12
III	**Operator Overloading:** Overloading unary and binary operators: arithmetic operators, manipulation of strings using operators. **Inheritance**: Derived class, base class, Accessing the base class member, Inheritance: multilevel, multiple, hierarchical, hybrid; Virtual base class, Abstract class.	11
IV	Virtual Functions, pure virtual functions; Polymorphism & its types **Exception Handling in C++**: exception handling model, exception handling constructs - try, throw, catch, Order of catch blocks, Catching all exceptions, Nested try blocks, handling uncaught exceptions.	11

V*	Practicum:
	Students are advised to do laboratory/practical practice not limited to but including the following types of problems:
	• Write a C++ program to print the following lines:
	  ◦ Your introduction
	  ◦ Your institute introduction
	• Write a program that accepts principle, rate, and time from the user and prints the simple interest.
	• Write a program to swap the values of two variables.
	• Write a program to check whether the given number is even or odd (using ?: ternary operator).
	• Write a program to check whether the given number is positive or negative (using?: ternary operator).
	• Write a program that inputs three numbers and displays the largest number using the ternary operator.
	• WAP to initialize data members of the class using the constructor.
	• Pass values to the constructor and initialize the members of that class to those values.
	• Create a class called cube with the data members Length, Breadth, Height
		30

	• Members functions:
	  • To accept the details.
	  • To calculate the volume of the cube.
	  • To display the details.
	• WAP to calculate the sum using constructor overloading.
	• WAP to demonstrate the use of destructor.
	• Create a C++ Program to show the order of constructor and destructor.
	• C++ Program to Find the Number of Vowels, Consonants, Digits, and White Spaces in a String
	• C++ Program to Multiply Two Matrices by Passing Matrix to Function
	• Increment ++ and Decrement -- Operator Overloading in C++ Programming
	• C++ Program to Add Two Complex Numbers
	• C++ Program to Show Function Overriding
	• C++ Program to Show Polymorphism in Class
	• C++ Program to Show Function Overloading
	• C++ Program to Show Inheritance	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for boththeory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Herbert Schildt, C++, The Complete Reference, Tata McGraw-Hill
- Robert Lafore, Object Oriented Programming in C++, SAMS Publishing
- Bjarne Stroustrup, The C++ Programming Language, Pearson Education
- Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill.
- Richard Johnson, An Introduction to Object-Oriented Application Development, Thomson Learning.

*Applicable for courses having practical components.

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KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24			
Part A - Introduction			
Subject	BCA		
Semester	II		
Name of the Course	Introduction to Web Technologies		
Course Code	B23-CAP-202		
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 web development. 2. understand different types of web pages and websites. 3. implement HTML and CSS for web page designing. 4. Understand the design of web crawlers and search engines. 5*. implement the programs based on various concepts of web development.		
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 Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Hypertext Transfer Protocol, URLs; Searching, Search Engines and Search Tools. Web Publishing: Hosting website; Internet Service Provider; Planning and designing website; Web Graphics Design, Steps For Developing website	11
II	Creating a Website and Introduction to Markup Languages (HTML and DHTML), HTML Document Features & Fundamentals, HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text color and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus; Working with Radio Buttons; Check Boxes; Text Boxes, HTML5	12
III	Introduction to CSS (Cascading Style Sheets): Features, Core Syntax, Types, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning, and other useful Style Properties; Features of CSS3.	11
IV	The Nature of JavaScript: Evolution of Scripting Languages, JavaScript-Definition, Programming for Non-Programmers, Introduction to Client–Side Programming, Enhancing HTML Documents with JavaScript. Static and Dynamic web pages	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Create a web page using an ordered list and an unordered list. • Design a web page to show your institute with hyperlinks. • Create your resume on an HTML page. • Create a web page and divide the web page into four frames. In one frame create three links that will display different HTML forms in the remaining three frames respectively. • Create a web page to show the college record in the form of a table. • Write an HTML code to add internal CSS on a webpage • Design a blog-style personal website.	30

	• Design a web page to display your college with hyperlinks. • Write a JavaScript function to calculate the sum of two numbers. • Write a JavaScript program to find the maximum number in an array. • Write a JavaScript function to check if a given string is a palindrome (reads the same forwards and backward). • Write a CSS file and attach it to any 3 HTML webpages. • Use Div and span in a page and color two words with the same colors. • Using HTML, CSS create a styled checkbox with animation on state change • Design a web page that is like a compose page of e-mail. It should have: a) Text boxes for To, CC, and BCC respectively. b) Text field for the message. c) Send button. d) Option for selecting a file for attachment • After clicking the send button a new page should open with the display message "Message has been sent".	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
- Ramesh Bangia, Multimedia and Web Technology, Firewall Media.
- Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill
- Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill.
- Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI
- David Flanagan, JavaScript: The Definitive Guide: The Definitive Guide.
- Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

*Applicable for courses having practical components.

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<table>
<tr><td colspan="4">Session: 2023-24</td></tr>
<tr><td colspan="4">Part A - Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">II</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Concepts of Operating Systems</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-203</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">100-199</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3"></td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand the basic concepts of operating systems and their services along with process management.
2. understand the concept of process scheduling and acquire knowledge of process synchronization.
3. learn about memory management and virtual memory concepts.
4. learn to work with directory structure and security aspects.
5*. implement the programs based on the operating system.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><td colspan="4">Part B- Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u>
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	Introductory Concepts: Operating System, Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure. Types of Operating System: Real-time, Multiprogramming, Multiprocessing, Batch processing. Operating System Services, Operating System Interface, Service System Calls, and System Programs. Process Management: Process Concepts, Operations on Processes, Process States, and Process Control Block. Inter-Process Communication.	11
II	CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling, Algorithm Evaluation. Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors. Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.	12
III	Memory Management Strategies: Memory Management of Single-user and Multiuser Operating Systems, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.	11
IV	Implementing File System: File System Structure, File System Implantation, File Operations, Type of Files, Directory Implementation, Allocation Methods, and Free Space Management. Disk Scheduling algorithm - SSTF, Scan, C- Scan, Look, C-Look. SSD Management.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Working with various operating systems, and performing different operations using operating systems. • Write a program to print file details including owner access permissions, and file access time, where file name is given as argument. • Write a program to copy files using system calls.	30

	• Write a program to implement the FCFS scheduling algorithm. • Write a program to implement the Round Robin scheduling algorithm. • Write a program to implement the SJF scheduling algorithm. • Write a program to implement a non-preemptive priority-based scheduling algorithm • Write a program to implement preemptive priority-based • scheduling algorithm. • Write a program to implement the SRJF scheduling algorithm. • Write a program to calculate the sum of n numbers using the thread library. • Write a program to implement first-fit, best-fit, and worst-fit allocation strategies.	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- 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 components.

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KURUKSHETRA UNIVERSITY, KURUKSHETRA

Session: 2023-24			
Part A - Introduction			
Subject	BCA		
Semester	II		
Name of the Course	Mathematical Foundations for Computer Science-II		
Course Code	B23-CAP-204		
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 to: 1. Understand the concept of integration. 2. Acquire cognitive and technical knowledge about a variety of methods of representation of statistical data 3. Understand methods of measure of central tendency. Analyze the problem and apply the best measure of central tendency to draw inferences from the available data. 4. Understand the concept of correlation, and correlation methods and conclude about the type of correlation for the available data. Comprehend the skills of curve fitting. 5. * Attain a range of cognitive and technical skills to integrate various functions. Have the technical and practical skills required for selecting and using suitable methods for data representation and measurement of central tendency.		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	1	2	3
Max. Marks:50(30(T)+20(P)) **Internal Assessment Marks:15(10(T)+5(P))** **End Term Exam Marks:35(20(T)+15(P))**		**Time: 3 Hrs.(T), 3Hrs.(P)**	
Part B-Contents of the Course			

Instructions for Paper-Setter

The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.

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

Unit	Topics	Contact Hours
I	Integration of simple algebraic, trigonometric, and exponential functions. **Presentation of data**: Frequency distribution and cumulative frequency distribution, Diagrammatic and graphical presentation of data, Construction of bar, Pie diagrams, Histograms, Frequency polygon, Frequency curve, and Ogives.	4
II	**Measures of central tendency**: Arithmetic mean, Median, Mode, Geometric mean, and Harmonic mean for ungrouped and grouped data. **Measures of dispersion**: Concept of dispersion, Mean deviation and its coefficient, Range, Variance and its coefficient, Standard deviation.	4
III	**Correlation**: Concept and types of correlation, Methods of finding correlation: Scatter diagram, Karl Pearson's coefficients of correlation, Rank correlation.	3
IV	**Linear regression**: Principle of least square, Fitting of a straight line, Two lines of regression, Regression coefficients.	4
V*	**Practicum**: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: **Problem Solving**- Questions related to the practical problems based on the following topics will be worked out and a record of those will be maintained in the Practical Note Book: • Demonstrate skills in finding integration of simple functions. • Representation of data using Bar and pie diagrams. • Representation of data using Histogram, Frequency polygon, Frequency curves, and Ogives. • Problems to compute measures of central tendency. • Problems to calculate measures of dispersion. • Problem to calculate Karl Pearson's coefficient of correlation. • Problem to fit the straight line for the given data. • Problem to find lines of regression.	30

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.** **End Term Exam Marks:35(20(T)+15 (P))**

Part C-Learning Resources

Text /Reference Books:

- S.C. Gupta and V.K. Kapoor (2014). Fundamentals of Mathematical Statistics, S. Chand & Sons, Delhi.
- R.V. Hogg, J. W. McKean and A. T. Craig (2013). Introduction to Mathematical Statistics (7 th edition), Pearson Education.
- J. V. Dyke, J. Rogers and H. Adams (2011). Fundamentals of Mathematics, Cengage Learning.
- A.S. Tussy, R. D. Gustafson and D. Koenig (2010). Basic Mathematics for College Students. Brooks Cole.
- G. Klambauer (1986). Aspects of calculus. Springer-Verlag.

*Applicable for courses having practical components.

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KURUKSHETRA UNIVERSITY, KURUKSHETRA

<table>
<tr><th colspan="4">Scheme: 2023-24, Syllabus: 2023-24</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">III</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Java OOP Foundations</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-301</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-A3</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">200-299</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Knowledge of any Computer Programming Language</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. Implement simple Java programs.
2. Implement multiple inheritance using Interfaces
3. Implement Exception Handling and File Handling.
4. Use AWT to design GUI applications.

5* develop the project using java.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
The examiner will set a total of nine questions. Out of which first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	Object Oriented Programming and Java Fundamentals: Structure of Java programs, Classes and Objects, Data types, Type Casting, Looping Constructs.	11
II	Interfaces: Interface basics; Defining, implementing, and extending interfaces; Implementing multiple inheritance using interfaces Packages: Basics of packages, Creating and accessing packages, System packages, Creating user-defined packages	11
III	Exception handling using the main keywords of exception handling: try, catch, throw, throws, and finally; Nested try, multiple catch statements, creating user-defined exceptions. File Handling Byte Stream, Character Stream, File I/O Basics, File Operations	11
IV	AWT and Event Handling: The AWT class hierarchy, Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Creating GUI applications using AWT.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • WAP to find the sum of 10 numbers, entered as command line arguments. • WAP to find the area of rectangle and circle using Interface. • WAP to implement multiple inheritance. • WAP to show the concept of packages. • WAP to handle the Exception using try and multiple catch blocks and a finally block. • WAP for Implementing Calculator in an Applet, use appropriate Layout Manager. • Write Applet code to add two integers in textbox and their sum should appear in third textbox. • Write AWT program in Java to find the sum, Multiplication and average of three numbers entered in three Text fields by clicking the corresponding Labeled Button. The result should be appearing in fourth text field.	30

	• Write Applet code to show all the activities of Mouse using Mouselistener and MouseMotionlistener. • What are various stream classes in Java? Write Java code to read character from a file and write into another file. • What are AWT Classes? Write a Java Program to generate Even numbers and Odd Numbers in TextField "T1 and T2 respectively" while pressing Buttons "Even" and "Odd". • Write a program to Copy the text from one file to another using byte stream.	

Suggested Evaluation Methods

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

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Schildt, H. (2018). Java: The Complete Reference. 10th edition. McGraw-Hill Education.
- Balaguruswamy E. (2014). Programming with JAVA: A Primer. 5th edition. India: McGraw Hill Education
- Horstmann, C. S. (2017). Core Java - Vol. I – Fundamentals (Vol. 10). Pearson Education
- Schildt, H., & Skrien, D. (2012). Java Fundamentals - A Comprehensive Introduction. India: McGraw Hill Education.

*Applicable for courses having practical component.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
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<table>
<tr><th colspan="4">Scheme: 2023-24, Syllabus: 2023-24</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">III</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Linux and Shell Programming</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-302</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-B3</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">200-299</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Must have basic knowledge of computer</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand Linux architecture.
2 use various Linux commands that are used to manipulate system operations.
3 acquire knowledge of Linux File System.
4 understand and make effective use of I/O and shell scripting language to solve problems.
5*. to implement the programs based on various shell commands and programs in Linux.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
The examiner will set a total of nine questions. Out of which first question will be compulsory.</td></tr>
</table>

The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.
The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Introduction to Linux: Linux distributions, Overview of Linux operating system, Linux architecture, Features of Linux, Accessing Linux system, Starting and shutting down system, Logging in and Logging out, Comparison of Linux with other operating systems.	11
II	Commands in Linux: General-purpose commands, File oriented commands, directory-oriented commands, Communication-oriented commands, process-oriented commands, etc. Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, grep; Introducing regular expressions.	11
III	Linux file system: Linux files, inodes and structure and file system, file system components, standard file system, file system types. Processes in Linux: Starting and Stopping Processes, Initialization Processes, Mechanism of process creation, and Job control in Linux using at, batch, cron & time.	11
IV	Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating & executing shell scripts in Linux.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Basic Linux command • Basic Shell Programming (Fibonacci Series generation, Factorial of a given number, Checking for Armstrong number) • Designing an Arithmetic calculator • Generation of Multiplication table • Base Conversion (Decimal to Binary, Binary to Decimal) • Finding the information about the Login name and File name. • Write a shell script to exchange the contents of two variables. • Write a shell script, which accepts three subject marks scored by a student and declare the result. • Write a shell script program to find area of a square,	30

	rectangle, circle and triangle. • Write a shell script to print integer numbers from 1 to 20.	
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA		**End Term Examination:** A three-hour exam for both theory and practicum.
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Yashwant Kanetkar, Unix & Shell programming – BPB Publications. • Richard Petersen, The Complete Reference – Linux, McGraw-Hill. • M.G.Venkateshmurthy, Introduction to Unix & Shell Programming, Pearson Education. • Stephen Prata, Advanced UNIX-A Programmer's Guide, SAMS Publication. • Sumitabha Das, Your Unix - The Ultimate Guide, Tata McGraw-Hill.		

*Applicable for courses having practical component.

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<table>
<tr><td colspan="4">Scheme: 2023-24, Syllabus: 2023-24</td></tr>
<tr><td colspan="4">Part A - Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">III</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Data Base Technologies</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-303</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-C3</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">200-299</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Basic Knowledge of computer</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand the concepts of database and its architecture
2. understand the various types of data models
3. understand various concepts in SQL and relational algebra
4. understand the relational model and normalization in detail.
_____
5*. to implement various SQL queries.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><td colspan="4">Part B- Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u>
Examiner will set a total of nine questions. Out of which first question will be compulsory.</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	Basic Concepts – Data, Information, Records, Files, Schema and Instance etc. Limitations of File-Based Approach, Characteristics of Database Approach, Database Management System (DBMS), Components of DBMS Environment, DBMS Functions and Components, Database Interfaces, Advantages and Disadvantages of DBMS. Database Users: Data and Database Administrator, Role and Responsibilities of Database Administrator, Database Designers, Application Developers etc. Database System Architecture – 1-Tier, 2-Tier & Three Levels of Architecture, External, Conceptual, and Internal Levels, Schemas, Mappings and Instances, Data Independence – Logical and Physical Data Independence.	11
II	Data Models: Hierarchical, Network, and Relational Data Models. Entity-Relationship Model: Entity, Entity Sets, Entity Type, Attributes: Type of Attributes, Keys, Integrity Constraints, Designing of ER Diagram, Symbolic Notations for Designing ER Diagram,	11
III	SQL: Meaning, Purpose, and Need of SQL, Data Types, SQL Components: DDL, DML, DCL and DQL, Basic Queries, Join Operations and Sub-queries. Constraints and its Implementation in SQL. Relational Algebra: Basic Operations: Select, Project, Join, Union, Intersection, Difference, and Cartesian Product, etc. Relational Calculus: Tuple Relational and Domain Relational Calculus.	12
IV	Relational Model: Functional Dependency, Characteristics, Inference Rules for Functional Dependency, Types of Functional Dependency, Normalization: Benefits and Need of Normalization, Normal Forms Based on Primary Keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF,	11

	Domain Key Normal Form.	
V*	The following activities be carried out/ discussed in the lab during the period of the semester. Programming Lab: • Performing various SQL statement. Creating various tables and performing all possible queries based on syllabus. • Understanding relational model concepts • Understanding normalization • Understanding various concepts of databases.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA		**End Term Examination:** **A three-hour exam for both theory and practicum.**
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Elmasri & Navathe, Fundamentals of Database Systems, Pearson Education. • A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, McGraw-Hill. • Thomas Connolly Carolyn Begg, Database Systems, Pearson Education. • C. J. Date, An Introduction to Database Systems, Addison Wesley.		

*Applicable for courses having practical component.

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<table>
<tr><th colspan="4">Scheme: 2024-25, Syllabus: 2024-25</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">III</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Basics of Data Science using Excel</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-304</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-M3</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">200-299</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Basic knowledge of mathematics and computer</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand the fundamental concepts of data science and the role of Excel in data analysis.
2. learn data cleaning, preparation, and visualization techniques using Excel.
3. apply statistical analysis and predictive modeling using Excel.
4. To explore advanced Excel functions and data analysis tools.
_____
5*. Implement the various functions in Excel</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
</table>

Instructions for Paper-Setter

The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.

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

Unit	Topics	Contact Hours
I	Introduction to Data Science: Definition, importance, and applications. Overview of Excel: Interface, basic functions, and features. Data Types and Formats in Excel: Text, numbers, dates, and custom formats. Basic Data Manipulation: Sorting, filtering, and basic formulas (SUM, AVERAGE, COUNT).	11
II	Data Import and Export: CSV, TXT, and Excel files. Data Cleaning Techniques: Handling missing values, duplicates, and errors. Data Transformation: Text-to-columns, concatenation, and data validation. Data Visualization: Creating and customizing charts (bar, line, pie).	11
III	Descriptive Statistics: Mean, median, mode, standard deviation, and variance. Inferential Statistics: Hypothesis testing, t-tests, and chi-square tests. Regression Analysis: Simple linear regression and multiple regression. Predictive Modeling: Introduction to basic predictive models and their implementation in Excel.	11
IV	Advanced Excel Functions: VLOOKUP, HLOOKUP, INDEX-MATCH, and PivotTables. Data Analysis ToolPak: Using Excel's built-in data analysis tools such as Descriptive Statistics, Histograms, Correlation, and Regression. What-If Analysis Tools: Scenario Manager, Goal Seek, and Data Tables.	12
V*	The following activities will be carried out/ discussed in the lab during the semester. Familiarize with Excel interface and basic operations. • Explore Excel ribbons, toolbars, and interface. • Practice data entry, formatting, and basic calculations. • Create a simple spreadsheet and perform basic functions. Import data and perform basic cleaning tasks.	30

- Import datasets from CSV and text files.
- Identify and handle missing values.
- Remove duplicates and correct data errors.

Manipulate data through sorting and filtering.

- Apply sorting to datasets based on different criteria.
- Use filters to analyze subsets of data.
- Create custom filters to extract specific data points.

Utilize formulas for data transformation.

- Practice text functions: LEFT, RIGHT, MID, CONCATENATE.
- Use date functions: TODAY, DATE, DATEDIF.
- Implement basic mathematical formulas: SUM, AVERAGE, COUNT.

Calculate and interpret descriptive statistics.

- Calculate measures of central tendency: mean, median, mode.
- Compute measures of dispersion: range, variance, standard deviation.
- Use built-in Excel functions for statistical analysis.

Apply conditional formulas and formatting.

- Use IF, SUMIF, and COUNTIF functions for conditional analysis.
- Apply conditional formatting to highlight data trends and anomalies.
- Create data-based rules for formatting.

Create and customize basic charts and graphs.

- Generate line charts, bar charts, and pie charts.
- Customize chart elements: titles, labels, and legends.
- Analyse data visually through chart types.

Summarize data using PivotTables.

- Create PivotTables to aggregate data.
- Group data and create custom summaries.
- Utilize slicers to filter and analyze PivotTable data interactively.

Apply lookup and reference functions.

- Use VLOOKUP and HLOOKUP for data retrieval.
- Implement INDEX and MATCH functions for advanced lookups.
- Practice using the OFFSET function for dynamic data ranges.

Perform statistical analysis using the Data Analysis Toolpak.

- Install and activate the Data Analysis Toolpak.
- Conduct regression analysis and ANOVA.
- Explore other statistical tests available in the Toolpak.

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End Term Examination:** A three-hour exam for both theory and practicum.
Part C-Learning Resources	
Recommended Books/e-resources/LMS: • "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett. • "Excel Data Analysis: Modeling and Simulation" by Hector Guerrero. • "Data Analysis Using Microsoft Excel" by Michael R. Middleton. • "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach. • "Practical Statistics for Data Scientists: 50 Essential Concepts" by Peter Bruce and Andrew Bruce.	

*Applicable for courses having practical components.

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Session: 2023-24			
Part A - Introduction			
Subject	BCA		
Semester	IV		
Name of the Course	Data Structures and Applications		
Course Code	B23-CAP-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I	200-299		
Pre-requisite for the course (if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. learn the basics of data structure and algorithm complexities. 2. acquire knowledge of arrays and strings. 3. understand the idea of implementation for linked lists and stacks. 4. learn various searching and sorting techniques along with the implementation of queues. 5* develop the project with data structures.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) **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

The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.

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

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

Unit	Topics	Contact Hours
I	**Data Structure** Definition, Data Type vs. Data Structure, Classification of Data Structures, Data Structure Operations, Applications of Data Structures. **Algorithm Specifications**: Performance Analysis and Measurement (Time and Space Analysis of Algorithms- Average, Best and Worst Case Analysis). **Arrays**: Introduction, Linear Arrays, Representation of Linear Array in Memory, Two Dimensional and Multidimensional Arrays, Sparse Matrix and its Representation, Operations on Array: Algorithm for Traversal, Selection, Insertion, Deletion and its implementation.	11
II	**String Handling**: Storage of Strings, Operations on Strings viz., Length, Concatenation, Substring, Insertion, Deletion, Replacement, Pattern Matching **Linked List**: Introduction, Array vs. linked list, Representation of linked lists in Memory, Traversing a Linked List, Insertion, Deletion, Searching into a Linked list, Type of Linked List.	11
III	**Stack**: Array Representation of Stack, Linked List Representation of Stack, Algorithms for Push and Pop, Application of Stack: Polish Notation, Postfix Evaluation Algorithms, Infix to Postfix Conversion, Infix to Prefix Conversion, Recursion. **Introduction to Queues**: Simple Queue, Double Ended Queue, Circular Queue, Priority Queue, Representation of Queues as Linked List and Array, Applications of Queue. Algorithm on Insertion and Deletion in Simple Queue and Circular Queue. Priority Queues.	12
IV	**Tree:** Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, postorder, preorder), Binary Search Trees – Definition, Operations viz., searching, insertions and deletion; Searching and Sorting Techniques, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching.	11
V*	**Practicum**: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Write a program that uses functions to perform the following operations on an array i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on strings i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on a singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal. • Write a program that uses functions to perform the following operations on a doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal • Write a program that implement stack (its operations) using i) Arrays ii) Linked list(Pointers).	30

	• Write a program that implements Queue (its operations) using i) Arrays and ii) Linked lists (Pointers). • Write a program that implements the following sorting i) Bubble sort ii) Selection sort iii) Quick sort. • Write programs for various types of tree traversals.	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Seymour Lipschutz, Data Structures, Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines.
- Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Data Structures Using C, Pearson Education.
- Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures with Applications, McGraw-Hill.
- Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison- Wesley.

* Applicable for courses having practical components.

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Session: 2023-24			
Part A - Introduction			
Subject	BCA		
Semester	IV		
Name of the Course	Front-end Development		
Course Code	B23-CAP-402		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I	200-299		
Pre-requisite for the course (if any)	B23-CAP-202		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the basic concept of objects and regular expressions in JavaScript; 2. acquire knowledge of JavaScript events and DOM 3. learn to use forms and BOM in JavaScript; 4. get familiar with jQuery 5*. Understand the programming of web pages and handling events using JavaScript and jQuery.		
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 The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory.			

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

Unit	Topics	Contact Hours
I	**Objects in JavaScript**: Introduction to objects, Type of objects in JavaScript, creating objects, Object methods, Constructor function, Prototype in JavaScript, Inheritance using prototype chain. **Regular Expressions**: Introduction to RegExp, Regular expression usage, Modifiers, RegExp patterns, RegExp methods, String methods for RegExp, Type conversion in JavaScript.	11
II	**Event handling**: JavaScript events, Event handler, Event flow, Event bubbling and capturing, Event listeners, Event types. **Document Object Model (DOM)**: Introduction to DOM, Types of DOM, DOM standards and methods, Manipulating documents using DOM, Handling images, Table manipulation, Animation, Node and Node-list handling	11
III	**Browser Object Model (BOM)**: Introduction to BOM, DOM vs BOM differences, Window object and methods, BOM navigator, BOM history, BOM location, BOM timer, Introduction to Cookies, Session and persistent cookies. **Form Handling**: Introduction to forms, Form processing, Forms object, Accessing data from forms, Form validation, Additional features in forms, Validation APIs	12
IV	**Introduction to jQuery**: jQuery Syntax, jQuery Selectors, jQuery Events, jQuery Effects, jQuery HTML, jQuery Traversing, jQuery AJAX, jQuery Misc.	11
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Use of JavaScript in Web page designing • Effective web page design • Creation of Event listeners in JavaScript • Update and modify website elements dynamically using asynchronously retrieved data • Style HTML content with JavaScript • Iterate over arrays and objects using JavaScript for syntax. • JavaScript Program to Create Objects (4 Different Ways) • JavaScript Program to Iterate Over an Object • JavaScript Program to Find Max/Min Value of an Attribute in an Array of Objects • JavaScript Program to Remove Duplicates from an Array of Objects • Writing programs for event handling in JavaScript. • Write a JavaScript function to add rows to a table. • Write a JavaScript program to remove items from a drop-down list. • Write a JavaScript program to calculate sphere volume.	30

	• Write a JavaScript program to get the window width and height • Using BOM navigation and location • Creating cookies and sessions. • How can you create forms and perform validations on the forms? • How can you use jQuery and perform various functions using jQuery?	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- David Flanagan, JavaScript: The Definitive Guide: The Definitive Guide.
- Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.
- JavaScript and jQuery: Interactive Front-End Web Development by Jon Duckett
- Head First JavaScript Programming: A Brain-Friendly Guide by Elisabeth Robson and Eric Freeman

*Applicable for courses having practical components.

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Session: 2023-24			
Part A - Introduction			
Subject	BCA		
Semester	IV		
Name of the Course	Computer Graphics		
Course Code	B23-CAP-403		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of computer		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the concepts of computer graphics 2. learn and implement point, line, and circle drawing algorithms. 3. acquire knowledge of two-dimensional transformations and line clipping algorithms. 4. understand 3-D graphics concepts and acquire skills for designing 3-D graphics 5*. to design programs based on theoretical concepts of Computer Graphics.		
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)**	

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.

The candidate must 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.

Part B- Contents of the Course		
Unit	**Topics**	**Contact Hours**
I	**Introduction**: History of Computer Graphics (CG), Applications of Computer Graphics, Components of interactive graphics systems **Display devices**: Refresh CRT, Color CRT, Plasma Panel displays LCD Panels, Raster-scan System, Random scan System, Graphic software, Input/Output Devices, Tablets	11
II	**Output Primitives**: Points and Lines, Line Drawing Algorithms: DDA algorithm, Bresenham's algorithm, **Circle drawing Algorithms**: Polynomial Method, Bresenham's algorithm. Parametric representation of Cubic Curves, Bezier Curves	11
III	**2D Transformation**: Use of Homogeneous Coordinates Systems, Composite Transformation: Translation, Scaling, Rotation, Mirror Reflection, Rotation about an Arbitrary Point. Clipping and Windowing, Clipping Operations. **Line Clipping Algorithms**: The Mid-Point subdivision method, Cohen-Sutherland Line Clipping Algorithms, Polygon Clipping, Sutherland Hodgeman Algorithms, Text Clipping.	12
IV	**3-D Graphics**: 3-D object representations, 3-D Transformations: Translation, Rotation, Scaling, Projections, **Hidden surface elimination**: Back face removal, Depth Buffer algorithm, Scan-line algorithm, Depth sort algorithm, Shading.	11
V*	The following activities be carried out/ discussed in the lab during the semester. Programming Lab: • Implement DDA line drawing algorithm for all types of slope. • Implement Bresenham's line drawing algorithm for all types of slopes. • Implement Bresenham's Circle drawing algorithm. • Implement Bresenham's Ellipse drawing algorithm. • Implement various 2-D transformations on objects like lines, rectangles, etc. • Implement to clip a line using the Mid-Point subdivision algorithm • Implement to clip a line using Cohen-Sutherland algorithm • Implement 3-D transformations on objects.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum**		**End Term Examination:** **A three-hour exam for both theory and practicum.** **End Term Exam**

• Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Donald Hearn, M. Pauline Baker, Computer Graphics, Pearson Education.
- J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Pearson Education.
- Newmann & Sproull, Principles of Interactive Computer Graphics, McGraw Hill.
- Rogers, David F., Procedural Elements of Computer Graphics, McGraw Hill.
- Zhigang Xiang, Roy Plastock, Computer Graphics, Tata McGraw Hill.

*Applicable for courses having practical components.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	BCA		
Semester	V		
Name of the Course	Software Engineering		
Course Code	B23-CAP-501		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A5		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Knowledge of any Programming language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. learn the various models for software development. 2. understand how to analyze software. 3. plan a software design and the risks associated with software. 4. test and validate software 5*. Implement the various tools and techniques used in software engineering.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) **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 The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory. The practicum will be evaluated by an external and an internal examiner. The examination will be of			

three-hour duration.

Unit	Topics	Contact Hours
I	Introduction: Program vs. Software, Software Engineering, Programming paradigms, Software Crisis – problem and causes, Phases in Software development: Requirement Analysis, Software Design, Coding, Testing, Maintenance, Software Development Process Models: Waterfall, Prototype, Evolutionary and Spiral models, Role of Metrics.	11
II	Feasibility Study, Software Requirement Analysis and Specifications: SRS, Need for SRS, Characteristics of an SRS, Components of an SRS, Problem Analysis, Information gathering tools, Requirement specification, validation and metrics. Structured Analysis and Tools: Data Flow Diagram, Data Dictionary, Decision table, Decision trees, Structured English, Entity-Relationship diagrams	11
III	Software Project Planning: Cost estimation: COCOMO model, Project scheduling, Staffing, and personnel planning, team structure, Software configuration management, Quality assurance plans, Project monitoring plans, Risk Management. Software Design: Design fundamentals, problem partitioning, and abstraction, design methodology, Cohesion & Coupling.	12
IV	Software testing strategies: unit testing, integration testing, Validation testing, System testing, Alpha and Beta testing. Software Maintenance: Type of maintenance, Management of Maintenance, Maintenance Process, maintenance characteristics.	11

V*	Practicum:
	Students are advised to do laboratory/practical practice not limited to but including the following types of problems:
	• Development of 0-level DFD
	• Development of 1 level DFD
	• Development of 2-level DFD
	• data dictionary,
	• E-R diagram for Student Teacher Relationship
	• E-R diagram for Library Management,
	• Draw an ER Diagram for the Hospital Management System.
	• ER diagram for (ANY 5)
	  • Student Result Management System
	  • Library management system
	  • Inventory control system
	  • Accounting system
	  • Fast food billing system
	  • Bank loan system
	  • Blood bank system
	  • Railway reservation system
	  • Automatic teller machine
	  • Video library management system
	  • Hotel management system
	  • Hostel management system
		30

	• E-ticking • Share online trading • Hostel management system • Resource management system • Court case management system	
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA		**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Pressman R. S., "Software Engineering – A Practitioner's Approach", Tata McGraw Hill. • Jalote P., "An Integrated Approach to Software Engineering", Narosa. • Sommerville, "Software Engineering", Addison Wesley. • Fairley R., "Software Engineering Concepts", Tata McGraw Hill. • James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons.		

*Applicable for courses having practical components.

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<table>
<tr><td colspan="4">Scheme: 2023-24, Syllabus: 2024-25</td></tr>
<tr><td colspan="4">Part A - Introduction</td></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">V</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Back-end Development</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-502</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-B5</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">300-399</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">B23-CAP-202</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. Understand the principles of back-end development.
2. Gain proficiency in back-end programming languages and frameworks.
3. Learn to design and manage databases.
4. Develop skills to create and use back-end applications.
5*. to equip with the knowledge of back-end programming.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:75(50(T)+25(P))
Internal Assessment Marks:20(15(T)+5(P))
End Term Exam Marks: 55(35(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><td colspan="4">Part B- Contents of the Course</td></tr>
<tr><td colspan="4"><u>Instructions for Paper-Setter</u>
The examiner will set a total of nine questions. Out of which first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	**Introduction to back-end Development:** Overview of backend, Client-server architecture, Introduction to web servers and database **Programming Languages and Tools:** Introduction to server-side languages (e.g., Node.js), Syntax and semantics of chosen server-side language	11
II	**Programming Languages:** Version control with Git, Introduction to IDEs (Integrated Development Environments) of chosen language, Writing and executing basic server-side scripts **Performance Optimization and Security:** Caching strategies, Query optimization	11
III	**Database Management:** Introduction to databases and DBMS (SQL and NoSQL), Designing a database schema, CRUD operations (Create, Read, Update, Delete), Connecting applications to a database	11
IV	**Server-Side Frameworks:** Overview of popular server-side frameworks (e.g., Express.js), Building a simple application using a framework. **API Development:** RESTful API concepts, Designing and documenting APIs, Authentication and authorization basics Web security best practices (SQL injection, XSS, CSRF)	12
V*	The following activities be carried out/ discussed in the lab during the initial period of the semester. Programming Lab: • Introduction to Backend Technologies: Objective: Familiarize students with backend technologies and tools. o Setup development environment (e.g., IDE, Git). o Create a simple "Hello World" backend application in Node.js. • Working with Databases (SQL): Objective: Learn basic SQL operations and database interactions. o Set up MySQL/PostgreSQL database. o Perform CRUD operations using SQL queries (Create, Read, Update, Delete). • Working with NoSQL Databases: Objective: Introduce students to NoSQL databases. o Set up MongoDB database. o Implement CRUD operations using NoSQL commands. • Building RESTful APIs: Objective: Develop skills in designing and implementing RESTful APIs. o Create endpoints for CRUD operations.	30

	○ Implement basic authentication and authorization. • Web Frameworks (Choose one: Node.js or Express.js): Objective: Gain practical experience with backend frameworks. ○ Setup Node.js/Express.js project. ○ Implement a simple web application (Express.js or Node.js). • Integrating Frontend and Backend: Objective: Understand frontend-backend interaction. ○ Create API endpoints to serve JSON data. ○ Develop a frontend (HTML/CSS/JavaScript) to consume backend API. • Data Validation and Error Handling: Objective: Learn techniques for validating input data and handling errors. ○ Implement input validation using middleware (Express.js) or Node.js forms. ○ Handle errors and exceptions gracefully. • Security Best Practices: Objective: Implement security measures in backend applications. ○ Implement HTTPS/SSL configuration. ○ Prevent common security vulnerabilities (e.g., SQL injection, XSS).	

Suggested Evaluation Methods

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

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- "Node.js Design Patterns" by Mario Casciaro and Luciano Mammino
- "Learning PHP, MySQL & JavaScript" by Robin Nixon
- Online documentation and tutorials for the chosen programming language and frameworks
- "Clean Code: A Handbook of Agile Software Craftsmanship" by Robert C. Martin
- "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and
- Maintainable Systems" by Martin Kleppmann
- "SQL Cookbook: Query Solutions and Techniques for Database Developers" by Anthony Molinaro
- "High-Performance Browser Networking: What every web developer should know about networking and web performance" by Ilya Grigorik

*Applicable for courses having practical component.

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Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	BCA		
Semester	V		
Name of the Course	Network Infrastructure and Data Communication Technologies		
Course Code	B23-CAP-503		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)	CC-C5		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Basic Knowledge of computer		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Understand the basic concepts and principles of computer networks. 2. Describe the analog and digital communication concepts. 3. Evaluate different data link layer designs and LAN technologies. 4. Analyze the various routing algorithms and know about the application layer. 5*. Use networking infrastructure and its applications.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) **Internal Assessment Marks:30(20(T)+10(P))** **End Term Exam Marks: 70(50(T)+20(P))**		**Time: 3 Hrs.(T), 3Hrs.(P)**	

Instructions for Paper-Setter

The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.

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

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

Part B- Contents of the Course		
Unit	**Topics**	**Contact Hours**
I	Introduction to Data Communication and Computer Networks; Uses of Computer Networks; Types of Computer Networks and their Topologies; Network Hardware Components: Connectors, Transceivers, Repeaters, Hubs, Network Interface Cards and PC Cards, Bridges, Switches, Routers, Gateways; Network Software: Network Design issues and Protocols; Connection-Oriented and Connectionless Services; OSI Reference Model; TCP/IP Model	11
II	Analog and Digital Communications Concepts: Analog and Digital data and signals; Bandwidth and Data Rate, Capacity, Baud Rate; Guided and Wireless Transmission Media; Communication Satellites; Switching and Multiplexing; Modems and modulation techniques	11
III	Data Link Layer Design issues; Error Detection and Correction methods; Sliding Window Protocols: One-bit, Go Back N, and Selective Repeat; Media Access Control: ALOHA, Slotted ALOHA, CSMA, Collision free protocols; Introduction to LAN technologies: Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet; Token Ring; Introduction to Wireless LANs and Bluetooth;	11
IV	Routing Algorithms: Flooding, Shortest Path Routing, Distance Vector Routing; Link State Routing, Hierarchical Routing; Congestion Control; Traffic shaping; Choke packets; Load shedding; Application Layer: Introduction to DNS, E-Mail, and WWW services; Network Security Issues: Security attacks; Encryption methods; Firewalls; Digital Signatures;	12
V*	The following activities be carried out/ discussed in the labduring the semester. Programming Lab: • Experiment Study of different types of Network cables and Practically implement the cross-wired cable and straight-through cable using a clamping tool. • Study of Network Devices in Detail. • Study of network IP. • Connect the computers to the Local Area Network. • Performing an Initial Switch Configuration Performing an Initial Router Configuration • To study about components and specifications of Laptops and Desktop. • Familiarization with networking components and devices LAN adapter, Hub, Switches, Routers, etc. • Familiarization with Transmission media and tools: Co-axial cable, UTP cable, Crimping tool, Connectors, etc. • Introduction to various interior and exterior routing protocols. • Study of various LAN topologies and their creation using network devices, cables, and Computer. • Configuration of TCP/IP protocols in Window/LINUX.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End Term Examination: A three-hour exam for both theory and practicum. End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Andrew S. Tanenbaum, "Computer Networks", Pearson Education.
- Michael A. Gallo, William M. Hancock, "Computer Communications and Networking Technologies", CENGAGE Learning.
- Behrouz A Forouzan, "Data Communications and Networking", McGraw Hill.

*Applicable for courses having practical components.

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Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	BCA		
Semester	VI		
Name of the Course	Programming using Python		
Course Code	B23-CAP-601		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-A6		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Knowledge of any Computer Programming Language		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. understand the basic concepts of Python programming 2. learn various data structures used in Python programming. 3. develop the simple programs of Python using arrays and functions. 4. illustrate the process of data file manipulations using python 5* develop the programs using Python.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) **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

The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.

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

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

Unit	**Topics**	**Contact Hours**

I	Introduction to Python: Python Interpreter, Python as calculator, Python shell, Indentation, identifier and keywords, literals, strings, Operators: Arithmetic, Relational, Logical, comparison, Bitwise, Assignment, Identity operator and Membership operator; Input & output statements; Control statements: Branching, looping, Conditional statement, Exit function	11
II	String Manipulations: Subscript operator, indexing, slicing a string, other functions on strings, string module. Strings and number system: Format functions, converting strings to numbers & Vice Versa. List, Tuples, Sets, Dictionaries: Basic list operators, replacing, inserting, removing an element, searching, Sorting lists, dictionary literals, adding & removing keys, accessing & replacing values, traversing dictionaries.	11
III	Array in Python, Design with Functions: hiding redundancy, complexity, arguments & return values; Formal/Actual arguments, named arguments, program structure and design, Recursive functions, scope & Global statements, Importing modules, Math modules & Random modules.	11
IV	Exception Handling: Exceptions, except clause, try and finally clause, user-defined exceptions. File Handling: Manipulating files & directories, OS & SYS modules, Reading, writing text & numbers from/to file. Graphics: "Turtle" module, drawing colors, shapes, digital images, image file formats.	12
V*	**Practicum**: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • WAP to find the roots of a quadratic equation. • WAP to accept a number 'n' and (a). Check if 'n' is prime (b). Generate all prime numbers till 'n' (c). Generate first 'n' prime numbers (d). This program may be done using functions. • WAP that accepts a character and performs the following: (a). print whether the character is a letter, numeric digit, or special character (b). if the character is a letter, print whether the letter is uppercase or lowercase (c). if the character is a numeric digit, print its name in the text (e.g., if the input is 9, the output is NINE) • WAP to perform the following operations on a string (a). Find the frequency of a character in a string. (b). Replace a character by another character in a string. (c). Remove the first occurrence of a character from a string. (d). Remove all occurrences of a character from a string. • WAP to swap the first n characters of two strings. • Write a function that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1. • WAP to create a list of the cubes of only the even integers appearing in the input list (may have elements of other types also) using the following: (a). 'for' loop (b). list comprehension	30

	• WAP to read a file and (a). Print the total number of characters, words, and lines in the file. (b). Calculate the frequency of each character in the file. Use a variable of dictionary type to maintain the count. (c). Print the words in reverse order. (d). Copy even lines of the file to a file named 'File1' and odd lines to another file named 'File2'. • Write a function that prints a dictionary where the keys are numbers between 1 and 5 and the values are cubes of the keys. • Consider a tuple t1= (1, 2, 5, 7, 9, 2, 4, 6, 8, 10). WAP to perform the following operations: (a). Print half the values of the tuple in one line and the other half in the next line. (b). Print another tuple whose values are even numbers in the given tuple. (c). Concatenate a tuple t2= (11,13,15) with t1. (d). Return maximum and minimum values from this tuple • WAP to accept a name from a user. Raise and handle the appropriate exception(s) if the text entered by the user contains digits and/or special characters.	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End-Term Examination:** A three-hour exam for both theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Sheetal Taneja, Naveen Kumar, Python Programming: A Modular approach, 5th Impression, Pearson.
- Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press.
- Mark Lutz, Learning Python (available online at pdf derive).
- Guttag John V, Introduction to Computation and Programming Using Python with Application to Understanding Data, PHI.
- Charles Diorbach, Introduction to Computer Science using Python, Wiley.
- Balaguruswamy E., Introduction to Computing and Problem Solving using Python, 2nd edition, McGraw Hill Education, 2018.
- Brown, Martin C., Python: The Complete Reference, 2nd edition, McGraw Hill Education, 2018.

* Applicable for courses having practical components.

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<table>
<tr><th colspan="4">Scheme: 2023-24, Syllabus: 2024-25</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">VI</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Advanced Web Development</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-602</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-B6</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">300-399</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">B23-CAP-202, B23-CAP-402, B23-CAP-502</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. gain proficiency in advanced web development frameworks and tools.
2. understand the principles of responsive design and progressive web apps.
3. learn best practices for database management and full-stack development.
4. know about optimization and devops.

5* To work on real-world projects and develop a comprehensive web application.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Max. Marks:100(70(T)+30(P))
Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u>
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.</td></tr>
</table>

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. The examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	**Advanced Front-End Development:** Advanced HTML5 & CSS3: Semantic HTML, CSS Grid and Flexbox, CSS Preprocessors (Sass/LESS) JavaScript ES6+: Advanced JavaScript concepts (Promises, Async/Await), ES6+ features (Arrow functions, Template literals, Destructuring)	11
II	Front-End Frameworks: Introduction to React, Angular, Component-based architecture, State management with Redux **Advanced Back-End Development:** Server-Side Programming: Express.js, GraphQL, Middleware, and Authentication (JWT, OAuth)	11
III	Database Management: Advanced SQL concepts, NoSQL databases (Firebase), ORMs (Sequelize) **Full-Stack Development:** Integrating Front-End and Back-End: Building a full-stack application, Handling asynchronous operations, Real-time applications with WebSockets	11
IV	**Performance Optimization**: Code splitting and lazy loading, Caching strategies, Optimizing images and assets **Deployment and DevOps:** Deployment Strategies: CI/CD pipelines, Containerization with Docker, Deployment platforms (Heroku, AWS, Netlify) DevOps and Monitoring: Infrastructure as code (Terraform, Ansible), Monitoring and logging (Prometheus, Grafana)	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • **Front-End Projects:** Develop a responsive web application using React/Angular. • **Back-End Projects:** Build and deploy a RESTful API using Node.js and Express.js. • **Full-Stack Projects:** Create a full-stack application integrating front-end and back-end. • **Optimization Projects:** Implement performance optimization techniques on existing projects. • **Deployment Projects:** Set up a CI/CD pipeline and deploy a web application to a cloud platform.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: 5		**End Term Examination:** A three-hour

• Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	exam for both theory and practicum.
Part C-Learning Resources	
Recommended Books/e-resources/LMS: • "JavaScript: The Good Parts" by Douglas Crockford • "You Don't Know JS" by Kyle Simpson • "Learning React" by Alex Banks and Eve Porcello	

*Applicable for courses having practical components.

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme: 2023-24, Syllabus: 2024-25			
Part A - Introduction			
Subject	BCA		
Semester	VI		
Name of the Course	Artificial Intelligence		
Course Code	B23-CAP-603		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-C6		
Level of the course (As per Annexure-I	300-399		
Pre-requisite for the course (if any)	Basic understanding of computer systems and programming.		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. learn the basic Artificial Intelligence (AI) concept and its application areas. 2. acquire the knowledge of heuristic search and approaches for knowledge representations. 3. understand the idea of natural language processing and predicate logic 4. gain the knowledge of learning technologies & build expert systems. 5*. Understand the practical aspects of artificial intelligence.		
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

The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.
The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory.

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

Unit	Topics	Contact Hours
I	Introduction to Artificial Intelligence (AI), Importance of AI, AI and its Related Field, AI Techniques, Criteria for success. Problem Space and Search: Problem as a State Space Search, Production System and its Characteristics, Issues in the Design of the Search Problem.	11
II	Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction. Knowledge Representation: Definition and Importance of Knowledge, Knowledge Representation, Various Approaches Used in Knowledge Representation, Issues in Knowledge Representation.	11
III	Using Predicate Logic: Representing Simple Facts in Logic, Representing Instances and is-a Relationship, Computable Function and Predicate, Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Discourse and Pragmatic Processing.	11
IV	Learning: Introduction to Learning, Rote Learning, Learning by Taking Advice, Learning in Problem-Solving, Learning from Example-Induction, Explanation-Based Learning. Expert System: Introduction, Representing Using Domain-Specific Knowledge, Expert System Shells.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: Problem Solving and Search Algorithms • Implementing uninformed search algorithms (Breadth-First Search, Depth-First Search) • Implementing informed search algorithms (A*, Greedy Best-First Search) Knowledge Representation and Reasoning • Implementing basic logic representation (Propositional and Predicate Logic) • Building simple inference engines • Developing rule-based systems for decision-making Introduction to Expert Systems • Understanding the components of expert systems • Designing knowledge bases using rule-based systems Expert Systems Applications • Developing expert systems for specific domains (e.g., medical diagnosis, financial advisory) • Case studies of successful expert systems	30

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

• Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- E. Rich and K. Knight, Artificial Intelligence, TMH.
- D.W. Patterson, Introduction to AI and Expert Systems, PHI.
- Nils J Nilsson, Artificial Intelligence -A new Synthesis, Harcourt Asia Ltd.

*Applicable for courses having practical components.

• Mid-Term Exam: 10 ➢ **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	theory and practicum. **End Term Exam Marks: 70(50(T)+20(P))**
Part C-Learning Resources	
Recommended Books/e-resources/LMS: • E. Rich and K. Knight, Artificial Intelligence, TMH. • D.W. Patterson, Introduction to AI and Expert Systems, PHI. • Nils J Nilsson, Artificial Intelligence -A new Synthesis, Harcourt Asia Ltd.	

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DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
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<table>
<tr><th colspan="4">Scheme: 2024-25, Syllabus: 2024-25</th></tr>
<tr><th colspan="4">Part A - Introduction</th></tr>
<tr><td>Subject</td><td colspan="3">BCA</td></tr>
<tr><td>Semester</td><td colspan="3">VI</td></tr>
<tr><td>Name of the Course</td><td colspan="3">Basics of Data Science using Python</td></tr>
<tr><td>Course Code</td><td colspan="3">B23-CAP-604</td></tr>
<tr><td>Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/ VAC)</td><td colspan="3">CC-M6</td></tr>
<tr><td>Level of the course (As per Annexure-I</td><td colspan="3">300-399</td></tr>
<tr><td>Pre-requisite for the course (if any)</td><td colspan="3">Must have basic knowledge of computer</td></tr>
<tr><td>Course Learning Outcomes(CLO):</td><td colspan="3">After completing this course, the learner will be able to:
1. understand the fundamental concepts of data science and the role of Python in data analysis.
2. To learn data cleaning, preparation, and visualization techniques using Python.
3. To apply statistical analysis and predictive modeling using Python.
4. To explore advanced Python libraries and data analysis tools.
5*. to implement the programs based on data science in Python.</td></tr>
<tr><td rowspan="2">Credits</td><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Contact Hours</td><td>3</td><td>2</td><td>5</td></tr>
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Internal Assessment Marks:30(20(T)+10(P))
End Term Exam Marks: 70(50(T)+20(P))</td><td colspan="2">Time: 3 Hrs.(T), 3Hrs.(P)</td></tr>
<tr><th colspan="4">Part B- Contents of the Course</th></tr>
<tr><td colspan="4"><u>Instructions for Paper- Setter</u>
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The</td></tr>
</table>

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

Unit	Topics	Contact Hours
I	Introduction to Data Science: Definition, importance, and applications. Overview of Python: Python programming basics, data types, and structures. Introduction to Python Libraries: NumPy, pandas, and matplotlib. Basic Data Manipulation: Reading and writing data files, basic operations with pandas DataFrame.	11
II	Data Import and Export: Handling CSV, Excel, and other file formats. Data Cleaning Techniques: Handling missing values, duplicates, and data inconsistencies. Data Transformation: Data type conversion, normalization, and scaling. Data Visualization: Creating and customizing plots using matplotlib and Seaborn.	11
III	Descriptive Statistics: Calculating mean, median, mode, standard deviation, and variance using pandas. Inferential Statistics: Conducting hypothesis testing, t-tests, and chi-square tests. Regression Analysis: Implementing simple linear regression and multiple regression using scikit-learn. Predictive Modeling: Introduction to basic predictive models such as decision trees and logistic regression.	11
IV	Advanced Python Libraries: Exploring advanced pandas, NumPy, and scikit-learn features. Data Analysis Tools: Time series analysis, clustering, and classification using scikit-learn. What-If Analysis Tools: Sensitivity analysis and scenario analysis using Python.	12
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: Introduction to Python for Data Science • Setting up the Python environment (Anaconda, Jupyter Notebook) • Introduction to libraries: NumPy, pandas, Matplotlib, and Seaborn Data Manipulation with pandas • Importing and exporting data • Data cleaning and preprocessing • Data transformation and aggregation Data Visualization • Creating basic plots with Matplotlib • Advanced visualization with Seaborn Exploratory Data Analysis (EDA) • Descriptive statistics and data summarization	30

	• Detecting and handling missing values • Identifying patterns and correlations in data Descriptive Statistics • Implementing regression using Sci-kit learn • Implementing predictive modelling and decision tress • Implementing basic statistics and various tests used in statistics • Implementing various data analysis tools	

Suggested Evaluation Methods

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

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- "Python Data Science Handbook: Essential Tools for Working with Data" by Jake VanderPlas.
- "Python for Data Analysis: Data Wrangling with pandas, NumPy, and IPython" by Wes McKinney.
- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.
- "Data Science from Scratch: First Principles with Python" by Joel Grus.
- "Think Stats: Exploratory Data Analysis" by Allen B. Downey.

*Applicable for courses having practical component.