



Panipat Institute of Engineering & Technology

An Autonomous Institution, Approved by A.I.C.T & Affiliated to Kurukshetra University, Kurukshetra
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Scheme of Studies and Examinations, and the Syllabi for Under Graduate Degree Programme

Bachelor of Computer Applications (Data Science)

(in phased manner)

as per NEP-2020 guidelines

**With Multiple Entry-Exit and Internship
w.e.f. Academic Session 2024-25**

DEPARTMENT OF COMPUTER APPLICATIONS - UG

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

DEPARTMENT OF COMPUTER APPLICATIONS - UG

Vision of the Department

To be acknowledged as a center of excellence for academic eminence in developing competent, ethical, innovative, team-oriented Computer Application Professionals who can make a global impact on industry, environment, and the society at large.

Mission of the Department

M1: Equip students with knowledge and industry-oriented practical skills in Computer Applications.

M2: To provide a conducive environment for promoting research and innovation, imbuing ethics and values and instilling teamwork in students

M3: Foster analytical mindset, soft skills and competence in students to provide sustainable solutions for the real-life problems.

M4: Facilitate industrial and institutional linkages globally to provide experiential learning opportunities in emerging technologies.

Program Educational Objectives (PEOs)

The Graduate of the program will be able to:

PEO1: To exhibit analytical abilities practical and soft skills, competence, experiential learning and innovation.

PEO2: To demonstrate team work and supportive roles in agile work environment with ethics and values in their profession

PEO3: To excel in careers in the emerging technologies of computer applications, higher education and entrepreneurship.

Program Outcomes (POs)

PO1	Foundation Knowledge	Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
PO2	Problem Analysis	Identify, review, formulate and analyse problems for primarily focussing on customer requirements using critical thinking frameworks.
PO3	Development of Solutions	Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
PO4	Modern Tool Usage	Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
PO5	Individual and Teamwork	Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
PO6	Project Management and Finance	Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
PO7	Ethics	Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware.
PO8	Life-long learning	Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

Program Specific Outcomes (PSOs)

PSO1: Ability to design and implement applications using data analytics techniques to derive and extract insights from datasets for decision making.

PSO2: Ability to design and implement data-driven applications using state-of-the-art programming and analysis tools in agreement with ethical standards and data privacy laws.

Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)

Bachelor of Computer Applications (DS) Semester – I

Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination (CIE) Max	Semester End Examination (SEE) Max	Total Marks (CIE+SEE) Max	Duration of Exam (Hours)
		L	T	P						
		Core Course (CC)								
BCA-101A	Foundations of Computer Science	3	0	0	3	3	40	60	100	3
BCA-103A	Digital Logic Design	3	0	0	3	3	40	60	100	3
ASH-MAT-115A	Basics of Mathematics-I	2	0	0	2	2	40	60	100	3
Value Added Course (VAC)										
ASH-HUM-107A	Universal Human Values	2	0	0	2	2	40	60	100	3
Skill Enhancement Course (SEC)										
BCA-105A	Problem Solving through C	3	0	0	3	3	40	60	100	3
Ability Enhancement Course (AEC)										
ASH-HUM-117A	English Language and Communication-1	2	0	0	2	2	40	60	100	3
Multi Disciplinary Course (MDC)										
BBA-215A	Digital Marketing	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
BCA-171A	Digital Logic Design Lab	0	0	4	4	2	50	50	100	3
BCA-173A	Problem Solving through C Lab	0	0	4	4	2	50	50	100	3
Total		17	0	8	25	21	380	520	900	

Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)

Bachelor of Computer Applications (DS) Semester – II

Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination (CIE) Max	Semester End Examination (SEE) Max	Total Marks (CIE+SEE) Max	Duration of Exam (Hours)
		L	T	P						
		Core Course (CC)								
BCA-102A	Operating System	3	0	0	3	3	40	60	100	3
BCA-122A	Programming with Python	3	0	0	3	3	40	60	100	3
BCA-124A	Office and Spreadsheet Tools	2	0	0	2	2	40	60	100	3
ASH-MAT-116A	Basics of Mathematics-II	2	0	0	2	2	40	60	100	3
Value Added Course (VAC)										
BT-CE-104A	Environmental Studies	2	0	0	2	2	40	60	100	3
Skill Enhancement Course (SEC)										
BCA-106A	Introduction to Web Technology	3	0	0	3	3	40	60	100	3
Ability Enhancement Course (AEC)										
ASH-HUM-118A	English Language and Communication-2	2	0	0	2	2	40	60	100	3
Multi Disciplinary Course (MDC)										
ASH-HUM-119A	Indian Knowledge System	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
BCA-192A	Programming with Python Lab	0	0	4	4	2	50	50	100	3
BCA-194A	Office and Spreadsheet Tools Lab	0	0	4	4	2	50	50	100	3
BCA-174A	Web Technology Lab	0	0	4	4	2	50	50	100	3
Total		19	0	12	31	25	470	630	1100	
Grand Total (Exit with 1 year Certificate)		36	0	20	56	50	950	1150	2100	

Note 1: The Industrial Internship shall be of 4 credits duration of 45-60 days after the 2nd semester. If a student takes exit after 2nd semester with **Under Graduate Certificate in Computer Applications (Data Science)**, marks of Industrial Internship shall be counted in 2nd semester itself.

Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – III										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Core Course (CC)										
ASH-MAT-215A	Probability and Statistics	3	0	0	3	3	40	60	100	3
BCA-112A	Data Structures using C++	3	0	0	3	3	40	60	100	3
BCA-203A	Database Management System	3	0	0	3	3	40	60	100	3
BCA-221A	Introduction to Data Science	3	0	0	3	3	40	60	100	3
Skill Enhancement Course (SEC)										
BCA-223A	Fundamentals of R Programming	3	0	0	3	3	40	60	100	3
Ability Enhancement Course (AEC)										
BBA-217A	Personality Development	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
BCA-271A	Data Structures using C++ Lab	0	0	4	4	2	50	50	100	3
BCA-273A	Database Management System Lab	0	0	4	4	2	50	50	100	3
BCA-291A	R Programming Lab	0	0	4	4	2	50	50	100	3
Total		17	0	12	29	23	390	510	900	

Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – IV										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Core Course (CC)										
BCA-222A	Statistical Foundation for Data Science	3	0	0	3	3	40	60	100	3
BCA-224A	Data Mining and Warehousing	3	0	0	3	3	40	60	100	3
BCA-226A	Data Visualization using Python	3	0	0	3	3	40	60	100	3
Value Added Course (VAC)										
BCA-202A	Quantitative Aptitude	2	0	0	2	2	40	60	100	3
Skill Enhancement Course (SEC)										
BCA-215A	Full Stack Development-I (MERN)	3	0	0	3	3	40	60	100	3
Discipline specific Elective Course (DSE)										
	Elective-I	3	0	0	3	3	40	60	100	3
Practicum Course (PC)										
BCA-292A	Data Mining and Warehousing Lab	0	0	4	4	2	50	50	100	3
BCA-294A	Data Visualization using Python Lab	0	0	4	4	2	50	50	100	3
BCA-274A	Full Stack Development-I (MERN) Lab	0	0	4	4	2	50	50	100	3
Total		17	0	12	29	23	390	510	900	
Grand Total (Exit with 2 years Diploma)		70	0	44	114	96	1730	2170	3900	

Note 2: The Industrial Internship shall be of 4 credits duration of 45-60 days after the 4th semester. If a student takes exit after 4th semester with **Under Graduate Diploma in Computer Applications (Data Science)**, marks of Industrial Internship (either done after 2nd or 4th semester) shall be counted in 4th semester itself.

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

Scheme of Studies and Examinations (for the students admitted in the year 2024-25 and onwards)										
Bachelor of Computer Applications (DS) Semester – V										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Core Course (CC)										
BCA-212A	Data Communication and Computer Networks	3	0	0	3	3	40	60	100	3
BCA-321A	Data Privacy and Ethics	3	0	0	3	3	40	60	100	3
BCA-323A	Big Data Analytics	3	0	0	3	3	40	60	100	3
Discipline specific Elective Course (DSE)										
BCA-	Elective-II	3	0	0	3	3	40	60	100	3
Skill Enhancement Course (SEC)										
BCA-371A	Seminar	0	0	2	2	1	100	-	100	-
Practicum Course (PC)										
BCA-383A	Big Data Analytics Lab	0	0	4	4	2	50	50	100	3
BCA-	Elective-II Lab	0	0	4	4	2	50	50	100	3
Industrial Internship (INTR)										
BCA-377A	Industrial Internship	0	0	0	0	4	100	-	100	-
Total		12	0	10	22	21	460	340	800	-

Note 3: If a student pursues 3 years UG Programme without taking Exit option, the Industrial Internship (either done after 2nd or 4th semester) will be taken into account in 5th semester.

Scheme of Studies and Examinations (for the students admitted in the year 2024-25 and onwards)										
Bachelor of Computer Applications (DS) Semester – VI										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Core Course (CC)										
BCA-322A	Business Intelligence and Analytics	3	0	0	3	3	40	60	100	3
BCA-324A	Cloud Services for Data Analytics	3	0	0	3	3	40	60	100	3
Discipline specific Elective Course (DSE)										
BCA-	Elective-III	3	0	0	3	3	40	60	100	3
Skill Enhancement Course (SEC)										
BBA-318A	Entrepreneurship and Startup Skills	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
BCA-382A	Business Intelligence and Analytics Lab	0	0	4	4	2	50	50	100	3
BCA-384A	Cloud Services for Data Analytics Lab	0	0	4	4	2	50	50	100	3
BCA-376A	Minor Project	0	0	8	8	4	50	50	100	3
Total		11	0	16	27	19	310	390	700	-
Grand Total (Exit with 3 years Degree)		93	0	70	163	132	2400	2900	5300	-

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Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – VII (Honours)										
Course Code	Course Title	Period(s)			Hours/Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Honour Course (HC)										
BCA-451A	Design and Analysis of Algorithm	3	0	0	3	3	40	60	100	3
	Elective-IV	3	0	0	3	3	40	60	100	3
Value Added Course (VAC)										
BT-ME-112A	Design Thinking and Innovation	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
BCA-471A	Design and Analysis of Algorithm Lab	0	0	4	4	2	50	50	100	3
BCA-473A	Major Project-1	0	0	20	20	10	50	50	100	3
Total		8	0	24	32	20	220	280	500	
Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – VIII (Honours)										
Course Code	Course Title	Period(s)			Hours/Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Honour Course (HC)										
BCA-460A	Data Visualization using Tableau	3	0	0	3	3	40	60	100	3
	Elective-V	3	0	0	3	3	40	60	100	3
Practicum Course (PC)										
BCA-492A	Data Visualization using Tableau Lab	0	0	4	4	2	50	50	100	3
BCA-474A	Major Project-2	0	0	20	20	10	50	50	100	3
Total		6	0	24	30	18	180	220	400	
Grand Total (4 years Honours Degree)		107	0	118	225	170	2800	3400	6200	

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Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – VII (Honours with Research)										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Honour Course (HC)										
BCA-455A	Research Methodology	3	0	0	3	3	40	60	100	3
	Elective-IV	3	0	0	3	3	40	60	100	3
Value Added Course (VAC)										
BT-ME-112A	Design Thinking and Innovation	2	0	0	2	2	40	60	100	3
Practicum Course (PC)										
	Elective-IV Lab	0	0	4	4	2	50	50	100	3
BCA-473A	Major Project-1	0	0	20	20	10	50	50	100	3
Total		8	0	24	32	20	220	280	500	
Scheme of Studies and Examinations (w.e.f. Session 2024 - 2025)										
Bachelor of Computer Applications (DS) Semester – VIII (Honours with Research)										
Course Code	Course Title	Period(s)			Hours/ Week	Credit (s)	Continuous Internal Examination	Semester End Examination	Total Marks	Duration of Exam (Hours)
		(CIE)	(SEE)	(CIE+SEE)						
		Max	Max	Max						
Practicum Course (PC)										
BCA-476A	Dissertation	0	0	36	36	18	100	100	200	3
Total		0	0	36	36	18	100	100	200	
Grand Total (4 years Honours with Research Degree)		101	0	130	231	170	2720	3280	6000	

Abbreviations Used:

Abbreviation	Full Form	Description
CC	Core Course	Compulsory core course for the programme, CC will be a theory course of 3 credits
PC	Practicum Course	Compulsory practical course (software lab) of 2 credits
INTR	Industrial Internship	<ul style="list-style-type: none"> A student can do industrial internship of 45-60 days duration after the 2nd or 4th semester. It will be of 4 credits. If a student pursues 3 year UG Programme without taking Exit option, this internship (either done after 2nd or 4th semester) will be taken into account in 5th semester. If a student takes Exit after 2 years in UG Programme, this internship (either done after 2nd or 4th semester) will be taken into account in 4th semester. If a student takes Exit after 1 year in UG Programme, the mandatory internship done after 2nd semester will be taken into account in 2nd semester.
SEC	Skill Enhancement Course	These courses aim at imparting knowledge, practical skills, hands-on training

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		and competencies, soft skills, etc. to enhance the employability of students.
AEC	Ability Enhancement Courses	These courses aim at enabling the students to achieve competency in the English language with special emphasis on communication skills.
VAC	Value-Added Course	This course aims to instil in students (i) Universal Human Values, (ii) Environmental Studies (iii) Quantitative Aptitude.
MDC	Multi-Disciplinary Course	These courses are based on introductory knowledge in a subject which is different from the main discipline of study to gain knowledge across the disciplines. Students are not allowed to choose or repeat courses already undergone at the Senior Secondary Level (Class XII) or disciplines of study under this category. Provided further that if a Multidisciplinary Course (MDC) across the discipline cannot be offered by a Department/ Institute, due to its constraints and available resources, then i) A subject from the same discipline can be offered as a MDC course if that subject also belongs to the list of subjects of some other discipline. ii) MDC can be opted out of Massive Open Online Courses (MOOCs) from NPTEL, SWAYAM. It shall be of minimum 2 credits.
DSE	Discipline-specific Elective Course	A discipline-specific elective course is a course aimed at imparting options for varied knowledge and skills in the specialized fields of a discipline/subject.
HC	Honour Course	An honour course in the 4 th year of the Honours or Honours with Research Degree Programme.

List of Discipline-specific Elective Courses:

Elective-I (Semester-IV)	
BCA-260A	Artificial Intelligence
BCA-262A	Internet of Things
Elective-II (Semester-V)	
BCA-359A	Machine Learning
BCA-361A	Image Processing
Elective-II Lab (Semester-V)	
BCA-385A	Machine Learning Lab
BCA-387A	Image Processing Lab
Elective-III (Semester-VI)	
BCA-360A	Software Engineering
BCA-362A	Time Series Analysis
Elective-IV (Semester-VII Honours/ Honours with Research)	
BCA-463A	Introduction to Deep Learning
BCA-465A	Natural Language Processing
Elective-IV Lab (Semester-VII Honours with Research)	
BCA-491A	Introduction to Deep Learning Lab
BCA-493A	Natural Language Processing Lab
Elective-V (Semester-VIII Honours)	
BCA-462A	Web Mining
BCA-315A	Cryptography and Network Security

Note 4: Relative weightage of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), criteria of passing marks, evaluation procedure, and other guidelines are as per the Ordinance of Under Graduate Degree Programmes: Bachelor of Computer Applications, Bachelor of Computer Applications (Cloud Technology and Information Security), Bachelor of Computer Applications (Data Science).

Bachelor of Computer Applications (Data Science) Semester-I

Course Code	Course Title	L	T	P	Credits
BCA-101A	Foundations of Computer Science (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-101A.1	Understand the fundamentals of computers, types of software, and memory hierarchy.
BCA-101A.2	Identify and explain the functions of I/O devices and basic components of operating systems.
BCA-101A.3	Demonstrate knowledge of internet concepts, email systems, and web browsing tools.
BCA-101A.4	Understand various computer threats and apply basic security and protection mechanisms.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-101A.1	3	2	-	2	-	-	-	2	2	2
BCA-101A.2	2	-	-	2	2	-	-	2	3	2
BCA-101A.3	2	2	2	3	2	-	-	3	2	3
BCA-101A.4	3	2	2	3	-	-	2	3	1	3

Course Contents:

UNIT-I

Contact Hours: 12

Basics of Computer, Software and Memory

Computer Fundamentals: Computer Evolution through Generations, Computer Characteristics, Computer Strengths and Limitations, Computer Classification, Computer System Components, Computer Applications in Various Fields.

Types of Software: System Software, Application Software, Utility Software, Shareware, Freeware, Firmware, Open Source Software.

Memory Systems: Bits, Bytes, Words, and Nibbles; Storage Locations and Addresses; Storage Capacity Measurement Units; Access Time; Memory Hierarchy. Primary Memory: RAM, ROM, PROM, EPROM. Secondary Memory: Storage Devices; Magnetic Tape, Hard Disk, Optical Disk, Flash Memory

UNIT-II

Contact Hours: 12

Input/ Output Devices and Operating System basics

I/O Devices: Desktop Computer I/O Ports, Device Controllers, Device Drivers. Input Devices: Types and Uses; Keyboard, Pointing Devices—Mouse, Touchpad, Trackball, Joystick, Magnetic Stripes, Scanner, Digital Camera, microphone. Output Devices: Speakers, Monitors, Printers—Types, Laser, Inkjet, Dot-Matrix, Plotters.

Introduction to Operating Systems: Definition, Functions, Features; Icons, Folders, Files; Start Button, Taskbar, Status Buttons, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Panel.

UNIT-III

Contact Hours: 10

Internet and Electronic mail concepts

The Internet: Network and Internet Basics, History, Internet vs. Intranet vs. Extranet, How the Internet Works, Internet Connection Methods.

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Electronic Mail: Overview, Pros and Cons, User IDs, Passwords, Email Addresses, Message Components, Composition, Mailer Features. Web Browsing: Browsers and Search Engines.

UNIT-IV

Contact Hours: 11

Threats and Security fundamentals

Threats: Physical and Non-Physical Threats, Viruses, Worms, Trojans, Spyware, Keyloggers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking.

Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policies, Anti-Virus Software and Firewalls, Backup and Recovery.

Text Books:

1. Sinha, P. K. & Sinha, Priti, *Computer Fundamentals*, BPB
2. Dromey, R.G., *How to Solve it By Computer*, PHI

Other References:

1. Balagurusamy E, *Computing Fundamentals and C Programming*, Tata McGraw Hill.
2. Norton, Peter, *Introduction to Computer*, McGraw-Hill

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-103A	Digital Logic Design (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-103A.1	Understand the fundamental principles of Number System.
BCA-103A.2	Optimize the logic functions using Boolean principles and K-map.
BCA-103A.3	Analyze various combinational logic circuits and Sequential logic circuits using data path circuits.
BCA-103A.4	Analyze basic Computer Organization including Instruction cycle.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-103A.1	3	2	2	-	-	-	-	2	2	2
BCA-103A.2	3	2	2	2	-	-	-	2	-	1
BCA-103A.3	2	2	2	2	-	-	-	2	-	-
BCA-103A.4	3	3	2	2	-	-	-	3	-	2

Course Contents:

UNIT-I

Contact Hours: 12

Number System and Codes

Introduction, Binary Number System, Decimal Number System, Octal Number System, Hexa Decimal Number System and Conversion from one number system to another, Error Detecting and Correcting Codes: Parity Check Code, CRC and Hamming Code, BCD Number System:BCD Codes, Natural Binary Codes, Weighted Codes, Self complementing Codes, Excess-3 Codes and Cyclic Codes, Representation of sign number, Sign magnitude, 1's and 2's Complement.

UNIT-II

Contact Hours: 12

Boolean Algebra and Logic Gates

Boolean Algebra Postulates, Boolean laws and theorems, Boolean expressions and functions, truth table, canonical representation (SOP, POS), simplification of Boolean function by Boolean algebra, K-Map (up to 4 variables), handling don't care conditions.

Digital Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, symbols, expressions and truth table, implementation- using NAND and NOR gates.

UNIT-III

Contact Hours: 10

Combinational and Sequential Circuit

Combinational Circuit-Introduction, half adder, full adder, half subtractor, full subtractor, multiplexer (2:1,4:1,8:1), demultiplexer (1:2,1:4,1:8), comparators (1 bit and 2 bit), multiplexer, demultiplexer, encoder, decoder, seven segment display, code convertor.

Sequential Circuit- Introduction, Flip Flops (SR, JK, D, T, Master Slave Flip Flop) and their applications, state diagram, state table, excitation table, state equations, characteristic table.

UNIT-IV

Contact Hours: 11

Registers and Computer Organization

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Register – Designing Registers-Serial in Serial Out Register (SISO), Serial in Parallel Out Register (SIPO), Parallel in Parallel Out Register (PIPO), Parallel in Serial Out Register (PISO), Shift Register.

Basic Computer Organization and Design - Instruction codes, Types of Instructions (Register reference, Memory reference, Input-Output reference), computer registers, addressing modes, instruction cycle.

Text Books:

1. M. Moris Mano (2006), *Computer System Architecture*, 3rd edition, Pearson/PHI, India.
2. Pratima Manhas and Shaveta Thakral, *Digital Electronics*, S.K. Kataria & sons, India
3. P. K. Sinha , *Computer Fundamentals*, 8th edition , BPB Publications, India

Other References:

1. William Stallings (2010), *Computer Organization and Architecture- designing for performance*, 8th edition, Prentice Hall, New Jersey.
2. Anrew S. Tanenbaum (2006), *Structured Computer Organization*, 5th edition, Pearson Education Inc,
3. John P. Hayes (1998), *Computer Architecture and Organization*, 3rd edition, Tata McGrawHill
4. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), *Computer Organization*, 5th edition, McGraw Hill, New Delhi, India.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-171A	Digital Logic Design Lab (Pre-requisite: Digital Logic fundamentals)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-171A.1	Understand the fundamental principles of Number System
BCA-171A.2	Optimize the logic functions using Boolean principles and K-map
BCA-171A.3	Design various combinational logic circuits and Sequential logic circuits using data path circuits.
BCA-171A.4	Analyze basic Computer Organization including Instruction cycle.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-171A.1	3	3	3	2	-	-	-	3	2	2
BCA-171A.2	3	3	3	2	-	-	-	3	-	1
BCA-171A.3	3	3	3	2	-	-	-	3	-	-
BCA-171A.4	3	3	3	2	-	-	-	3	-	2

List of Experiments

No.	Experiment Detail
1.	Draw and realize Trainer Kit and its other components.
2.	Draw and study of different Digital IC's and its specification and Verification of the Truth Table of logic gates using TTL IC's.
3.	Evaluation of a given Boolean function using logic gates in both SOP and POS form.
4.	Design and Implement 4 bit Half Adder using 7483 IC.
5.	Design and Implement 4-bit Full Adder using 7483 IC.
6.	Design and Implement 4:1 Multiplexer using 4153 IC.
7.	Design and Implement 1:4 Demultiplexer using 74155 IC.
8.	Implementation and verification of 2 x 4 decoder using logic gates.
9.	Implementation and verification of 2 x 4 encoder using logic gates.
10.	Design and Implement 4x16 decoder with 3 x 8 decoder
11.	Construct 7 Segment Display Circuit using decoder or 7 Segment LED and test it.
12.	Draw the circuit diagram of a single bit comparator and test the output.
13.	Verification of state table of RS, JK, T and D flip flop using logic gates.
14.	Verify the operations of 4-bit shift register for different modes of operations.

Text Books:

1. M. Moris Mano (2006), *Computer System Architecture*, 3rd edition, Pearson/PHI, India.

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2. Pratima Manhas and Shaveta Thakral, *Digital Electronics*, S.K. Kataria & sons, India
3. P. K. Sinha , *Computer Fundamentals*, 8th edition , BPB Publications, India

Other References:

1. William Stallings (2010), *Computer Organization and Architecture- designing for performance*, 8th edition, Prentice Hall, New Jersey.
2. Andrew S. Tanenbaum (2006), *Structured Computer Organization*, 5th edition, Pearson Education Inc,
3. John P. Hayes (1998), *Computer Architecture and Organization*, 3rd edition, Tata McGrawHill
4. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), *Computer Organization*, 5th edition, McGraw Hill, New Delhi, India.

Course Code	Course Title	L	T	P	Credits
BCA-105A	Problem Solving through C (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-105A.1	Understand the basic structure of a C programming
BCA-105A.2	Apply operators, expressions, and various control structures.
BCA-105A.3	Analyze the implement arrays, strings, and user-defined functions
BCA-105A.4	Apply advanced concepts like structure, union and pointers.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-105A.1	3	2	2	2	-	-	-	-	-	-
BCA-105A.2	3	2	2	2	2	2	-	2	1	2
BCA-105A.3	3	2	2	2	2	2	-	2	2	2
BCA-105A.4	3	2	3	2	3	2	-	2	1	2

Course Contents:

UNIT-I

Contact Hours: 12

Fundamentals of C language

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 and unformatted I/O Functions-, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), sscanf(), output functions viz. printf(), putchar(), puts(), sprintf()

UNIT-II

Contact Hours: 10

Operators and Control Structures

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.

Control Structures: Decision making Statements- simple if, if else, nested if, else if ladder, switch and break statement, goto statement, Looping Statements: for, while, and do while loop, nested loops, jumps in loops..

UNIT-III

Contact Hours: 11

Arrays, Strings, and Functions

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation, Advantages and disadvantages of arrays

Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate, Reverse etc.

Functions: Definition, Advantages, prototype, function call, function classification, passing arguments to a function: call by value; call by reference, recursive functions.

UNIT-IV

Contact Hours: 12

User defined data types, pointers and storage class concepts

User defined data types: Structures Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; difference between Structure and Union.

Pointers in C: Definition, Advantages, Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays, Pointers and Character Strings.

Storage classes in C: Auto, Static, Register, Extern

Text Books:

1. Balagurusamy, E., *Programming in ANSI C*, Tata McGraw-Hill
2. Yashwant Kanetkar, *Let us C*, BPB

Other References:

1. Gottfried, Byron S., *Programming with C*, Tata McGraw Hill
2. Rajaraman, V., *Computer Programming in C*, PHI
3. Jeri R. Hanly & Elliot P. Koffman, *Problem Solving and Program Design in C*, Addison Wesley
4. Brian W. Kernighan, Dennis Ritchie, *The C Programming Language*, Pearson

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-173A	Problem Solving through C Lab (Pre-requisite: C Programming)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-173A.1	Apply basic input/output operations, operators, and expressions in C
BCA-173A.2	Develop C programs using decision-making and looping constructs
BCA-173A.3	Apply and manipulate arrays, strings, and matrices in C
BCA-173A.4	Construct modular C programs using functions, structures, and pointers.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-173A.1	3	2	2	2	-	-	-	2	-	-
BCA-173A.2	3	3	2	2	1	-	-	2	1	2
BCA-173A.3	3	2	2	2	-	-	-	2	2	2
BCA-173A.4	3	3	2	2	2	-	-	2	1	2

List of Experiments

No.	Experiment Detail
1.	An engineer designing circular rides in an amusement park needs to calculate the area and circumference of each ride. Develop a C program that reads radius as input, computes the area and circumference and outputs the results to ensure efficient design.
2.	Develop a C program that implements nested if to find the largest of three numbers.
3.	Develop a C program to read the percentage of marks and display appropriate grades to demonstrate the use of the else-if ladder.
4.	Develop a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
5.	Design a C program to find the roots of a quadratic equation.
6.	Design a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
7.	Design a C program to read a number, find the sum of the digits, reverse the number and check it for palindrome.
8.	A teacher uses a C program to read marks scored by n students. The program stores marks in a single-dimensional array and calculates the average marks of a class.
9.	Implement a C program that finds both the largest and smallest number in a list of integers.
10.	Implement a C program that sorts elements of an array in ascending order.
11.	Create a C program to perform addition and subtraction of matrices.
12.	Create a C program to perform multiplication of two matrices
13.	Create a C program to demonstrate string library functions
14.	Create a C program to find the length of a string and to copy string without using built-in function.

15.	Create a C program to read, display and add two m x n matrices using functions.
16.	Create a C program that use both recursive and non-recursive functions to find factorial of a given number.
17.	Create a C program that use both recursive and non-recursive functions to generate first n terms of Fibonacci series.
18.	A school administrator uses a C program to manage student records. The program utilizes a student structure to read and display records of n students, ensuring organized and efficient data handling.
19.	Create a C program to swap two numbers using pointers to demonstrate call by reference method for passing arguments in function.
20.	A linguistics researcher uses a C program to analyze text data. The program employs pointers to count vowels and consonants in a given string, ensuring accurate linguistic analysis and data processing.

Text Books:

1. Balagurusamy, E., *Programming in ANSI C*, Tata McGraw-Hill
2. Yashwant Kanetkar, *Let us C*, BPB

Other References:

1. Gottfried, Byron S., *Programming with C*, Tata McGraw Hill
2. Rajaraman, V., *Computer Programming in C*, PHI
3. Jeri R. Hanly & Elliot P. Koffman, *Problem Solving and Program Design in C*, Addison Wesley
4. Brian W. Kernighan, Dennis Ritchie, *The C Programming Language*, Pearson

**Syllabus of the Courses offered by other Departments
for
Bachelor of Computer Applications (DS)
Semester –I**

Course Code	Course Title	L	T	P	Credits
ASH-MAT-115A	Basics of Mathematics-I (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-MAT-115A.1	Understand the basic concepts of sets, types, various operations and their applications
ASH-MAT-115A.2	Analyze the properties of relation and understand the concept of functions and their types
ASH-MAT-115A.3	Apply the basic operations on matrices, and understand the determinant and inverse of matrices
ASH-MAT-115A.4	Understand Arithmetic progression, Geometric progression, Harmonic progression and evaluate Arithmetic mean, Geometric mean, Harmonic mean and Relation between them.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-MAT-115A.1	3	2	1	2	-	-	-	2	2	-
ASH-MAT-115A.2	3	3	2	2	-	-	-	2	2	1
ASH-MAT-115A.3	3	3	2	2	-	-	-	2	3	2
ASH-MAT-115A.4	3	2	1	1	-	-	-	2	2	1

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 7

Set Theory

Sets and their representations, Empty set, Finite and infinite sets, Subsets, Equal sets, Power sets, Universal set, Union and intersection of sets, Difference of two sets, Complement of a set, Venn diagram, De-Morgan's laws and their applications

UNIT-II

Contact Hours: 6

Relation and Function

Properties of relations, equivalence relation, Functions: Definition, domain and range of function, Injective function, Surjective function, Bijjective function, composite and inverse function

UNIT-III

Contact Hours: 9

Matrices and Determinants

An introduction to matrices and their types, Operations on matrices, Symmetric and skew-symmetric matrices, Minors, Co-factors. Determinant of a square matrix, Adjoint and inverse of a square matrix, Solutions of system of Linear equations of three variables.

UNIT-IV

Contact Hours: 8

Sequence and Series

Basics of Logarithms, Arithmetic progression, Geometric progression, Harmonic progression, Arithmetic mean

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

(A.M.), Geometric mean (G.M.), Harmonic mean (H.M.), Relation between A.M., G.M. and H.M.

Text Books:

1. J. P. Tremblay and P. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill.
2. C. L. Liu and D. P. Mohapatra, *Elements of Discrete Mathematics-A Computer Oriented Approach*, Tata McGraw Hill.
3. S.C. Malik and Savita Arora, *Mathematical Analysis*, New Age publication
4. J.K. Thukral, *Business Mathematics*.

Other References:

1. K. H. Rosen, *Discrete Mathematics and its Applications*, 7th ed., McGraw – Hill

Course Code	Course Title	L	T	P	Credits
ASH-HUM-107A	Universal Human Values (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-HUM-107A.1	Understand the importance of value, types and roles of values in personal and societal development.
ASH-HUM-107A.2	Understand and apply principles of inner harmony to enhance overall well-being and foster balanced personal development
ASH-HUM-107A.3	Understand principles of harmonious relationships to promote unity and cooperation within families, society and nature.
ASH-HUM-107A.4	Understand the difference between ethical and unethical practices

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-HUM-107A.1	2	-	2	-	2	-	-	2	-	2
ASH-HUM-107A.2	-	-	-	-	2	-	-	2	-	-
ASH-HUM-107A.3	-	-	2	-	3	2	3	2	-	-
ASH-HUM-107A.4	-	-	2	-	-	-	3	2	-	2

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 7

Introduction to Value Education

Value Education - Definition, concept and need, the content and process of value education, basic guidelines for value education, self-exploration as a means of value education, happiness and prosperity as parts of value education.

UNIT-II

Contact Hours: 8

Harmony in the Human Being

Human being is more than just the body, harmony of the self ('I') with the body, understanding myself as co-existence of the self and the body, understanding needs of the self and the needs of the body, understanding the activities in the self and the activities in the body.

UNIT-III

Contact Hours: 8

Harmony in the Family and Nature

Harmony in the Family: Family as a basic unit of human interaction and values in relationships; The basics for respect and today's crisis: affection, guidance, reverence, glory, gratitude and love; Comprehensive human goal: the five dimensions of human endeavor;

Harmony in Nature: the four orders in nature, the holistic perception of harmony in existence.

UNIT-IV

Contact Hours: 7

Social and Professional Ethics

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Social and Professional Ethics: The basics for ethical human conduct, defects in ethical human conduct, holistic alternative and universal order, universal human order and ethical conduct. Value based life and profession, professional ethics and right understanding, competence in professional ethics; Issues in professional ethics – the current scenario.

Practice Sessions:

Unit-1

- To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit-2

- To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation.

Unit-3

- To reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives. To discuss human being as cause of imbalance in nature.

Unit-4

- To explore ethical human conduct and steps of transition towards universal human order.

Text Books:

1. A. N. Tripartly, *Human Values*, New Age International Publishers
2. Bajpai, B. L., *Human Values and Professional Ethics*, New Royal Book Co, Lucknow, Reprinted

Other References:

1. Gaur. R. R., Sangal R., Bagaria. G. P., *A Foundation Course in Value Education*, Excel Books
2. I. C. Sharma. *Ethical Philosophy of India*, Nagin & Co., Jalandhar

Course Code	Course Title	L	T	P	Credits
ASH-HUM-117A	English Language and Communication-1 (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-HUM-117A.1	Understand and remember the basic concepts of communication skills and its usage in day to day life.
ASH-HUM-117A.2	Classify, interpret, differentiate, and organize the learned knowledge.
ASH-HUM-117A.3	Develop and execute listening and writing skills.
ASH-HUM-117A.4	Learn group discussion skills.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-HUM-117A.1	2	2	2	-	2	-	-	2	-	-
ASH-HUM-117A.2	2	2	2	-	2	2	2	2	-	-
ASH-HUM-117A.3	2	3	2	2	3	2	2	2	-	-
ASH-HUM-117A.4	2	3	2	2	3	-	3	3	-	-

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 8

Communication Skills and Barriers

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

UNIT-II

Contact Hours: 8

Elements of Communication and Perspectives

Elements of Communication: Introduction, Face to Face Communication – Tone of voice, Body Language (Non-Verbal Communication), Verbal Communication Physical Communication.

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT-III

Contact Hours: 8

Listening and Written Communication skills

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations.

Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication.

Group Discussion

Introduction to Group Discussion, Communication skills in group discussion, Do's and Don'ts of group discussion

Textbooks:

1. Andreja. J. Ruther Ford, *Basic communication skills for Technology*, 2nd Edition, Pearson Education
2. Sanjay Kumar, Pushpalata, *Communication skills*, Oxford Press
3. Stephen. P. Robbins, *Organizational Behavior*, Pearson
4. Gill Hasson, *Brilliant- Communication skills*, Pearson Life
5. GopalaSwamy Ramesh, *The Ace of Soft Skills: Attitude, Communication and Etiquette for success*, Pearson

Other references:

1. Deborah Dalley, Lois Burton, Margaret, Greenhall, *Developing your influencing skills*, Universe of Learning LTD
2. Konar nira, 2nd Edition, *Communication skills for professionals*, New arrivals –PHI
3. Barun K Mitra, *Personality development and soft skills*, Oxford Press
4. Butter Field, *Soft skill for everyone*, 1st Edition, Cengage Learning India pvt.ltd
5. Francis Peters SJ, *Soft skills and professional communication*, McGraw Hill Education
6. John Adair, *Effective communication*, Pan Mac Millan
7. Aubrey Daniels, *Bringing out the best in people*, Mc Graw Hill.

Course Code	Course Title	L	T	P	Credits					
BBA-215A	Digital Marketing	2	0	0	2					
		CIE	SEE		Total					
		40	60	100						
Course Outcomes										
CO1	Discuss the historical perspective and key milestones in the evolution of digital marketing.									
CO2	Apply strategies for effective social media marketing, email marketing, and affiliate marketing.									
CO3	Analyze data to inform digital marketing strategies and decisions.									
CO4	Evaluate the impact of digital wellbeing and ethical considerations in digital marketing practices.									
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	3	2	2	-	-	-	1	1	2
CO2	2	2	3	3	2	1	-	2	3	3
CO3	1	3	2	3	1	-	-	2	2	3
CO4	2	2	1	-	-	-	3	3	2	3

Course Outline

Unit Number: 1	Digital Marketing and Search Engine Marketing	Contact Hours: 8
<p>Foundations and Evolution of Digital Marketing: Historical Perspective and Key Milestones: Transition from traditional to digital marketing channels</p> <p>Search Engine Marketing (SEM): Fundamentals of search engine optimization (SEO) and its role in digital marketing, pay-per-click (PPC) advertising strategies and best practices, importance of keyword research and targeting in SEM campaigns</p>		
Unit Number: 2	Social Media and Email marketing	Contact Hours: 6
<p>Social Media Marketing: Strategies for leveraging social media platforms, creating engaging content, understanding social media metrics, and building brand presence.</p> <p>Email Marketing: Role of email marketing in the digital marketing mix, strategies for building and maintaining email lists, personalization, segmentation, and automation in email campaigns</p>		
Unit Number: 3	Data Analytics in Digital marketing	Contact Hours: 8
<p>Digital Marketing, Data, and Analytics: Role of data in informing digital marketing strategies and decisions.</p> <p>Social Media Advertising and Analytics: Tools for social media Advertising; Planning and executing social media campaigns; An Overview of social media analytics tools.</p>		
Unit Number: 4	Digital Wellbeing and Ethics	Contact Hours: 8
<p>Digital Wellbeing: Understanding digital stress and its impact on mental health, strategies for promoting digital detox and mindfulness in the digital age, incorporating principles of digital wellbeing into digital marketing practices.</p> <p>Ethical Issues in Digital Marketing: Ethical considerations, privacy concerns, and legal aspects of digital marketing</p>		

Textbooks:

1. Chaffey, Dave and Fiona Ellis Chadwick, *Digital Marketing- Strategy, Implementation and Practice*, Pearson Education Inc.
2. Ahuja, Vandana, *Digital Marketing*, Oxford University Press

Other references:

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

1. Hanson, W and Kirthi Kalyanam, *Internet Marketing and E-Commerce*, Cengage Learning
2. Mullen, J and D Daniels, *E-Marketing- An Hour a Day*, Sybex Publisher
3. Kotler et. Al, *Principles of Marketing*, Pearson Education Inc., New Delhi
4. Kaufman, Era and Chris Hortan, *Digital Marketing- Integrating Strategies and Tactics with Values*, Routledge

Bachelor of Computer Applications (Data Science) Semester–II

Course Code	Course Title	L	T	P	Credits
BCA-102A	Operating System (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-102A.1	Understand the fundamental concepts of operating systems.
BCA-102A.2	Apply process scheduling algorithms to solve process management problems
BCA-102A.3	Interpret memory management techniques and virtual memory.
BCA-102A.4	Implement file systems and disk scheduling algorithms.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-102A.1	3	2	2	2	-	-	-	2	-	-
BCA-102A.2	3	3	2	2	2	1	-	2	2	-
BCA-102A.3	3	2	2	3	-	-	-	2	-	2
BCA-102A.4	3	2	2	3	2	2	2	2	2	2

Course Contents:

UNIT-I

Contact Hours: 11

Fundamentals of Operating System and Processes

Introduction of Operating System: Definition, Functions & Characteristics; Operating System Services; Operating System Architecture; Types of Operating system: Batch, Multiprogramming, Multi Processing, Time-sharing, Real-time, Distributed; System Programs and System calls.

Processes: Definition, Process states, Process Control Block, Operations on Processes, inter process Communication, Threading and Multithreading.

UNIT-II

Contact Hours: 12

Process Scheduling, Synchronization and Deadlocks

Process Scheduling: Definition, Types of Schedulers, Scheduling Criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only), Scheduling algorithms: Preemptive and Non - Preemptive, FCFS, SJF, Priority, RR, and Multi-level Queue (with and without Feedback) Scheduling.

Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization.

Deadlocks: Definition, Necessary conditions for Deadlock, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.

UNIT-III

Contact Hours: 12

Memory Management

Memory Concepts: Logical and Physical Address Space, Swapping, Internal and External Fragmentation.

Memory Allocation Techniques: Contiguous Memory Allocation- Single and Multi-Partitioned, Non-Contiguous Memory Allocation – Paging and Segmentation.

Virtual Memory Management: Demand Paging, Page-Replacement Algorithms: FIFO, LRU, Optimal, Thrashing.

UNIT-IV

Contact Hours: 10

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

File and Directory management, Disk Scheduling algorithms

File Concept: File System and its Functions, Different types of Files and their access methods.

Directory: Directory Structures, Directory Operations, Directory Allocation Methods.

Disk Scheduling: Disk Structure, Disk Scheduling Algorithms: First come First Serve (FCFS), Shortest Seek Time First (SSTF), SCAN, C-SCAN, LOOK, C-LOOK.

Text Books:

1. Silberschatz A., Galvin P.B., and Gagne G., *Operating System Concepts*, John Wiley & Sons.
2. Godbole, A.S., *Operating Systems*, Tata McGrawHill Publishing Company, New Delhi.

Reference Books:

1. William Stallings, *Operating Systems: Internals and Design Principles*, Prentice Hall
2. William S. Davis and T. M. Rajkumar, *Operating Systems: A Systematic View*, Pearson.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits					
BCA-122A	Programming with Python (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-122A.1	Understand the fundamentals of Python programming.									
BCA-122A.2	Analyze and implement operators and control structures in Python.									
BCA-122A.3	Utilize ordered data objects including string, list and tuple.									
BCA-122A.4	Utilize unordered data objects including set and dictionary and design functions.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-122A.1	3	2	2	-	-	-	-	2	2	2
BCA-122A.2	3	3	3	3	2	2	-	-	2	2
BCA-122A.3	3	3	3	3	2	2	-	2	3	3
BCA-122A.4	3	3	3	3	2	2	-	2	3	3

Course Contents:

UNIT-I

Contact Hours: 9

Basics of Python

Overview and applications areas of Python, Python installation, Comments, Keywords, Identifiers, Variables declaration, Standard Data types, id(), type(), quotations for string literals, data type conversion methods, Input/Output statements, escape characters, round(), importing 'math' package

UNIT-II

Contact Hours: 11

Operators and Control statements in Python

Operators: Arithmetic, Assignment, Comparison, Logical, Bitwise, Reference or identity (is/ is not), Membership (in /not in)

Control Statements: conditional statements (if, else, elif), loop statements (for, while), break, continue, pass statement.

UNIT-III

Contact Hours: 13

Ordered Data Objects

Ordered Data Objects: String: declaration, indexing, len(), concatenation, repetition, 'in'/'not in' operator, slice, Traversal, Built-in functions; List: declaration, indexing, len(), creating list using range(), list with initial values, converting string to list, concatenation, repetition, 'in'/'not in' operator, slice, traversal, built-in functions; Tuple: declaration, indexing, len(), creating tuple using range(), tuple with initial values, converting string to tuple, converting list to tuple, concatenation, repetition, 'in'/'not in' operator, slice, traversal, built-in functions.

UNIT-IV

Contact Hours: 12

Unordered Data Objects and Functions

Unordered Data Objects: Set: Roster and Rule form, len(), converting list to set and set to list, Built-in functions, Set operations; Dictionary: declaration, len(), inserting and accessing a value, keys(), values(), items(), Built-in functions
Functions: defining a function, calling a function, keyword arguments, default arguments, variable length arguments, scope of variables, Recursive function, map(), Lambda function

Text Books:

1. E. Balagurusamy, *Introduction to Computing and Problem Solving Using Python*, McGrawHill Education
2. Yashavant Kanetkar, Aditya Kanetkar, *Let us Python*, BPB Publications
3. Bob Dowling, *An introduction to Python for absolute beginners*, Cambridge University Press.
4. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson Education
5. Sheetal Taneja, Naveen Kumar, *Python Programming A Modular Approach*, Pearson
6. Rao R. Nageswara , *Core Python Programming*, Dream Tech, New Delhi

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

Reference Books:

1. Mark Lutz, *Learning Python*, 5th edition, O'Reilly.
2. Martin C. Brown, *Python: The Complete Reference*, McGraw-Hill

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-192A	Programming with Python Lab (Pre-requisite: Python)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-192A.1	Implement basic Python programs.
BCA-192A.2	Apply operators and control structures in Python.
BCA-192A.3	Design Python programs utilizing ordered data objects.
BCA-192A.4	Design Python programs using unordered data objects and functions.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-192A.1	3	2	3	-	-	-	-	2	2	2
BCA-192A.2	3	3	3	3	2	2	-	2	2	-
BCA-192A.3	3	3	3	3	2	2	-	2	2	2
BCA-192A.4	3	3	2	3	2	2	-	2	2	2

List of Experiments

No.	Experiment Detail																				
1.	Assume you travel 80 km to and fro in a day. Fuel Cost is INR 80 per liter and your vehicle's Fuel Average is 18 km/litre. Write a Python program to calculate the Driving Cost per day.																				
2.	Write a program to calculate the area and circumference of a circle for the given radius as input.																				
3.	Write a program to make use of various Data conversion methods in Python.																				
4.	Write a Python program which iterates the integers from 1 to 30 (included). if number is divisible by 3 print "PIET", if number is divisible by 5 print "DCA". if number is divisible by both 3 and 5 print "PIET & DCA" and otherwise print the number itself.																				
5.	Write a Python program to display the following pattern for the given input of no. of lines. 1 121 12321 1234321																				
6.	Write a program to check whether the given integer number is Palindrome or not.																				
7.	Assuming your weight in kilogram and height in meters, calculate your Body Mass Index (BMI) value using the formula $BMI = \text{weight} / (\text{height} * \text{height})$ Height is given in (feet.inches) form and weight is given in kgs and to convert total height in meters consider 1 Feet = 0.3048 meter and 1 Inch = 0.0254 meter																				
8.	Create a list of city names from the given list where city name contains substring 'pur' cities=['Jaipur','Ambala','Nagpur','Kanpur','Karnal','Sholapur']																				
9.	Write a program to remove leading and trailing blank spaces from string items in the list animals = [' monkey ', ' pitbull dog ', ' rabbit ']																				
10.	Book order is given as list of sublists with the following items <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Order Number</th> <th>Book Title</th> <th>Author</th> <th>Quantity</th> <th>Unit Price</th> </tr> </thead> <tbody> <tr> <td>34587</td> <td>Learning Python</td> <td>Mark Lutz</td> <td>4</td> <td>40.95</td> </tr> <tr> <td>98762</td> <td>Programming Python</td> <td>Mark Lutz</td> <td>5</td> <td>56.80</td> </tr> <tr> <td>77226</td> <td>Head First Python</td> <td>Paul Barry</td> <td>3</td> <td>32.95</td> </tr> </tbody> </table>	Order Number	Book Title	Author	Quantity	Unit Price	34587	Learning Python	Mark Lutz	4	40.95	98762	Programming Python	Mark Lutz	5	56.80	77226	Head First Python	Paul Barry	3	32.95
Order Number	Book Title	Author	Quantity	Unit Price																	
34587	Learning Python	Mark Lutz	4	40.95																	
98762	Programming Python	Mark Lutz	5	56.80																	
77226	Head First Python	Paul Barry	3	32.95																	

	Write a Python program to generate the Order summary in this List of tuple form [(34587, 163.8), (98762, 284.0), (77226, 108.85)] Where first item in the tuple is Order Number, second item is Net Price i.e. Quantity*Unit Price if Net Price < 100.00 it should be increased by Rs. 10.
11.	employees=['Gurpreet','Manjot','Shabadpreet','Gurleen','Vishal','Noor','Navjeet'] gym_members=['Shabadpreet','Vishal','Navjeet'] developers=['Shabadpreet','Gurpreet','Gurleen','Manjot','Navjeet'] From the above given lists write Python program to answer the following queries: i) List all employees who have gym membership and also developers ii) List all the employees who are not either gym members or developers
12.	A string is given to you e.g. "aabaacdaadd". Create a dictionary of each character in the given string and its frequency, i.e. output={'a': 6, 'b': 1, 'c': 1, 'd': 3}
13.	In a shop store, data operator enters Item Name, Quantity sold and its Unit Price one by one till 'CLOSE' is entered. Create Python dictionary of Item Name and its Net Price. Sample Input: BANANA FRIES 2 20.60 POTATO CHIPS 3 15.50 APPLE JUICE 10 100.75 CANDY 5 2.50 APPLE JUICE 6 100.75 CANDY 5 2.50 CANDY 5 2.50 BANANA FRIES 3 20.60 CANDY 5 2.50 POTATO CHIPS 5 15.50 CLOSE Sample Output: {'BANANA FRIES': 103.0, 'POTATO CHIPS': 124.0, 'APPLE JUICE': 1612.0, 'CAND Y': 50.0}
14.	Write a function to make use of variable length arguments.
15.	Write a Recursive function to generate ith term of a Fibonacci Series 0,1,1,2,3,5,8,13,... Generate n terms of Fibonacci Series using this recursive function.

Text Books:

1. E. Balagurusamy, *Introduction to Computing and Problem Solving Using Python*, McGrawHill Education
2. Yashavant Kanetkar, Aditya Kanetkar, *Let us Python*, BPB Publications
3. Bob Dowling, *An introduction to Python for absolute beginners*, Cambridge University Press.
4. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson Education
5. Sheetal Taneja, Naveen Kumar, *Python Programming A Modular Approach*, Pearson
6. Rao R. Nageswara , *Core Python Programming*, Dream Tech, New Delhi

Reference Books:

1. Mark Lutz, *Learning Python*, 5th edition, O'Reilly.
2. Martin C. Brown, *Python: The Complete Reference*, McGraw-Hill

Course Code	Course Title	L	T	P	Credits
BCA-124A	Office and Spreadsheet Tools (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-124A.1	Understand the basic functions and features of operating systems and common system software.
BCA-124A.2	Develop word processing skills using MS Word for documentation.
BCA-124A.3	Apply spreadsheet functions and data analysis using MS Excel.
BCA-124A.4	Create effective presentations using MS PowerPoint tools and techniques.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-124A.1	3	-	-	-	-	-	-	2	-	2
BCA-124A.2	2	-	-	2	2	-	-	-	-	2
BCA-124A.3	3	3	2	3	-	2	-	2	3	3
BCA-124A.4	2	1	1	2	3	2	-	-	2	2

Course Contents:

UNIT-I

Contact Hours: 8

Fundamentals of Windows Operating System

Definition, types of operating system, the user interface, exploring computer, icons, taskbar, desktop, using menu and menu selection, managing files and folders; types of software - system software, application software. Control panel - display properties, add/remove software and hardware, common utilities.

UNIT-II

Contact Hours: 8

Working with MS-Word

Creating, saving and editing a document - Selecting, deleting, replacing text, copying text to another file. Insert, formatting text and paragraph, using the font, dialog box, paragraph formatting using bullets and numbering in paragraph, use of smart art, checking spelling, line spacing, margins, mail merge, inserting headers and footers.

UNIT-III

Contact Hours: 8

Working with Spreadsheet

Entering Information - Numbers, formula, editing data in a cell, cell height and widths; Excel functions (sum, min, max, average, count) using a range, moving and copying data, different operations on rows and columns in the worksheet, format cells, dialog box. Drawing different types of charts (column, bar, pie, line, area etc.), Sort and filter data.

UNIT-IV

Contact Hours: 6

Working with MS-Power Point

Introduction to Power Point presentation, creating a presentation, inserting smart arts, adding objects, applying transitions, and animation effects, adding tables, charts and media files, slide show.

Text Books:

1. David W. Beskeen, *Microsoft Office 365 & Office 2019: Introductory*, Cengage Learning, 2019
2. Sinha, P.K. and Sinha, Priti, *Computer Fundamentals*, BPB, 2004.
3. Sagman S, *MS Office for Windows XP*, Pearson Education, 2007
4. R. K.Taxali, *PC Software for Windows*, Made Simple, 2017.

Reference Books:

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

1. Norton, Peter, *Introduction to Computer*, McGrawHill, 2002.
2. Peter Waverka, *Microsoft Office 365 All-in-one for Dummies*, 2023.
3. Mansfield Ron, *Working in Microsoft Office*, Tata McGrawHill.
4. Balagurusamy E, *Fundamentals of Computers*, Tata McGrawHill.
5. Mavis Beacon, *All-in-one MS Office CD based views for self-learning*, BPB Publication.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-194A	Office and Spreadsheet Tools Lab (Pre-requisite: MS Office)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-194A.1	Understand basic interface and file management features of Windows operating system
BCA-194A.2	Apply MS Word features for document creation, including advanced formatting, mail merge, and collaboration tools.
BCA-194A.3	Analyze and visualize data using MS Excel functions and charts to generate summaries and insights.
BCA-194A.4	Design and deliver effective PowerPoint presentations with multimedia, transitions, and animations.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-194A.1	2	2	-	2	-	-	-	2	-	2
BCA-194A.2	3	-	2	3	2	-	-	2	-	3
BCA-194A.3	2	3	3	3	-	2	-	2	3	3
BCA-194A.4	3	1	2	2	3	2	-	2	1	2

List of Experiments

No.	Experiment Detail
1.	Identify and describe the function of icons, taskbar, and desktop.
2.	Navigate the Start menu and create, delete and move the files & folders.
3.	Install a new application via the Control Panel and also navigate through the control panel.
4.	Create a multi-page report in MS-Word with a table of contents, headers and footers, section breaks, and advanced formatting styles (e.g., columns, drop caps).
5.	Use mail merge in MS-Word to create personalized letters or emails using a data source (e.g., Excel spreadsheet) with fields for recipient names and addresses.
6.	Collaborate on a document with a partner using MS-Word's track changes, comments, and version history features to suggest edits and revisions.
7.	Use advanced Excel functions such as SUMIF, COUNTIF, and PivotTables to analyze and summarize data effectively.
8.	Analyze a dataset in Excel by calculating totals and averages.
9.	Create and customize different types of charts (e.g., bar chart, pie chart, line graph) in Excel based on a dataset, and interpret the data visually.
10.	Develop a professional PowerPoint presentation with slides containing multimedia elements (e.g., images, audio/video), animations, and transitions between slides.

Text Books:

1. David W. Beskeen, *Microsoft Office 365 & Office 2019: Introductory*, Cengage Learning, 2019
2. Sinha, P.K. and Sinha, Priti, *Computer Fundamentals*, BPB, 2004.
3. Sagman S, *MS Office for Windows XP*, Pearson Education, 2007
4. R. K.Taxali, *PC Software for Windows*, Made Simple, 2017.

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1. Norton, Peter, *Introduction to Computer*, McGrawHill, 2002.
2. Peter Waverka, *Microsoft Office 365 All-in-one for Dummies*, 2023.
3. Mansfield Ron, *Working in Microsoft Office*, Tata McGrawHill.
4. Balagurusamy E., *Fundamentals of Computers*, Tata McGrawHill.
5. Mavis Beacon, *All-in-one MS Office CD based views for self-learning*, BPB Publication.

Course Code	Course Title	L	T	P	Credits					
BCA-106A	Introduction to Web Technology (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-106A.1	Understand the evolution and components of the Internet.									
BCA-106A.2	Explore the basic and advance elements of HTML in designing web pages.									
BCA-106A.3	Apply CSS for Web Page Styling and Layout.									
BCA-106A.4	Analyze Dynamic Web Functionality Using JavaScript.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-106A.1	3	2	-	2	-	-	-	2	-	-
BCA-106A.2	3	2	2	2	-	-	-	2	2	2
BCA-106A.3	3	2	2	3	2	2	-	2	2	2
BCA-106A.4	3	3	3	3	2	2	-	2	2	2

Course Contents:

UNIT-I

Contact Hours: 12

Introduction to Internet and Web Publishing

Introduction to Internet and its Components: Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers, Hypertext Transfer Protocol, HTTP Request Message, Response Message, URLs, Searching, Dynamic and Static Website, Search Engines and Search Tools.

Web Publishing: Hosting website, Internet service provider, Planning and designing website, Steps for developing website.

UNIT-II

Contact Hours: 11

Basics of Hyper Text Mark-up Language (HTML)

Introduction, History of HTML, Introduction to DHTML, Structure of HTML Page, HTML tags versus HTML elements, HTML Basic Formatting Tags and attributes of tag, Paragraph Tag, Comments in HTML, Heading Tag, Div Tag, Span Tag, Different types of List Tag- Unordered Lists, Ordered Lists, Definition list, Image Tag, Hyperlink-Internal and External, Table tag and its attributes, iFrame, Forms in HTML, Post and Get method

UNIT-III

Contact Hours: 12

Introduction to Cascading Style Sheet (CSS)

Basic Concepts, CSS Syntax, Features of CSS3, Style Rule: Cascading and Inheritance, Creating Style Sheets, CSS Selectors, CSS Comments, CSS Text Properties, CSS Colour Methods, Background Properties, Cursor Properties, CSS Table and List Properties, CSS Box Model, CSS Positioning, CSS Display Properties, CSS Float Properties.

UNIT-IV

Contact Hours: 10

Java Script and Document Object Model (DOM)

Introduction to JavaScript: History of JavaScript, Features of JavaScript, JavaScript basic programming: Variables, Operators, String manipulation, Control statements, Functions, Callback, JavaScript OOPs, Object, and Inheritance.

Working with HTML DOM: Finding HTML Elements, Changing HTML Elements, Adding and Deleting Elements, Adding Events Handlers.

Text Books:

1. Jon Duckett, *HTML and CSS: Design and Build Webs*, Wiley
2. Julie Meloni, *HTML, CSS and JavaScript All in One*, Sams Teach Yourself: Covering HTML5, CSS3, and jQuery, Sams Publishing.

Reference Books:

1. Raj Kamal, *Internet and Web Technologies*, Tata McGrawHill.

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

2. Ramesh Bangia, *Multimedia and Web Technology*, Firewall Media.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-174A	Web Technology Lab (Pre-requisite: HTML, CSS, JavaScript)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-174A.1	Apply basic and advanced HTML elements to design web pages
BCA-174A.2	Implement CSS properties to enhance the functionality of HTML page
BCA-174A.3	Utilize JavaScript basic concepts to create dynamic web pages
BCA-174A.4	Implement event handling features of JavaScript in designing dynamic web pages

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-174A.1	3	2	2	2	-	-	-	2	-	-
BCA-174A.2	3	2	2	2	2	2	-	2	2	2
BCA-174A.3	3	3	2	2	2	2	-	2	2	2
BCA-174A.4	3	3	3	3	2	2	-	2	2	2

List of Experiments

No.	Experiment Detail
1.	Design a web page to demonstrate various text formatting HTML tags.
2.	Create ordered and unordered lists to display items, such as a list of favorite movies or a to-do list.
3.	Design a simple resume page with sections for personal information, education, experience, and skills.
4.	Create a simple image gallery with captions using the tag
5.	Create a webpage with different section and demonstrate internal link.
6.	Create a table where some cells span multiple columns (using colspan) and rows (using rowspan).
7.	Develop a web page to demonstrate the use of the <iframe> tag to embed an external webpage within another HTML page
8.	Create registration form include different input types, radio buttons, checkboxes, and dropdown menus.
9.	Create a webpage and styling HTML Elements with CSS.
10.	Implement a CSS file and attach it to any 3 HTML webpages.
11.	Design a static website with HTML and CSS for a organization include pages like Home, About, Services, and Contact.
12.	Design a webpage with a form. Upon submission, a new page opens displaying "Message has been sent" in an alert box, ensuring user feedback and interaction.
13.	Create a Basic Calculator having add, subtract, multiply and division operators.
14.	Implement a JavaScript function to verify if a string reads the same forwards and backwards, ensuring efficient string manipulation.
15.	Create a 'to do' list (add and remove HTML Elements) with JavaScript by click event.

16.	Design an interactive image slider using JavaScript. Users can click buttons to navigate through images. JavaScript handles image changes dynamically, enhancing user engagement and showcasing practical DOM manipulation skills in web development.
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Text Books:

1. Jon Duckett, *HTML and CSS: Design and Build Webs*, Wiley
2. Julie Meloni, *HTML, CSS and JavaScript All in One*, Sams Teach Yourself: Covering HTML5, CSS3, and jQuery, Sams Publishing.

Reference Books:

1. Raj Kamal, *Internet and Web Technologies*, Tata McGrawHill.
2. Ramesh Bangia, *Multimedia and Web Technology*, Firewall Media.

Course Code	Course Title	L	T	P	Credits					
BCA-377A	Industrial Internship (Pre-requisite: None)	0	0	0	4					
		CIE	SEE	Total						
		100	-	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-377A.1	Examine and evaluate problems given by industry.									
BCA-377A.2	Learn professional skills such as teamwork, communication, and project management in an industry setting.									
BCA-377A.3	Employ industry-standard tools and technologies to successfully complete assigned tasks and projects.									
BCA-377A.4	Develop comprehensive documentation summarizing project outcomes, and detailing the skills acquired during the internship.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-377A.1	2	3	-	-	-	-	-	-	2	-
BCA-377A.2	2	-	-	3	3	3	2	3	3	2
BCA-377A.3	3	3	3	3	3	2	-	2	3	3
BCA-277A.4	2	-	3	3	3	-	2	3	-	-

Guidelines for Industrial Training/ Internship: This course requires students to participate in professional employment-related activity or work experience or co-operative education activity with an entity external to the educational institution, normally under the supervision of an employee of an organization or an individual professional. A key aspect of the internship is induction into actual, formal, and organized work situation. Internship involves working with government or private industry, training or high-end educational organizations (such as IITs, etc.), business establishments, etc. to provide opportunities for students to actively engage in on-site experiential learning.

- a) The candidate shall be required to undergo industrial trainings /internships of the specified duration, provided in the Scheme of Studies and Examinations, in an industry/ business enterprise/ organization approved by the Head of the Department.
- b) If the concerned Department perceives any limitations from the industry to accommodate all the enrolled students, a student may be permitted to complete a skill-oriented e-content course (of sufficient duration) relevant to the industry or undertake a project-based / research project under the supervision of a faculty of a premier Institute (such as I.I.T., I.I.Sc.) with prior approval from the competent authority.
- c) The Training will be completed under the supervision of the officer (herein called Co. Training Supervisor) of the Company/ Organization under whose guidance and supervision the training was allotted to the candidate.
- d) A student can do industrial training/internship of 45-60 days duration during summer vacation after the 2nd or 4th semester before taking an exit or completing the degree programme in the respective discipline. It will be of 4 credits.
- e) If a student pursues 3 years UG Programme in respective discipline without taking Exit option, this internship (either done after 2nd or 4th semester) will be taken into account in 5th semester.
- f) If a student takes Exit after 2 years in UG Programme, this internship (either done after 2nd or 4th semester) will be taken into account in 4th semester.
- g) If a student takes Exit after 1 year in UG Programme, the mandatory internship done after 2nd semester will be taken into account in 2nd semester.
- h) However, for those students who have taken lateral entry into the 3rd semester and have completed internship of 45-60 days duration during first year, the internship is not required after the 4th semester.

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- i) The candidates are required to submit a comprehensive report Training Supervisor within two weeks of completion of the training along with Co. Training Supervisor's Certificate in the beginning of the report stating that the report is an outcome of the work done by the candidate during his/her training.
- j) The viva-voce shall be held by Internal Examiner within two weeks after submission of the report.
- k) The Industrial Training/ Internship has only CIE component of 100 marks that shall be conducted as given in Table-1.

Table-1: Relative Weightages of Industrial Training/ Internship

Component	Description of the Component		Relative Weightage (Out of 100)
CIE	i)	Internship Synopsis Evaluation within 10 days of start of Internship	20
	ii)	Mid-Term Internship Evaluation	30
	iii)	Final Presentation and Internship Evaluation	50
	CIE Total		100
SEE	NIL		NIL
	Grand Total		100

**Syllabus of the Courses offered by other Departments
for
Bachelor of Computer Applications (DS)
Semester –II**

Course Code	Course Title	L	T	P	Credits
ASH-MAT-116A	Basics of Mathematics-II (Pre-requisite: Basics of Mathematics-I)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-MAT-116A.1	Understand the limit, and continuity of functions
ASH-MAT-116A.2	Understand the basic concepts of differentiation.
ASH-MAT-116A.3	Evaluate the Integration of algebraic and transcendental functions.
ASH-MAT-116A.4	Understand the basic concepts of Vector calculus including gradient, divergence and curl.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-MAT-116A.1	3	2	-	2	-	-	-	2	2	1
ASH-MAT-116A.2	3	2	1	2	-	-	-	2	2	2
ASH-MAT-116A.3	3	2	2	2	-	-	-	2	3	3
ASH-MAT-116A.4	3	2	2	2	-	-	-	2	3	3

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 8

Limit and Continuity

Limit and Continuity: Limit at a point, Properties of limit, Computation of limits of various types of functions, Continuity of a function at a point, Continuity over an Interval, Properties of continuous functions.

UNIT-II

Contact Hours: 7

Differentiation

Concept of Differentiation, Differentiation of simple, algebraic, trigonometric, logarithmic, and exponential functions, Differentiation of sum, difference, product and quotient of functions.

UNIT-III

Contact Hours: 8

Indefinite integrals

Indefinite integrals: Integration of algebraic, trigonometric, exponential and logarithmic functions, Methods of integration: by substitution and by parts.

UNIT-IV

Contact Hours: 7

Vector Calculus

Vector Calculus: Scalars, vectors, dot product and cross product of vectors, partial differentiation of scalar and vector point function, basic concepts of - gradient of scalar, divergence and curl of a vector.

Text Books:

1. S. C. Malik and Savita Arora, *Mathematical Analysis*, New Age Publication.
2. J. K. Thukral, *Business Mathematics*, the World Book Depot.
3. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, *Schaum's Outlines Vector Analysis*

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Reference Books:

1. A. Tussy, R. Gustafson and D. Koenig, *Basic Mathematics for College Students*, Brooks Cole
2. Shanti Narayan and P K Mittal, *Differential Calculus*, Sultan Chand & Co.
3. J. V. Dyke, J. Rogers and H. Adams, *Fundamentals of Mathematics*, Cengage Learning

Course Code	Course Title	L	T	P	Credits
BT-CE-104A	Environmental Studies (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BT-CE-104A.1	Understand the importance of environmental studies and natural resource.
BT-CE-104A.2	Illustrate the structure and functions of ecosystems, analyze biodiversity threats, and evaluate conservations.
BT-CE-104A.2	Evaluate the causes, effects, and control measures of environmental pollution, solid waste management and disaster management.
BT-CE-104A.3	Discuss the emerging environmental issues and environmental pollution act.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BT-CE-104A.1	-	2	-	1	-	-	2	2	-	-
BT-CE-104A.2	2	3	2	2	2	2	3	2	3	3
BT-CE-104A.2	2	3	3	2	2	2	3	2	2	2
BT-CE-104A.3	-	2	3	2	2	-	2	3	-	2

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 8

Introduction to environmental studies and Natural resources

Multidisciplinary nature of environmental studies: Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems. (a) Forest Resources: Use and over-exploitation, deforestation, case studies. (b) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. (c) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.

UNIT-II

Contact Hours: 8

Ecosystem, Biodiversity and Conservation

Ecosystem: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Food Chains, food webs.

Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity, Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

UNIT-III

Contact Hours: 8

Environmental pollution, Solid waste management, and Disaster management

Environmental Pollution: Definition, Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution. Visit to a local polluted site- Urban /Rural/Industrial/Agricultural. (Field work equal to 5 lecture hours).

Solid waste management: cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, E- waste management, plastic waste.

Disaster management: Natural: floods, earthquake, cyclone and landslides etc. Man-made Disaster: Fire, industrial pollution, nuclear disaster, biological Disaster, Disaster preparedness plans.

Emerging Issues and Environment Protection Act

Social Issues and the Environment: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns.

Environmental ethics-issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, Case studies, Concept of green building, carbon foot printing.

Environment Protection Act (Air,water, wildlife, forest), Environment and human health, Role of Information Technology in Environment and Human Health, Case Studies. Emerging technologies for Environmental management.

Text Books:

1. Deswal and Deswal, *Environmental Studies*, Dhanpat Rai & Co.
2. Anandan, P. and Kumaravelan, R., *Environmental Science & Engineering*, Scitech Publications (India) Pvt. Ltd.
3. Bharucha, E., *A Textbook of Environmental Studies for Undergraduate Courses*, Orient Blackswan Pvt. Ltd.

Reference Books:

1. Daniels Ranjit R. J. and Krishnaswamy, *Environmental Studies*, Wiley India
2. Botkin and Keller, *Environmental Science*, Wiley
3. Joshi, P.C. and Joshi, N., *A Text Book of Environmental Science*, APH Publishing Corporation.
4. Basu, M. and Xavier Savarimuthu, S.J., *Fundamentals of Environmental Studies*, Cambridge University Press.

Course Code	Course Title	L	T	P	Credits					
ASH-HUM-118A	English Language and Communication-2 (Pre-requisite: English Language and Communication-1)	2	0	0	2					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
ASH-HUM-118A.1	Understand the basic concepts of English Grammar.									
ASH-HUM-118A.2	Use appropriate reading skills in professional communication.									
ASH-HUM-118A.3	Use appropriate writing styles in professional communication.									
ASH-HUM-118A.4	Apply interview and presentation skills.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-HUM-118A.1	2	2	-	-	2	2	2	2	-	2
ASH-HUM-118A.2	2	3	2	2	2	-	2	2	-	-
ASH-HUM-118A.3	2	2	2	2	3	2	2	3	2	2
ASH-HUM-118A.4	2	3	2	2	3	2	3	2	2	-

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 8

Basic Language Skills:

Basic Language Skills: Parts of Speech, Subject-Verb agreement, Articles, Transformation of Sentences (Simple, Compound, Complex) and Tenses..

UNIT-II

Contact Hours: 7

Reading Skills

Reading Skills: Reading with fluency and speed, Skimming and scanning, Identifying relevant information, Isolating fact from opinion, Understanding concepts and arguments, Identifying distinctive features of language (Passage should be of 250-350 words of Level I. The passage may be taken from literary/scientific/technical writing as well as from the fields of journalism, management and commerce.)

UNIT-III

Contact Hours: 8

Writing Skills

Writing Skills (Formal Correspondence): Letters, Job Application Letter, Statement of Purpose, Request for Recommendation Letter, Request for information under Right to Information Act (RTI)

Writing Skills: Essay, Expository, Persuasive, Analytical and Reflective/Descriptive

UNIT-IV

Contact Hours: 7

Interview and Presentation skills

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview

Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

Text Books:

1. Bellare, Nirmala. *Reading Strategies. Vols. 1 and 2.* New Delhi. Oxford University Press.
2. Brown, Ralph, *Making Business Writing Happen: A Simple and Effective Guide to Writing Well,* Allen and Unwin, Sydney.

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3. Hamp-Lyons, Liz and Ben Heasley, *Study Writing: A Course in Writing Skills for Academic Purposes*, Cambridge University Press

Reference Books:

1. Jakeman, Vanessa and Clare McDowell. *Cambridge Practice Test for IELTS 1*, Cambridge University Press.
2. Mohan Krishna and Banerji, Meera, *Developing Communication Skills*, Macmillan India, New Delhi
3. Mohan Krishna and Singh, N. P., *Speaking English Effectively*, Macmillan India, New Delhi.
4. Savage, Alice, *Effective Academic Writing*, Oxford University Press.

Webliography:

1. <https://www.onestopenglish.com/>
2. <https://www.britishcouncil.org/learning-learn-english.htm>
3. <http://www.teachingenglish.org.uk>
4. <https://www.usingenglish.com?>
5. <https://www.bbc.co.uk/>
6. <https://www.pearsoned.co.uk/AboutUs/ELT/>
7. <https://www.howisay.com/>
8. <https://www.thefreedictionary.com/>
9. [Online English Grammar Book | ENGLISH PAGE](#)

Course Code	Course Title	L	T	P	Credits
ASH-HUM-119A	Indian Knowledge System (Pre-requisite: None)	2	0	0	2
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-HUM-119A.1	Identify the concept and importance of Traditional knowledge.
ASH-HUM-119A.2	Illustrate the various enactments related to the protection of traditional knowledge.
ASH-HUM-119A.3	Interpret the concepts of Intellectual property to protect the traditional knowledge.
ASH-HUM-119A.4	Explain the importance of Traditional knowledge in Agriculture and Medicine.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-HUM-119A.1	-	2	2	-	-	1	3	2	-	-
ASH-HUM-119A.2	-	2	2	-	-	1	3	2	-	-
ASH-HUM-119A.3	-	2	2	-	2	2	3	2	-	-
ASH-HUM-119A.4	-	2	3	-	2	2	3	2	-	-

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 8

Introduction and Protection to Traditional Knowledge

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge versus western knowledge traditional knowledge.

The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-II

Contact Hours: 7

Legal framework and Traditional Knowledge

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill.

UNIT-III

Contact Hours: 8

Traditional knowledge and intellectual property

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-IV

Contact Hours: 7

Traditional Knowledge in Different Sectors

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

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Text Books:

1. Amit Jha, *Traditional Knowledge System in India*, Atlantic publishers, 2002.
2. Kapil Kapoor, Michel Danino, *Knowledge Traditions and Practices of India*, Central Board of Secondary Education, Delhi
3. Dr. Rohidas Nitonde, *Introduction to Indian Knowledge System: A Textbook for UG Students as per NEP 2020*, Notion Press

Reference Books:

1. B. Mahadevan, Vinayak Rajat Bhat, and Nagendra Pavana R.N., *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning

Online Videos Tutorials:

1. <https://www.youtube.com/watch?v=LZP1StpYEPM>
2. <http://nptel.ac.in/courses/121106003/>

Bachelor of Computer Applications (Data Science) Semester–III

Course Code	Course Title	L	T	P	Credits					
BCA-112A	Data Structures using C++ (Pre-requisite: C Programming)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-112A.1	Understand the fundamentals of Object-Oriented Programming (OOP) in C++									
BCA-112A.2	Explore the Data Structures concepts and operations of Arrays and Strings									
BCA-112A.3	Examine the features and operations of Stack and Queue data structure.									
BCA-112A.4	Implement searching and sorting algorithms and linked lists operations.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-112A.1	3	2	2	-	-	-	-	2	-	1
BCA-112A.2	3	2	2	2	-	-	-	2	-	2
BCA-112A.3	3	3	2	3	2	-	-	2	2	2
BCA-112A.4	3	3	3	3	-	2	-	2	2	2

Course Contents:

UNIT-I

Contact Hours: 10

Object-Oriented Programming concepts

Object-Oriented Programming: Object-Oriented programming features and benefits. Object-Oriented features of C++, Class and Objects, Data Hiding & Encapsulation, Structures, Data members and Member functions, Scope resolution operator and its significance, Accessing Members of Class and Structure, Passing and Returning Objects to Functions.

UNIT-II

Contact Hours: 11

Introduction to Data Structures and Arrays

Basic data Structure: Introduction to Data Structures, algorithms and Pseudo code, Types of Data Structures, Relationship among data, data structures, and algorithms, Abstract Data Types, Analysis of Algorithms, asymptotic notations, asymptotic analysis.

Arrays, Representation of Arrays in Memory, Operations on Array (Traversing, Insertion, Deletion), Strings and its Representation in Memory, Operations on Strings (length, reverse).

UNIT-III

Contact Hours: 12

Stacks and Queues

Stacks: Introduction, Representation of Stacks Using Sequential Organization (Arrays), Applications of Stack, Expression Evaluation and Conversion, Polish notation and expression conversion, Processing of Function Calls, Reversing a String with a Stack, Recursion. Stack Abstract Data Type

Queues: Concept of Queues, Realization of Queues Using Arrays, Circular Queue, Multi-queues, Dequeue, Priority Queue, Applications of Queues, Queue as Abstract Data Type

UNIT-IV

Contact Hours: 12

Linked Lists, Searching and Sorting techniques

Linked Lists: Introduction, Types (singly, double, circular, circular double) and Operations (Insertion, Deletion, Traversal, Searching, Sorting), Applications.

Searching and Sorting: Search Techniques-Linear Search, Binary Search, Sorting Techniques- Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Comparison of Sorting Methods

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Text Books:

1. Michael T. Goodrich, R. Tamassia and Mount, *Data structures and Algorithms in C++*, John Wiley and Sons.
2. Mark Allen Weiss, *Data structures and Algorithm Analysis in C++*, Pearson Education.
3. Robert L. Kruse and A.J. Ryba, *Data Structures and Program Design in C++*, Prentice Hall, Inc., NJ
4. Herbert Schildt, *C++ The Complete Reference*, Tata McGraw-Hill

Reference Books:

1. Narasimha Karamanchi, *Data Structures and Algorithms Made Easy*, CareerMonk Publications
2. Adam Drozdek, *Data Structures and Algorithms in C++*, Course Technology.
3. Balaguruswami, E., *Object Oriented Programming In C++*, Tata McGraw-Hill.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-271A	Data Structures using C++ Lab (Pre-requisite: C++)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-271A.1	Design and implementation of various operations on arrays in C++.
BCA-271A.2	Implement various operations on Linked lists.
BCA-271A.3	Apply various operations on stack and queue data structures.
BCA-271A.4	Implement searching and sorting techniques in C++.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-271A.1	3	2	2	2	-	-	-	2	-	-
BCA-271A.2	3	2	2	2	2	-	-	2	-	2
BCA-271A.3	3	3	3	2	2	-	-	2	2	2
BCA-271A.4	3	3	3	2	-	2	2	2	2	2

List of Experiments

No.	Experiment Detail
1.	Write a program to remove the duplicates from an array.
2.	Write a program that prints a table indicating the number of occurrences of each alphabet in the text entered.
3.	Write a program that uses functions to perform the following operations on an array (a) Creation (b) Insertion (c) Deletion (d) Traversal.
4.	Write a program to implement simple Stack using array to perform the following operations: (a) Create (b) Peek (c) Push (d) Pop (e) Traverse
5.	Write a menu driven program that implements singly linked list for the following operations: (b) Creation (b) Insertion (c) Deletion (d) Traversal.
6.	Write a menu driven program that implements doubly linked list for the following operations: Create, Display, Insert, Delete, Search,
7.	Write a program to implement simple Stack using Link list to perform the following operations: (a) Create (b) Peek (c) Push (d) Pop (e) Traverse
8.	Write a program to implement simple Queue using array to perform the following operations: (a) Create (b) Enqueue (c) Dequeue (d) Traverse
9.	Write a program to implement circular Queue using array to perform the following operations: (a) Create (b) Enqueue (c) Dequeue (d) Traverse
10.	Write a program to search an elements in an array using linear search technique.
11.	Write a program to search an elements in an array using binary search technique.
12.	Write a program to sort the elements using Insertion Sort algorithm.
13.	Write a program to sort the elements using Bubble Sort algorithm.
14.	Write a program to sort the elements using Quick Sort algorithm.

15.	Write a program to sort the elements using Merge Sort algorithm.
16.	Write a program to sort the elements using Selection Sort algorithm.

Text Books:

1. Michael T. Goodrich, R. Tamassia and Mount, *Data structures and Algorithms in C++*, John Wiley and Sons.
2. Mark Allen Weiss, *Data structures and Algorithm Analysis in C++*, Pearson Education.
3. Robert L. Kruse and A.J. Ryba, *Data Structures and Program Design in C++*, Prentice Hall, Inc., NJ
4. Herbert Schildt, *C++ The Complete Reference*, Tata McGraw-Hill

Reference Books:

1. Narasimha Karamanchi, *Data Structures and Algorithms Made Easy*, CareerMonk Publications
2. Adam Drozdek, *Data Structures and Algorithms in C++*, Course Technology.
3. Balaguruswami, E., *Object Oriented Programming In C++*, Tata McGraw-Hill.

Course Code	Course Title	L	T	P	Credits					
BCA-203A	Database Management System (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-203A.1	Understand the fundamentals of DBMS, data models, schema architecture, and ER/EER design.									
BCA-203A.2	Apply SQL and PL/SQL concepts to create, query, and manage relational databases.									
BCA-203A.3	Understand normal forms and functional dependencies and apply normalization to database schemas.									
BCA-203A.4	Analyze transaction processing, concurrency control, and data warehousing concepts.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-203A.1	3	3	3	2	2	-	-	1	2	-
BCA-203A.2	3	2	2	3	2	2	-	2	2	3
BCA-203A.3	3	2	2	2	2	2	-	2	2	2
BCA-203A.4	3	3	2	3	2	-	-	2	3	3

Course Contents:

UNIT-I

Contact Hours: 11

Database and Database Management System

Introduction and need of Database and Database Management System (DBMS). Characteristics of DBMS, Database Users, Data Models, Schema, and Instances. Three-Schema architecture and data Independence.

Database Design using ER model: Entity types, Entity set, attributes and Keys. Relationship types. Expressing M:N relation. Enhanced Entity Relationship Model (EER): Specialization, Generalization, Attribute inheritance and Aggregation

UNIT-II

Contact Hours: 12

Relational model and Relational Algebra

Relational model concepts. Introduction to SQL, Types of SQL commands (DDL, DML, and DCL etc), SQL operators and their procedure, views and indexes. Queries and sub queries, Group by and Having clause, Aggregate functions and Constraints. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL.

Relational Algebra: Introduction of Relational Algebra, Selection and projection. Renaming, Joins, Unions, Intersection, Cartesian product and Division.

UNIT-III

Contact Hours: 10

Normalization

Need for Normalization, anomalies (insert, delete and update), Functional Dependencies, Minimal set of Functional Dependencies, Normal Forms: 1NF, 2NF, 3NF. Higher Level Normal Forms: Boyce/ Codd Normal Form, multi-valued dependency (MVD), Fourth Normal Form, Join dependencies and Fifth Normal Form.

UNIT-IV

Contact Hours: 12

Transaction processing, Overview of data mining and warehousing

Transaction Processing Concepts: Transaction and Schedules, transaction properties, concurrent execution of transaction, Conflict and View serializability, testing for serializability, concepts in Recoverable and Cascadeless schedules. Concurrency Control Techniques: Lock based protocols, Two phase locking technique, time stamp based protocols, validation based protocols.

Overview of data mining technology, Introduction of data warehousing, Characteristics of data warehouses.

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson
2. Ivan Bayross, *SQL, PL/SQL the Programming Language of Oracle*, BPB

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill
2. Markus Winand, *SQL Performance Explained*, Self Publishing
3. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw Hill

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-273A	Database Management System Lab (Pre-requisite: DBMS, PL/SQL)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-273A.1	Understand the fundamentals of ER design and map to relational model.
BCA-273A.2	Apply SQL and PL/SQL concepts to create, query, and manage relational databases.
BCA-273A.3	Perform pattern matching and other operations
BCA-273A.4	Implement selection, loop, exception, normalization and transaction processing concept in database using PL/SQL.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-273A.1	3	3	3	2	2	-	1	-	2	-
BCA-273A.2	3	2	2	2	2	2	-	-	2	3
BCA-273A.3	3	2	3	2	2	-	1	2	2	2
BCA-273A.4	2	3	2	3	3	2	-	2	3	3

List of Experiments

No.	Experiment Detail
1.	Design an ER diagram for a college database with students, departments, and courses.
2.	Convert the ER diagram into relational schema and identify primary, foreign keys.
3.	Create tables in a relational DBMS using SQL based on the ER schema.
4.	Execute basic SQL commands: DDL, DML, DCL on a sample database
5.	Demonstrate the use of Data Constraints.
6.	Write SQL queries using WHERE, BETWEEN, LIKE, IN, and ORDER BY.
7.	Use aggregate functions with GROUP BY and HAVING clauses.
8.	Demonstrate pattern matching and range searching functions.
9.	Demonstrate the use of ORACLE operators <ul style="list-style-type: none"> • Arithmetic operators • Comparison operators • Logical operators
10.	Demonstrate the use of DUAL table
11.	Demonstrate the use of INDEX in DBMS
12.	Perform different types of joins (INNER, OUTER).
13.	Write PL/SQL programs using variables, IF-THEN, loops, and exceptions.
14.	Identify anomalies and perform step-by-step normalization (1NF to 3NF) on a sample unnormalized relation.
15.	Demonstrate the concept of locking using a small transaction simulation.

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson
2. Ivan Bayross, *SQL, PL/SQL the Programming Language of Oracle*, BPB

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill
2. Markus Winand, *SQL Performance Explained*, Self Publishing
3. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw Hill

Course Code	Course Title	L	T	P	Credits					
BCA-221A	Introduction to Data Science (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-221A.1	Understand the scope, evolution, and real-world applications of data science, and explain the phases of a typical data science project.									
BCA-221A.2	Identify and evaluate data sources, collection methods, and data quality issues.									
BCA-221A.3	Explain data preprocessing, integration techniques, and storage models.									
BCA-221A.4	Apply data analysis concepts and principles of effective data visualization.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-221A.1	3	2	-	-	-	-	-	2	2	2
BCA-221A.2	2	3	2	3	2	2	2	2	2	2
BCA-221A.3	2	2	2	3	2	2	2	2	2	2
BCA-221A.4	2	3	2	3	2	2	-	3	3	2

Course Contents:

UNIT-I

Contact Hours: 12

Introduction to Data Science and Analysis

Definition and scope of Data Science, Historical evolution of the field, Importance of data-driven decision-making, Applications of Data Science, Healthcare (predicting diseases, patient data analysis), Finance (fraud detection, credit scoring), Phases of a Data Science Project: Business, Understanding Data Collection, Data Preparation, exploratory Data Analysis

UNIT-II

Contact Hours: 11

Data Collection Methods, Data Sources and Tools

Data Collection Methods (Surveys, Web Scraping, Sensors, Logs, APIs), Types of Data Sources (Databases, Data Warehouses, Open Data Repositories), Internal vs. External Data Sources, Metadata and Data Provenance, Data Quality Issues (Accuracy, Completeness, Consistency, Timeliness, Validity), Data Governance and Stewardship, Introduction to Big Data Ecosystems (Hadoop, Spark – Conceptual)

UNIT-III

Contact Hours: 12

Data pre-processing techniques and Data storage models

Data Cleaning (Missing Data, Outliers, Noise), Data Transformation (Normalization, Aggregation, Discretization), Data Integration and Fusion (Schema Integration, Redundancy Analysis), Data Reduction Techniques (Sampling, Dimensionality Reduction – Conceptual), Data Storage Models (Relational, NoSQL, Cloud Storage), Data Lifecycle Management (DLM)

UNIT-IV

Contact Hours: 10

Descriptive Analytics and Data visualization techniques

Descriptive Analytics, Inferential Analytics, Exploratory Data Analysis (EDA), Types of Variables, Scales of Measurement, Central Tendency (Mean, Median, Mode), Dispersion (Variance, Standard Deviation), Data Distributions, Principles of Data Visualization, Types of Charts (Bar, Line, Histogram, Scatter, Heatmap), Color Theory and Perception, Misleading Visualizations, Dashboard Design, Storytelling with Data, Data Ethics in Visualization

Text Books:

1. Foster Provost & Tom Fawcett, *Data Science for Business*, O'Reilly Media
2. EMC Education Services, *Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data*, Wiley
3. Cathy O'Neil & Rachel Schutt, *Doing Data Science*, O'Reilly Media

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4. David Stephenson, *Data Science for Executives: Leveraging Machine Intelligence to Drive Business ROI*, O'Reilly Media

Reference Books:

1. Kelleher, John D., & Brendan Tierney, *Data Science*, The MIT Press Essential Knowledge Series
2. Thomas H. Davenport & D.J. Patil, *Keeping Up with the Quants: Your Guide to Understanding and Using Analytics*, Harvard Business Review Press
3. V. K. Jain, *Data Science and Analytics*, Khanna Book Publishing
4. Davy Cielen, Arno D. B. Meysman & Mohamed Ali, *Introducing Data Science: Big Data, Machine Learning, and More*, Manning Publications

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits					
BCA-223A	Fundamentals of R Programming (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-223A.1	Understand the foundational concepts of R programming.									
BCA-223A.2	Implement control statements and operations on vectors, matrices, and arrays.									
BCA-223A.3	Apply operations on lists, data frames and perform data manipulation using packages and files.									
BCA-223A.4	Perform statistical data analysis and visualization using tables, charts, and regression techniques.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-223A.1	3	-	-	2	-	-	-	2	2	2
BCA-223A.2	3	3	3	2	-	-	-	3	3	2
BCA-223A.3	3	3	2	3	2	2	2	3	2	3
BCA-223A.4	3	3	2	3	2	3	2	3	3	2

Course Contents:

UNIT-I

Contact Hours: 11

Basics of R programming and Data structures

Introduction to Programming language, Overview of R Language and its Applications, Why to use R language, Difference between Python and R Language, introduction of IDE. Basic Data Types: numeric, character, logical, Integer, complex, Variables and Strings.

R-Operators: Arithmetic Operators, Logical Operators, Relational Operators, Assignment Operators.

Data Structures: Vectors, Lists, Data frames, Matrices, Arrays, Factors, Tibbles, Help Function NA and Null values, Using All and Any.

UNIT-II

Contact Hours: 12

Control statements, String, Vectors, and Matrices

Conditional statements: If Statement, If-Else Statement, Looping: While, Do-While, Functions and Recursions in R.

String in R: Various Types of Strings, Adding and Deleting Data into String. String Manipulation Functions.

Vectors in R: Types of Vectors, Operations on Vectors.

Matrices: Creating Matrices, Matrix Operations, Matrix Functions, Add, update and Delete Rows and Columns. Vector/Matrices Distinction, Introduction to array.

UNIT-III

Contact Hours: 10

List and Data Frames

List: Creating List, Operations on List, Accessing List Data, Functions on List, Recursive List, Various Operations in R using List, Matrix, Array.

Data Frames: Creating and Manipulating Data Frames, Operations on Data Frames in form of a Matrix, Subsetting and Indexing, Data Manipulation with "dplyr". Directly read Data-File

UNIT-IV

Contact Hours: 12

Data manipulation, visualization and Statistical methods

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Tables: Creating Table, Operation on Tables. Factors: Creating Factor, Functions used with Factors, operations on Factors.

Charts & Graphs: How to create PIE Chart, Bar Charts, Bar Plot, Line Graphs, Scatterplots, Histogram and Box Plot .

Statistics: Means, Median & Mode, Linear Regression, Multiple Regression, Logistic Regression

Text Books:

1. Crawley, M. J., *The R book*. John Wiley & Sons.
2. Gardener, M., *Beginning R: The statistical programming language*. John Wiley & Sons.
3. Aphalo, P. J., *Learn R: as a language*. Chapman and Hall/CRC.

Reference Books:

1. Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, Pearson Education.
2. Michael J. Crawley, *The R Book*, John Wiley & Sons
3. Brian S. Everitt, Torensten Hothorn, *A Handbook of Statistical Analyses using R*, CRC Press

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-291A	R Programming Lab (Pre-requisite: R language)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-291A.1	Understand the installation process and environment setup of R and RStudio
BCA-291A.2	Apply basic R programming constructs such as data types, lists, vectors, and operators
BCA-291A.3	Develop programs using control structures like loops and conditional statements in R
BCA-291A.4	Analyze and manipulate complex data structures like lists, vectors, and matrices and perform basic statistical analysis and data manipulation using R and its packages

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-291A.1	3	3	2	3	2	1	2	3	2	3
BCA-291A.2	3	3	3	3	2	2	1	3	3	2
BCA-291A.3	3	3	2	2	2	1	2	3	3	3
BCA-291A.4	3	3	2	3	2	2	1	3	3	2

List of Experiments

No.	Experiment Detail
1.	Write steps for the Installation of R and RStudio
2.	Write an R program to create list containing strings, numbers, vectors and logical value.
3.	Design a program to solve quadratic equation in R language.
4.	Calculate the sum of first 100 natural numbers by using the concept of loops .
5.	Write a program to calculate Even or Odd number by using the concept of control statement.
6.	Write an R program to find all elements of a given list that are not in another list.
7.	Write a program to convert list to vector, merging list.
8.	Write an R program to add 10 to each element of the first vector in the given list.
9.	Write a program for: Create a variable outside a function & use it inside the function. Create a variable inside a function & use it outside the function.
10.	Create a program to implement various operation on matrix.
11.	Write an R program to create data set & find mean, mode and median data set
12.	Write an R program to read and load data from larger data set.
13.	Write a program to create sample data in R and perform data manipulation
14.	Write a program to manipulate data with dplyr package and data.table package
15.	Write a program to create histogram, piechart & barchart from csv file.

Text Books:

1. Crawley, M. J., *The R book*. John Wiley & Sons.
2. Gardener, M., *Beginning R: The statistical programming language*. John Wiley & Sons.
3. Aphalo, P. J., *Learn R: as a language*. Chapman and Hall/CRC.

Reference Books:

1. Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, Pearson Education.
2. Michael J. Crawley, *The R Book*, John Wiley & Sons
3. Brian S. Everitt, Torsten Hothorn, *A Handbook of Statistical Analyses using R*, CRC Press

**Syllabus of the Courses offered by other Departments
for
Bachelor of Computer Applications (DS)
Semester –III**

Course Code	Course Title	L	T	P	Credits
ASH-MAT-215A	Probability and Statistics (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

ASH-MAT-215A.1	Understand fundamental of central measures.
ASH-MAT-215A.2	Apply the concept of correlation and regression
ASH-MAT-215A.3	Understand and apply the concept of probability, probability distributions.
ASH-MAT-215A.4	Apply the concept of population, sampling and hypothesis testing.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
ASH-MAT-215A.1	3	2	-	-	-	-	-	2	2	2
ASH-MAT-215A.2	3	3	2	2	-	-	-	2	3	2
ASH-MAT-215A.3	3	3	3	2	-	-	-	2	3	2
ASH-MAT-215A.4	3	3	2	2	-	2	-	2	3	2

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Contact Hours: 12

Basic concepts of Statistics, Measures of Central Tendency and Dispersion

Basic concepts of Statistics: Definition of statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data (histogram, bar chart, pie chart, ogives).

Measures of Central Tendency: Definition, properties, calculation and comparison of Arithmetic Mean, Median, Mode. Introduction to Geometric Mean and Harmonic Mean.

Measures of Dispersion: Definition, calculation, merit and demerit of Range, Mean Deviation, Quartile Deviation, Variance and Standard Deviation.

UNIT-II

Contact Hours: 10

Correlation and Regression

Correlation: Definition, types of correlation (positive, negative, zero), scatter diagram, measurement of correlation using Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient (including calculation and interpretation).

Regression: Linear regression, fitting a linear regression equation using the least squares method, and interpretation.

UNIT-III

Contact Hours: 12

Concepts of Probability, Random Variables and Probability Distributions

Concepts of probability: Experiment and sample space, events (simple, compound) operations with events (union, intersection, complements), definition of probability of an event (classical, empirical, axiomatic), basic probability rules (addition, multiplication), applications of probability rules, conditional probability, Bayes' Theorem (statement only).

Random Variables: Definition of discrete and continuous random variable, probability distribution of a random variable, mean (expected value) and variance of a random variable.

Probability Distributions: Discrete: Binomial distribution (definition, properties without proof and applications), Poisson distribution (definition, properties without proof and applications) Continuous: Normal distribution (definition, properties without proof), applications, standard and normal distribution.

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Sampling Distribution, Statistical Inference, and Hypothesis Testing

Sampling Distribution: Concept of population and sample, types of sampling (random, cluster, multi-stage sampling – basic concepts only).

Statistical Inference: Introduction to estimation and hypothesis testing (null and alternative hypothesis – conceptual understanding only).

Hypothesis Testing for a Single Population: Concept of hypothesis testing, tests involving a population mean and population proportion (z-test and t-test). Chi-square test for independence of attributes and goodness of fit

Text Books:

1. Manish Sharma, Amit Gupta, *The Practice of Business Statistics*, Khanna Book Publishing Company
2. Das N. G., *Statistical Methods*, Combined Edition, Tata McGraw Hill
3. Ross Sheldon M., *Introduction to Probability and Statistics for Engineers and Scientists*, Elsevier
4. Miller Irwin and Miller Marylees, *Mathematical Statistics with Applications*, Pearson Education

Other References:

1. Pal Nabendu and Sarkar Sahadeb, *Statistics: Concepts and Applications*, Second Edition, PHI
2. Montgomery Douglas and Runger George C., *Applied Statistics and Probability for Engineers*, Wiley.
3. Reena Garg, *Engineering Mathematics*, Khanna Publishing House

Course Code	Course Title	L	T	P	Credits
BBA-217A	Personality Development	2	0	0	2
		CIE	SEE		Total
		40	60	100	

Course Outcomes

CO1	To understand the various aspects of personality development.
CO2	To learn the importance of positive attitude.
CO3	To build the employability quotient among students.
CO4	To understand the techniques of self-management.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	-	-	3	-	-	-	2	-	1
CO2	2	1	-	2	-	-	-	3	1	1
CO3	2	1	2	3	2	-	-	2	2	2
CO4	3	2	-	2	1	3	3	3	1	2

Course Outline

Unit Number: 1	Introduction to Personality Development	Contact Hours:7
Personality Development: Motivation, Positive Attitude and Confidence Building Techniques; Personal Grooming and Hygiene: Defining Strengths, Formal and Informal Presentation of Self, Situational Conversations, Teamwork and Collaboration, Conflict Resolution, Networking Skills		
Unit Number: 2	Attitude & Motivation	Contact Hours:8
Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation		
Unit Number: 3	Employability Quotient	Contact Hours:7
Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.		
Unit Number: 4	Other Aspects of Personality Development	Contact Hours:8
Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics – Good manners and etiquette.		

Text Books:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition: Prentice Hall.

Reference Books

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003

Bachelor of Computer Applications (Data Science) Semester–IV

Course Code	Course Title	L	T	P	Credits					
BCA-222A	Statistical Foundation for Data Science (Pre-requisite: Basic math concepts)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-222A.1	Understand statistical concepts like measures of central tendency, dispersion & graphs.									
BCA-222A.2	Apply probability rules and distributions to solve problems involving random variables.									
BCA-222A.3	Analyze data using sampling, estimation, and hypothesis testing techniques.									
BCA-222A.4	Evaluate and interpret relationships between variables using regression and correlation.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-222A.1	3	2	-	2	-	-	-	2	2	2
BCA-222A.2	3	3	2	2	-	-	-	2	3	3
BCA-222A.3	3	3	3	2	2	-	-	2	3	3
BCA-222A.4	2	3	3	2	2	2	-	2	3	3

Course Contents:

UNIT-I

Contact Hours: 12

Introduction to Statistics

Introduction to Statistics: Types (Descriptive vs. Inferential), Scales of Measurement: Nominal, Ordinal, Interval, Ratio, Measures of Central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Variance, Standard Deviation, IQR, Frequency Distributions and Graphical Representation: Histogram, Boxplot

UNIT-II

Contact Hours: 11

Basic Probability Concepts

Basic Probability Concepts: Experiment, Sample Space, Events, Rules of Probability, Conditional Probability and Bayes' Theorem, Random Variables: Discrete vs. Continuous, Probability Distributions: Discrete: Binomial, Poisson, Continuous: Normal Distribution, Expectation and Variance of Random Variables.

UNIT-III

Contact Hours: 12

Sampling Techniques

Concept of Sampling and Sampling Techniques, Sampling Distribution and Central Limit Theorem Estimation: Point Estimation and Confidence Intervals, Hypothesis Testing: Null and Alternative Hypotheses. Type I and Type II Errors, p-value and Statistical Significance, t-test and z-test (1-sample, 2-sample).

UNIT-IV

Contact Hours: 10

Correlation and Regression

Correlation: Pearson and Spearman Correlation Coefficients, Simple Linear Regression: Regression Line Coefficient of Determination (R^2), Residual Analysis, Introduction to Multiple Linear Regression (conceptual only), Chi-Square Test for Independence and Goodness of Fit.

Text Books:

1. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons
2. David S. Moore and George P. McCabe, *Introduction to the Practice of Statistics*, W. H. Freeman & Co Ltd.
3. Peter Bruce and Andrew Bruce, *Practical Statistics for Data Scientists*, Shroff/O'Reilly

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Reference Books:

1. Paul Newbold, William Carlson, Betty Thorne, *Statistics for Business and Economics*, Pearson
2. Ronald E. Walpole, *Probability and Statistics for Engineers and Scientists*, Pearson
3. Andy Field, Jeremy Miles, Zoë Field, *Understanding Statistics Using R*, SAGE Publications India Pvt Ltd.
4. Richard A. Johnson and Dean W. Wichern, *Applied Multivariate Statistical Analysis*, Pearson
5. Allen B. Downey, *Think Stats: Exploratory Data Analysis*, Shroff/O'Reilly

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits					
BCA-224A	Data Mining and Warehousing (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-224A.1	Understand core concepts and architecture of data warehousing.									
BCA-224A.2	Demonstrate various data pre-processing techniques.									
BCA-224A.3	Analyze clustering techniques and similarity models for effective data grouping and pattern recognition.									
BCA-224A.4	Implement classification techniques and association rule mining algorithms, and evaluate their performance.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-224A.1	2	2	-	2	-	-	-	2	2	2
BCA-224A.2	2	3	2	3	-	-	-	2	3	2
BCA-224A.3	3	2	3	3	2	2	2	3	3	3
BCA-224A.4	3	2	3	3	3	3	2	3	3	3

Course Contents:

UNIT-I

Contact Hours: 12

Basics of Data Warehousing

Data Warehouse: Basic concepts, The Data Warehouse - A Brief History, Characteristics, Difference between Operational Database Systems and Data Warehouse, Architecture for a Data Warehouse, Fact and Dimension Tables, Data Warehouse Schemas, Data Cube : A Multidimensional Data Model, Data Cube Computation Methods, Typical OLAP Operations.

UNIT-II

Contact Hours: 11

Data Mining and Pre-processing

Data Mining: Introduction: Motivation, Importance, Knowledge Discovery Process, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues, Data Objects and Attribute Types. Data Preprocessing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-III

Contact Hours: 12

Clustering Techniques

Data Mining Classical Techniques: Statistics – Similarity Models, Steps for Designing Similarity Models, Table Lookup Model. Clustering- Requirement for Cluster Analysis, Clustering Methods- Partitioning Methods, Hierarchical Methods, Density-Based Methods, Evaluation of Clustering. Nearest Neighborhood- Memory Based Reasoning.

UNIT-IV

Contact Hours: 10

Classification and Association Rules Techniques

Decision Tree- Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining- Market Basket Analysis, Frequent Itemset Mining using Apriori Algorithm, Improving the Efficiency of Apriori, Neural Network- Bayesian Belief Networks, Classification by Backpropagation. Data Mining Applications, Data Mining Trends and Tools.

Text Books:

1. J Hanes, M. Kamber, *Data Mining Concepts and Techniques*, Elsevier India.
2. G.S. Linoff, M.J.A. Berry, *Data Mining Techniques*, Wiley India Pvt. Ltd.
3. Acharya, *Data Analytics Using R*, McGraw Hill Education (India) Private Limited

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Reference Books:

1. A. Berson, S.J. Smith, *Data Warehousing, Data Mining & OLAP*, Tata McGraw- Hill.
2. Jared P. Lander, *R For Everyone*, Pearson India Education Services Pvt. Ltd.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-292A	Data Mining and Warehousing Lab (Pre-requisite: R/Python)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-292A.1	Implement Data Pre-processing and Visualization on datasets
BCA-292A.2	Implement Data Clustering techniques
BCA-292A.3	Apply Data Clustering Techniques
BCA-292A.4	Implement Association Rules and Neural network.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-292A.1	2	2	-	2	-	-	-	2	2	2
BCA-292A.2	2	3	3	3	2	2	-	2	3	2
BCA-292A.3	3	3	3	3	2	2	2	3	3	3
BCA-292A.4	3	2	3	3	3	3	2	3	3	3

List of Experiments

No.	Experiment Detail
1.	Implement Data cleaning techniques on any raw data set
2.	Implement Data reduction techniques on any raw data set
3.	Implement Data manipulation on CVS files: <ul style="list-style-type: none"> Filtering Aggregation Summarization etc.
4.	Perform following Data visualization: <ul style="list-style-type: none"> Histograms Dot plots Bar plots Line charts Pie Charts Box Plots Scatter plots etc.
5.	Implement hierarchical clustering technique.
6.	Implement k-Nearest Neighbours (KNN) classification algorithm.
7.	Implement Density-Based clustering technique.
8.	Implement the decision tree classification algorithm.
9.	Implement Apriori Algorithm for Frequent Itemset Mining
10.	Implement Neural Network

Text Books:

1. J Hanes, M. Kamber, *Data Mining Concepts and Techniques*, Elsevier India.

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

2. G.S. Linoff, M.J.A. Berry, *Data Mining Techniques*, Wiley India Pvt. Ltd.
3. Acharya, *Data Analytics Using R*, McGraw Hill Education (India) Private Limited

Reference Books:

1. A. Berson, S.J. Smith, *Data Warehousing, Data Mining & OLAP*, Tata McGraw- Hill.
2. Jared P. Lander, *R For Everyone*, Pearson India Education Services Pvt. Ltd.

Course Code	Course Title	L	T	P	Credits					
BCA-226A	Data Visualization using Python (Pre-requisite: None)	3	0	0	3					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-226A.1	Build a solid foundation in Python by mastering core programming concepts									
BCA-226A.2	Perform efficient data manipulation and analysis using NumPy and Pandas libraries.									
BCA-226A.3	Visualize data using Matplotlib with customized plots and data from various sources.									
BCA-226A.4	Implement Data visualizations using Seaborn integrated with Pandas.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-226A.1	3	2	3	2	-	-	-	2	2	2
BCA-226A.2	3	2	3	3	2	2	2	2	3	3
BCA-226A.3	3	2	2	3	2	2	-	2	2	2
BCA-226A.4	3	2	2	3	2	2	-	2	2	2

Course Contents:

UNIT-I

Contact Hours: 12

Python Fundamentals

Python Fundamentals - Introduction to Python, Variables, Data Types, Operators, Control Flow (if-else, loops), Functions, Object-Oriented Programming (OOP) concepts- class, encapsulation, 'self' keyword, inheritance, polymorphism, Modules and Packages – creating and using module, accessing modules from a package and built-in vs. user-defined modules.

UNIT-II

Contact Hours: 11

Manipulation with NumPy and Pandas

Manipulation with NumPy and Pandas - Array operations using NumPy (Arithmetic, Logical, Slicing, Indexing), Pandas Data Structures – Series: Creating, Indexing, slicing, Arithmetic operations, Statistical operations, conditional filtering, Update, modify, check for Null values, sorting and ranking. Data Frames: Creating, viewing data, statistical operations, accessing columns and rows, filtering, adding and modifying, deleting rows and columns, sorting, aggregation and grouping, merging and joining, and handling missing data.

UNIT-III

Contact Hours: 12

Data Visualization with Matplotlib

Data Visualization with Matplotlib - Basic Plotting (Line, Bar, Scatter, Histograms), Customizing Plots (Labels, Titles, Colors), Subplots, Multiple Axes (Subplots), Annotations, Styling with Themes and Grids. Data Loading and Reading from various sources (CSV, Excel, Databases)

UNIT-IV

Contact Hours: 10

Data Visualization with Seaborn

Data Visualization with Seaborn - Seaborn vs Matplotlib, Integration with Pandas, Basic Plotting Concepts - Distribution Plots (Histogram, Box Plot, and Violin Plot), Categorical Plots (Bar Plot, Count Plot, and Strip Plot), Scatter Plots & Relationships (Scatter Plot, Line Plot, and Relational Plot), Heatmaps (Correlation Heatmap, Pair Plot, and Facet Grid), and Style & Themes.

Text Books:

1. Reema Thareja, *Data Science and Machine Learning using Python*, Mc Graw Hill
2. Bharti Motwani, *Data Analytics using Python*, Wiley
3. Rituraj Dixit, *Data Analytics using Python*, BPB

Reference Books:

1. Anil Maheshwari, *Data Analytics*, Mc Graw Hill
2. William McKinney, *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*, O'Reilly

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Course Code	Course Title	L	T	P	Credits
BCA-294A	Data Visualization using Python Lab (Pre-requisite: Python)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-294A.1	Implement the fundamental concepts of Python.
BCA-294A.2	Develop expertise in manipulating and analyzing structured data effectively using NumPy and Pandas.
BCA-294A.3	Apply data visualizations concepts using Matplotlib.
BCA-294A.4	Implement advanced visualizations with Seaborn, including distribution, categorical, relational plots, and heatmaps

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-294A.1	3	2	3	2	-	-	-	2	2	2
BCA-294A.2	3	3	3	3	2	2	2	2	3	3
BCA-294A.3	2	2	2	3	2	2	-	2	2	2
BCA-294A.4	2	2	2	3	2	2	-	2	2	2

List of Experiments

No.	Experiment Detail
1.	Prime Number Checker Write a function is_prime(num) that: 1. Returns True if the number is prime, False otherwise 2. Use it in a loop to find all prime numbers from 1 to 100
2.	Bank Account Class with Encapsulation 1. Create a class BankAccount 2. It should have private attributes: __balance 3. Methods: deposit(amount), withdraw(amount), get_balance() 4. Use self to refer to instance variables
3.	Inheritance Example: Person and Student 1. Create a base class Person with name and age 2. Inherit a class Student that adds grade attribute 3. Method display_info() to print details
4.	Shapes Area Calculator 1. Create a base class Shape with method area() 2. Create derived classes Rectangle and Circle 3. Override the area() method in both
5.	Basic Array Creation and Operations using NumPy: 1. Slicing and Indexing 2. 2D Array and Logical Operations
6.	To track sales for the week using a pandas.Series. Perform operations on following data:

	<pre>sales = pd.Series([250, 300, np.nan, 400, 380, 500, 450], index=['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday'])</pre> <ol style="list-style-type: none"> 1. Creating the series 2. Indexing and slicing 3. Arithmetic operations 4. Statistical analysis 5. Filtering 6. Updating values 7. Checking for missing values
7.	<p>Student Performance Tracker: Create a DataFrame with student data</p> <pre>data = { 'Name': ['Alice', 'Bob', 'Charlie', 'David', 'Eva'], 'Math': [85, 78, 92, np.nan, 74], 'Science': [90, 88, np.nan, 84, 76], 'English': [78, 72, 88, 80, 82], 'Class': ['10A', '10B', '10A', '10B', '10A'] }</pre> <p>Using student performance data perform followings:</p> <ol style="list-style-type: none"> 1. View, modify, and filter data 2. Perform basic statistics 3. Sort and rank students 4. Handle missing scores
8.	<p>Create Flipkart E-Commerce Sales Analysis project using given dataset and compute</p> <ol style="list-style-type: none"> 1. Top Performing Products and Brands 2. Discount Analysis 3. Customer Activity by Time 4. Price Trends Over Months <p>https://www.kaggle.com/datasets/mansithummar67/flipkart-product-review-dataset</p>
9.	<p>Create Basic Line Plot using matplotlib for $x = [1, 2, 3, 4, 5]$ $y = [10, 12, 8, 15, 18]$ and perform following:</p> <ol style="list-style-type: none"> 1. Line with Markers & Style 2. Multiple Lines in One Plot 3. Changing Axis Limits & Ticks 4. Annotating Points 5. Subplots with Line Plots 6. Filled Area Under Line
10.	<p>Design a Bar Plot – Comparing Values for Sales by Product Category using matplotlib for data categories = ['Electronics', 'Clothing', 'Books', 'Toys'] sales = [15000, 12000, 5000, 8000]</p>

	and Design a Histogram – Value Distribution for Distribution of Exam Scores using data scores = [55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 72, 84, 68, 79, 91]
11.	Design a Pie Chart – Proportional Data for Market Share of Smartphone Brands using matplotlib for data brands = ['Apple', 'Samsung', 'Xiaomi', 'Others'] market_share = [30, 25, 20, 25]
12.	Learn to Customize Plots using simple sale dataset for matplotlib days = ['Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat', 'Sun'] sales = [200, 250, 180, 300, 400, 350, 500] and visualize 1. Plot with custom figure size 2. Plot with custom color, style, marker 3. Title and axis labels with custom font sizes and styles 4. Add grid with custom style 5. Add legend with custom location and font 6. Annotate a specific point and 7. Add background color
13.	Visualizing for the Iris Dataset 1. Pair Plot 2. Distribution of Variables with Histograms and KDE 3. Heatmap to visualize the correlation matrix
14.	Seaborn's categorical plots using Titanic (Passenger Info) dataset 1. Bar plot to visualize mean survival rate per class 2. Count plot for gender breakdown, colored by survival 3. Strip plot for ages of passengers in each class
15.	Visualize for flights dataset 1. Line plots (to show trends over time) 2. Scatter plots (month vs passengers) 3. Relational plots (multivariate views with hue/style)
16	Design plotting for “tips” Dataset 1. Histogram and KDE for 'total_bill' 2. Box plot showing the distribution of 'tip' by 'day' using “tips” Dataset 3. Facet grid to compare the distribution of tips by time and day using “tips” Dataset

Text Books:

1. Reema Thareja, *Data Science and Machine Learning using Python*, Mc Graw Hill
2. Bharti Motwani, *Data Analytics using Python*, Wiley
3. Rituraj Dixit, *Data Analytics using Python*, BPB

Reference Books:

1. Anil Maheshwari, *Data Analytics*, Mc Graw Hill
2. William McKinney, *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*, O'Reilly

Course Code	Course Title	L	T	P	Credits					
BCA-202A	Quantitative Aptitude (Pre-requisite: Basic math)	2	0	0	2					
		CIE	SEE	Total						
		40	60	100						
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-202A.1	Explain the concepts of linear and quadratic equations, and apply them to solve problems involving ages and clocks.									
BCA-202A.2	Apply mathematical concepts to solve problems related to time-distance, work-time, and work-wages.									
BCA-202A.3	Solve problems related to interest, partnership, sets, and trigonometric ratios.									
BCA-202A.4	Apply the concept of measures of central tendencies, permutations and combinations, probability, and data interpretation.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-202A.1	3	-	-	-	-	-	-	2	-	-
BCA-202A.2	3	2	3	-	-	-	-	3	2	2
BCA-202A.3	3	2	3	-	2	-	-	3	-	2
BCA-202A.4	3	2	3	-	-	-	-	3	3	3

Course Contents:

UNIT-I

Contact Hours: 8

System of algebraic equations, Ages and Clocks problems

Linear Equations, Quadratic equations, System of algebraic equations in two variables and their applications in simple problems. Problems on ages, Clocks.

UNIT-II

Contact Hours: 7

Time and distance, Work and Time problems

Time and distance: Problems based on trains, Boats and Streams, Pipes and Cistern. Work and time: Problems on work and time, work and wages.

UNIT-III

Contact Hours: 7

Interest, Partnership, Sets, Height and Distance problems

Simple interest, Compound Interest, Partnership. Basic idea of set theory to solve practical problems. Trigonometric ratios and identities, Height and distance.

UNIT-IV

Contact Hours: 8

Permutations and Combinations, Data interpretation

Basic idea of Permutations and Combinations. Events and sample space, Probability. Data interpretation: Raw and grouped data, Bar Graph, Pie Chart, Mean, Median and Mode.

Text Books:

1. R. S. Aggarwal, *Quantitative Aptitude*, S. Chand & Company Limited, New Delhi
2. A. Guha. *Quantitative Aptitude*, 7th Edition, McGraw-Hill Publications

Reference Books:

1. A.S. Tussy, R. D. Gustafson and D. Koenig, *Basic Mathematics for College Students*, Brooks Cole
2. C. C. Pinter, *A Book of Set Theory*, Dover Publications
3. V. Dyke, J. Rogers and H. Adams, *Fundamentals of Mathematics*, Cengage Learning

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by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.

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Course Code	Course Title	L	T	P	Credits
BCA-215A	Full Stack Development-I (MERN) (Pre-requisite: Web Technology (HTML, CSS, JavaScript))	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-215A.1	Understand the core concepts of the MERN stack, including React.js, Express.js, Node.js, and MongoDB.
BCA-215A.2	Develop front-end applications using React.js, including state management and component-based architecture.
BCA-215A.3	Build RESTful APIs with Express.js and integrate MongoDB for backend data storage and retrieval.
BCA-215A.4	Implement authentication, middleware, and deployment techniques for full-stack applications.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-215A.1	3	-	-	2	-	-	-	2	-	-
BCA-215A.2	3	-	2	3	2	2	-	2	2	2
BCA-215A.3	3	3	3	3	2	3	2	3	2	2
BCA-215A.4	3	3	3	3	3	3	-	3	2	3

Course Contents:

UNIT-I

Contact Hours: 12

Introduction to MERN Stack & Node.js

Overview of Full Stack Development and MERN Stack. Node.js: Introduction, history, features, and its role in MERN. Comparison between JavaScript Client-side vs. Server-side programming. Installation of Node.js and npm, writing and executing basic scripts. Understanding JavaScript fundamentals: Variables, functions, loops, and arrays. Event-driven architecture and the Node.js runtime environment.

UNIT-II

Contact Hours: 11

Frontend Development with React.js basics

React.js Introduction: Why React? Virtual DOM, React Setup (Create React App). JSX & Components: Functional vs. Class Components, Props, State. React Hooks: useState, useEffect, useContext, handling side effects. Event Handling & Forms: Controlled vs. Uncontrolled components. React Router: Navigation, dynamic routing, route parameters. State Management in React: Context API, Prop Drilling, Lifting State Up.

UNIT-III

Contact Hours: 12

Backend Development with Node.js & Express.js

Node.js Modules: Core modules, global modules, and user-defined modules. Express.js: Introduction, routing, request handling, middleware. Template Engines (EJS) for rendering dynamic web pages. Middleware: Introduction to Express.js middleware and error handling. Database Integration: Introduction to MongoDB, performing CRUD operations with Mongoose. Using Postman for API testing.

UNIT-IV

Contact Hours: 10

Advanced Concepts and Deployment

Asynchronous Programming: Callback, Promises, Async/Await, Event loop in Node.js. Mongoose ORM: Schema and model creation, advanced queries. Authentication & Authorization: JSON Web Tokens (JWT), bcrypt, Role-based authentication. State Management in React: Context API, Redux basics. File Handling & APIs: Using `multer` for file uploads, building Search APIs. Deployment: Hosting MERN applications using services like Vercel, Netlify, and AWS.

Text Books:

1. Basarat Ali Syed, *Beginning Node.js*, Apress.
2. Adam Boduch, Roy Derks, *React and React Native*, Packt Publishing.
3. Ethan Brown, *Learning JavaScript Design Patterns*, O'Reilly.

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4. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, Apress, 2019.

Reference Books:

1. Boronczyk, Naramore, *Beginning PHP, Apache, MySQL Web Development*, Wiley India Pvt.Ltd.
2. Kyle Simpson, *You Don't Know JS: Up and Going*, O'Reilly.
3. David Flanagan, *JavaScript: The Definitive Guide*, O'Reilly Media.
4. Simon Holmes, Clive Harber, *Getting MEAN with Mongo, Express, Angular, and Node*, Manning Publications.

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Course Code	Course Title	L	T	P	Credits
BCA-274A	Full Stack Development-I (MERN) Lab (Pre-requisite: MERN Stack)	0	0	4	2
		CIE	SEE	Total	
		50	50	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-274A.1	Implement Node.js applications
BCA-274A.2	Write programs implementing Express.js
BCA-274A.3	Write programs implementing React.js
BCA-274A.4	Deploy a Full stack development application

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-274A.1	3	-	-	2	2	-	-	2	2	2
BCA-274A.2	3	2	2	2	2	2	-	3	2	-
BCA-274A.3	3	2	2	3	3	2	-	3	3	3
BCA-274A.4	3	3	3	3	3	3	-	3	3	3

List of Experiments

No.	Experiment Detail
1.	Write a simple 'Hello World' program in Node.js.
2.	Create a Node.js script that reads and writes files using the `fs` module.
3.	Build a basic Express.js server with different routes.
4.	Implement middleware in Express.js for logging request details.
5.	Create a RESTful API in Express.js to perform CRUD operations on a MongoDB database.
6.	Implement authentication using JWT in an Express.js application.
7.	Upload and retrieve files/images using `multer` in Express.js.
8.	Set up a basic React application and create a functional component.
9.	Implement React state and props in a simple To-Do List app.
10.	Build a multi-page React app using React Router.
11.	Fetch data from an API and display it using React (Axios or Fetch API).
12.	Implement global state management using the Context API in React.
13.	Implement form validation and handle user input in React.
14.	Connect a React frontend with a Node.js/Express backend using Axios.
15.	Deploy a full-stack MERN application (frontend + backend) using Vercel and Netlify.

Text Books:

- Basarat Ali Syed, *Beginning Node.js*, Apress.
- Adam Boduch, Roy Derks, *React and React Native*, Packt Publishing.
- Ethan Brown, *Learning JavaScript Design Patterns*, O'Reilly.
- Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, Apress, 2019.

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Reference Books:

1. Boronczyk, Naramore, *Beginning PHP, Apache, MySQL Web Development*, Wiley India Pvt.Ltd.
2. Kyle Simpson, *You Don't Know JS: Up and Going*, O'Reilly.
3. David Flanagan, *JavaScript: The Definitive Guide*, O'Reilly Media.
4. Simon Holmes, Clive Harber, *Getting MEAN with Mongo, Express, Angular, and Node*, Manning Publications.

Course Code	Course Title				L	T	P	Credits		
BCA-260A	Artificial Intelligence (Pre-requisite: None)				3	0	0	3		
					CIE	SEE	Total			
					40	60	100			
Course Outcomes (COs): At the end of this course, students will be able to										
BCA-260A.1	Understand the fundamental concepts and problem representation techniques in AI.									
BCA-260A.2	Apply knowledge representation and inferencing techniques to model intelligent behaviour.									
BCA-260A.3	Implement search algorithms and game playing strategies to solve complex decision problems.									
BCA-260A.4	Explore architecture and components of Expert systems and fundamentals of natural language processing.									
Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-260A.1	3	3	2	2	-	-	1	3	3	2
BCA-260A.2	3	3	2	2	1	-	-	2	3	2
BCA-260A.3	3	3	3	3	2	-	-	2	3	2
BCA-260A.4	3	3	2	3	2	-	2	2	3	2

Course Contents:

UNIT-I

Contact Hours: 12

Overview and Types of AI

Overview of AI: Introduction to AI, Definition, Historical Evaluation of AI, AI and its related fields, Turing Test and Revised Turing Test.

Types of AI: Narrow, General, Super AI

Problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem

UNIT-II

Contact Hours: 11

Knowledge Representation, Propositional and Predicate Logic

Knowledge Representation: Various Approaches of Knowledge representation (Logical, Procedural, Declarative, Frames, Semantic Nets, Scripts)

Propositional and Predicate Logic: Propositions, FOPL, Unification, resolution, most general unifier, Inference Rules

UNIT-III

Contact Hours: 12

Search and Game Playing Strategies

Search strategies: - data driven search, goal driven search, uninformed search strategies (BFS, DFS, IDDFS), Informed Search strategies (Hill Climbing, Best First Search, A*, AO*), Properties of Search Algorithms

Game Playing Strategies: - Components of Game Playing, Min-max strategy, Min-Max strategy with alpha-beta pruning

UNIT-IV

Contact Hours: 10

Expert System and Natural Language Processing

Expert System: Components of Expert System: Knowledge Base, Inference Engine, User Interface, Features of Expert System, Expert System Life Cycle, Categories of Expert System, Rule Based vs. Model Based Expert Systems, Advantages/Limitations of Expert System, Developing an Expert System: Identification, Conceptualization, Formalization, Implementation, Testing, Using an Expert System, Application Areas of Expert System

Natural Language Processing: Introduction, Need, Goal, Fundamental problems in NLP, How to overcome problems in NLP

Text Books:

1. George F. Luger, *Artificial Intelligence*, Pearson Education.
2. Dan W. Patterson, *Introduction to Artificial Intelligence and Expert system*, PHI.
3. David W. Rolston: *Principles of Artificial Intelligence and Expert System Development*, McGraw Hill Book Company.

Reference Books:

1. Elaine Rich, Kevin Knight: *Artificial Intelligence*, Tata McGraw Hill.
2. Nils J Nilsson, *Artificial Intelligence- A new Synthesis*, Harcourt Asia Pvt. Ltd.
3. Ben Coppin, *Artificial Intelligence Illuminated*, Narosa Publishing House.
4. Jackson Peter, *Introduction to Expert systems*, Pearson-Education.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-262A	Internet of Things (Pre-requisite: None)	3	0	0	3
		CIE	SEE	Total	
		40	60	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-262A.1	Understand fundamentals of IoT.
BCA-262A.2	Explore business process in IoT, M2M and models.
BCA-262A.3	Analyze IoT Protocols and challenging issues.
BCA-262A.4	Implement IoT concepts using Python.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-262A.1	3	-	-	2	-	-	-	2	2	-
BCA-262A.2	2	3	2	2	2	2	2	2	2	2
BCA-262A.3	3	2	2	3	-	-	3	2	2	2
BCA-262A.4	3	-	2	3	2	2	-	3	3	2

Course Contents:

UNIT-I

Contact Hours: 12

Introduction to Internet of Things

Introduction to IoT, definition and characteristics of IoT, Physical and logical design of IoT, IoT functional blocks, IoT communication model, IoT enabling technologies, IoT advantages & disadvantages, Difference between IoT and M2M, SDN for IoT.

UNIT-II

Contact Hours: 11

IoT, M2M fundamentals and Models

IoT and M2M fundamentals, Business processes in IoT, M2M and IoT Analytics, Knowledge Management. Architecture Reference Model, Domain model, Information model, Functional model, Communication model.

UNIT-III

Contact Hours: 12

Protocols and Challenging issues

Messaging protocols, transport protocols, Ipv4, Ipv6, URI, Cloud for IoT: IoT with cloud, challenges, introduction to fog computing, cloud computing. Challenges in IoT: Design challenges, development challenges.

UNIT-IV

Contact Hours: 10

Implementing IoT concepts with Python

Introduction to Python, data types, data structures, control flow, functions, modules, file handling and classes, implementing IoT concepts with Python. Application of IoT: Home automation, Agriculture, Smart cities.

Text Books:

1. A Bahaga, V. Madiseti, *Internet of Things- Hands on approach*, University press.
2. CunoPfister, *Getting started with Internet of Things*, Maker Media,

Reference Books:

1. Samuel Greenguard, *Internet of Things*, MIT Press.
2. S. K.Vasudevan, A. S. Nagarajan, *Internet of Things*, Wiley.

NOTE:

1. For the semester examination, nine questions are to be set by the examiner. Question no. 1, containing 5-7 short answer type questions, will be compulsory and based on the entire syllabus. Rest of the eight questions is to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 1. All questions will carry equal marks.

Bachelor of Computer Applications (DS): Approved in 2nd meeting of Academic Council held on 28.06.2025.

2. The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

Course Code	Course Title	L	T	P	Credits
BCA-377A	Industrial Internship (Pre-requisite: None)	0	0	0	4
		CIE	SEE	Total	
		100	-	100	

Course Outcomes (COs): At the end of this course, students will be able to

BCA-377A.1	Examine and evaluate problems given by industry.
BCA-377A.2	Learn professional skills such as teamwork, communication, and project management in an industry setting.
BCA-377A.3	Employ industry-standard tools and technologies to successfully complete assigned tasks and projects.
BCA-377A.4	Develop comprehensive documentation summarizing project outcomes, and detailing the skills acquired during the internship.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
BCA-377A.1	2	3	-	-	-	-	-	-	2	-
BCA-377A.2	2	-	-	3	3	3	2	3	3	2
BCA-377A.3	3	3	3	3	3	2	-	2	3	3
BCA-377A.4	2	-	3	3	3	-	2	3	-	-

Guidelines for Industrial Training/ Internship: This course requires students to participate in professional employment-related activity or work experience or co-operative education activity with an entity external to the educational institution, normally under the supervision of an employee of an organization or an individual professional. A key aspect of the internship is induction into actual, formal, and organized work situation. Internship involves working with government or private industry, training or high-end educational organizations (such as IITs, etc.), business establishments, etc. to provide opportunities for students to actively engage in on-site experiential learning.

- l) The candidate shall be required to undergo industrial trainings /internships of the specified duration, provided in the Scheme of Studies and Examinations, in an industry/ business enterprise/ organization approved by the Head of the Department.
- m) If the concerned Department perceives any limitations from the industry to accommodate all the enrolled students, a student may be permitted to complete a skill-oriented e-content course (of sufficient duration) relevant to the industry or undertake a project-based / research project under the supervision of a faculty of a premier Institute (such as I.I.T., I.I.Sc.) with prior approval from the competent authority.
- n) The Training will be completed under the supervision of the officer (herein called Co. Training Supervisor) of the Company/ Organization under whose guidance and supervision the training was allotted to the candidate.
- o) A student can do industrial training/internship of 45-60 days duration during summer vacation after the 2nd or 4th semester before taking an exit or completing the degree programme in the respective discipline. It will be of 4 credits.
- p) If a student pursues 3 years UG Programme in respective discipline without taking Exit option, this internship (either done after 2nd or 4th semester) will be taken into account in 5th semester.
- q) If a student takes Exit after 2 years in UG Programme, this internship (either done after 2nd or 4th semester) will be taken into account in 4th semester.
- r) If a student takes Exit after 1 year in UG Programme, the mandatory internship done after 2nd semester will be taken into account in 2nd semester.
- s) However, for those students who have taken lateral entry into the 3rd semester and have completed internship of 45-60 days duration during first year, the internship is not required after the 4th semester.

- t) The candidates are required to submit a comprehensive report Training Supervisor within two weeks of completion of the training along with Co. Training Supervisor's Certificate in the beginning of the report stating that the report is an outcome of the work done by the candidate during his/her training.
- u) The viva-voce shall be held by Internal Examiner within two weeks after submission of the report.
- v) The Industrial Training/ Internship has only CIE component of 100 marks that shall be conducted as given in Table-1.

Table-1: Relative Weightages of Industrial Training/ Internship

Component	Description of the Component		Relative Weightage (Out of 100)
CIE	i)	Internship Synopsis Evaluation within 10 days of start of Internship	20
	ii)	Mid-Term Internship Evaluation	30
	iii)	Final Presentation and Internship Evaluation	50
	CIE Total		100
SEE	NIL		NIL
	Grand Total		100