JHARKHAND Rai University RANCHI

Bachelor of Computer Application

Academic Year: 2025-2029 onwards

Syllabus

JHARKHAND Rai University RANCHI

Vision

To develop the Department of Computer Science & Information Technology as a Centre for Excellence to produce leading Professionals who can serve the society with innovative skills, Computer Experts, Researchers to meet the needs of the software industry in national /global scenario responding to the challenges of ever changing world.

Mission

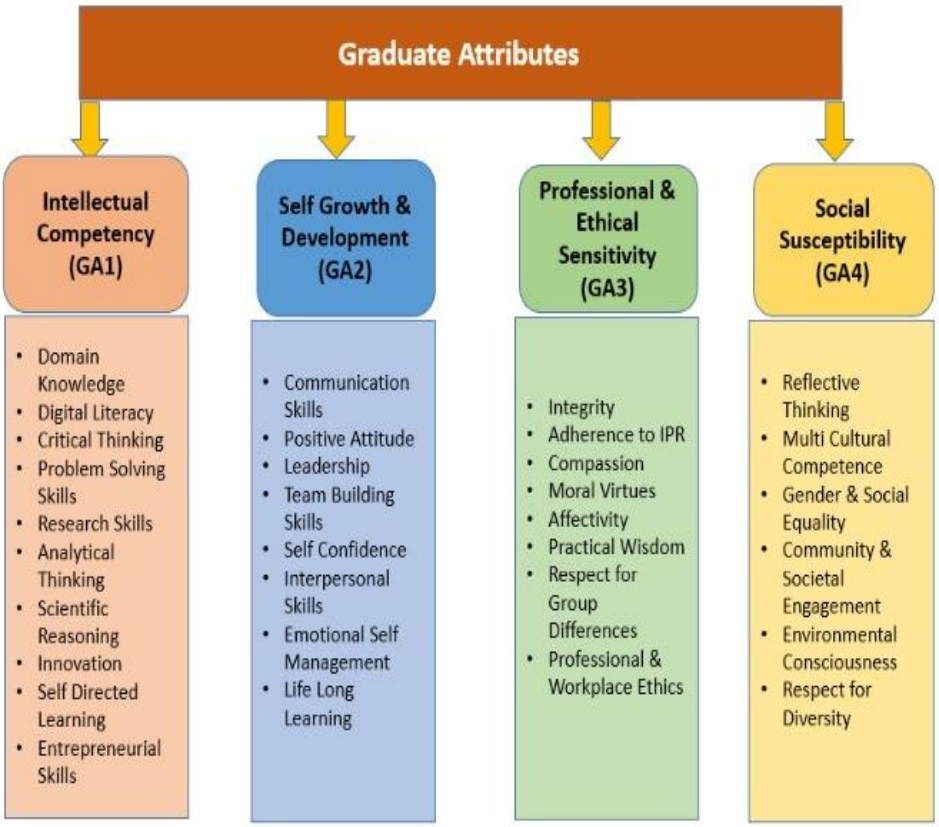
- We endeavour to provide the best possible learning environment to enhance innovations, research capabilities, and problem solving skills, leadership qualities, team spirit and ethical responsibilities.
- To nurture the talent of the students to be successful, ethical and effective problem solvers who will contribute positively to the economic growth of the nation and prepare to respond to the challenges.

Graduate Attributes

Jharkhand Rai University is a mecca of transformative education which strongly believes in the holistic development of students. The university provides the cutting-edge of holistic learning to develop promising youngsters into leaders of tomorrow with globally relevant, future-ready and actionable intelligence. The objective of the Department is to make each student proficient in synthesizing/analysing information and be ethical, socially responsible, and just when making decisions. JRU ensures inclusive and equitable quality education and promote lifelong learning opportunities for all.

Every graduate of the Department will be developed to possess the following attributes:

1. Intellectual Competency
2. Self-Growth & Development
3. Professional & Ethical Sensitivity
4. Social Susceptibility



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Program Educational Objectives (PEO)

- PEO1: To develop comprehensive understanding in the areas of Programming, Databases, Software Engineering, Web Designing, Networking and other Computer application areas.
- PEO2: To build up the ability among the students to identify the problem, analyse the requirements, understand the technical specification, design and provide innovative IT solutions to resolve the industrial problems and address the societal issues.
- PEO3: To inculcate professionalism, ethical attitude, strong communication skills and teamwork spirit among the students with the aim to make them a successful professional.
- PEO4: To enable students for pursuing respectable career through Self- Employment or Entrepreneurship.
- PEO5: To empower the students to employ their skill with a strong base to prepare themselves for higher education.

PROGRAMME OUTCOME (POs)

- PO1: Apply the concept of Programming, databases, software engineering, web designing, networking and other computer application area to design solution for complex IT problems.
- PO2: Apply necessary skill-set for designing of hardware/software system, components, and/or processes to meet desired needs, within realistic constraints.
- PO3: Ability to understand, analyze and communicate national, global, economic, legal and ethical aspects of IT and ITeS and apply ethical principles and commit to professional ethics and responsibilities.
- PO4: Contribute to the ecosystem of entrepreneurship by formulating sustainable innovative solutions in the larger interest of the society and community
- PO5: Pursue higher education to specialize in his/her study stream & become more employable
- PO6: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in context of technological changes.

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Mapping of PEO and PO

Program Outcome (PO)	Program Educational Objective (PEO)				
	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	✓	✓			
PO2	✓	✓			
PO3			✓		
PO4				✓	
PO5					✓
PO6					✓

Semester	Total Credit (Without Vocational Course)	Total Credit (With Vocational Course)
1	20	20
2	23	23
Year 1 (Certificate)	43	47
3	20	20
4	22	22
Year 2 (Diploma)	85	89
5	23	
6	20	
Year 3 (Degree)	128	NA
7	20	
8	20	
Year 4 (Honours)	168	NA
7	20	
8	20	
Year 4 (Honours with Research)	168	NA

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3 Year Course

Category	Required Number of Credit	Credit Offered
Discipline Specific Courses-Core/Major	60	49
Discipline Specific Courses-Core/Minor	24	29
Multidisciplinary Courses	9	9
Ability Enhancement Course- Compulsory	8	8
Skill Enhancement Course- Compulsory	9	8
Common Value-Added Courses	6	15
Project	4	8
Internship	2	2
Total	122	128

4 Year Course

Category	Required Number of Credit	Credit Offered
Discipline Specific Courses-Core/Major	80	69
Discipline Specific Courses-Core/Minor	32	33
Multidisciplinary Courses	9	9
Ability Enhancement Course- Compulsory	8	8
Skill Enhancement Course- Compulsory	9	8
Common Value Added Courses	6	15
Dissertation/ Project	12	24
Internship	2	2
Total	158	168

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Detailed Assessment Scheme

Assessment Scheme					
CIA- Continuous Internal Assessment (50 Marks)					
Assessment Parameters	**Assessment Tools**	**Marks**	**Percentage (%)**	**Bloom's Taxonomy Category**	**Bloom's Taxonomy Level LOT/HOT**
Assignment 1	Assignment consisting of minimum 5 Questions	10	20	Remember, Understand, Apply	LOT
Assignment 2	Assignment consisting of minimum 2 Questions	10	20	Analyse, Evaluate, Create	HOT
Teacher Assessment/ Class Participation					
Teacher Assessment 1	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other activity	10	20	Remember, Understand, Apply	LOT
Teacher Assessment 2	Quiz, Case Studies, Presentations, Group Discussion, Lab work, Project or any other activity	10	20	Analyse, Evaluate, Create	HOT
Class Participation	Brainstorming, Discussion, Attendance, Extempore or any other activity	10	20		

(LOT: Low Order Thinking, HOT: High Order Thinking)

'ESE- End Semester Examination (70 Marks)			
Bloom's Taxonomy Category	**ESE Question Paper Section**	**Percentage (%)**	**Bloom's Taxonomy Level LOT/HOT**
Remember	A	30	LOT
Understand	A		
Apply	B	40	LOT/ HOT
Analyse	B		
Evaluate & Create	C	30	HOT

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Course Scheme

BCA 2025-2029					
Choice Based Credit System					
SEM 1					
Code	**Subject**	**L**	**T**	**P**	**Credits**
Core Courses-Compulsory					
3CCC101	Computer Fundamentals	3	0	0	3
3CCC101P	Computer Fundamentals Lab	0	0	2	1
3CCC102	Problem solving Techniques using C	3	0	0	3
3CCC102P	C Programming Lab	0	0	2	1
Multidisciplinary Courses					
3CMDC101	Mathematical Foundation for Computer Science	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC101	Functional English	2	0	0	2
Skill Enhancement Course- Compulsory					
3CSEC101	Basic Accountancy	3	0	0	3
Common Value Added Courses					
3CVAC101	Environmental Studies	2	0	0	2
3CVAC102	Character Building & Holistic Development of Personality-I (Spiritual & Mental Health)	2	0	0	2
					20

SEM 2					
Core Courses-Compulsory					
3CCC103	Data Structure using C	3	0	0	3
3CCC103P	Data Structure using C Lab	0	0	2	1
3CCC104	Object Oriented Programming Using JAVA	3	0	0	3
3CCC104P	JAVA Programming Lab	0	0	2	1
3CCC105	Computer Architecture	3	0	0	3
3CCC106	Discrete Mathematics	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC102	Communication Skills	2	0	0	2
Multidisciplinary Courses					
3CMDC102	Entrepreneurship	3	0	0	3
Skill Enhancement Course- Compulsory					
3CSEC102	Computer Assembly and Repair	1	0	2	2
Common Value Added Courses					
3CVAC103	Character Building & Holistic Development of Personality- II (Yoga and Physical Fitness)	2	0	0	2
Vocational Courses (Summer): Only for students who wish to exit after the First Year with a Certificate					
3CVOC101	Advance Excel	2	0	4	4
Total without Vocational Course					**23**
Total with Vocational Course					**27**
SEM 3					
Core Courses-Compulsory					
3CCC201	Python Programming	3	0	0	3
3CCC201P	Python Programming Lab	0	0	2	1
3CCC202	Database Management System	3	0	0	3
3CCC202P	Database Management System Lab	0	0	2	1
3CCC203	Operating System	3	0	0	3
Multidisciplinary Courses					
3CMDC201	Non Computer Course Through MOOCs	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC201	Professional Skills	2	0	0	2
Common Value Added Courses					
3CVAC201	Character Building & Holistic Development of Personality- III (Universal Human Values and Ethics)	2	0	0	2
3CVAC202	Understanding India	2	0	0	2
					20

SEM 4					
Core Courses-Compulsory					
3CCC207	Data Communication and Computer Networks	3	0	0	3
3CCC204	Artificial Intelligence	3	0	0	3
3CCC204P	Artificial Intelligence Lab	0	0	2	1
3CCC205	Computer Graphics and Multimedia	3	0	0	3
3CCC205P	Computer Graphics and Multimedia Lab	0	0	2	1
3CCC206	Software Engineering	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC202	Seminar In Executive Communication *	2	0	0	2
Skill Enhancement Course- Compulsory					
3CSEC201	Statistics for BCA	3	0	0	3
Common Value Added Courses					
3CVAC203	Cyber Security	3	0	0	3
Vocational Courses (Summer): Only for students who wish to exit after the First Year with a Certificate					
3CVOC201	Full Stack Web Development	2	0	4	4
	Total without Vocational Course				22
	Total with Vocational Course				26

SEM 5					
Core Courses-Compulsory					
3CCC301	Machine Learning	3	0	0	3
3CCC301P	Machine Learning Lab	0	0	2	1
3CCC302	Internet Technologies using HTML,CSS & JAVAScript	3	0	0	3
3CCC302P	Internet Technologies using HTML,CSS & JAVAScript Lab	0	0	2	1
3CCC303	Design and Analysis of Algorithm	3	0	0	3
3CINT301	Internship/ Tour & Training/ Industrial Training	0	0	4	2
Departmental Elective- (Students have to choose any two course)					
3CCDE301	Cloud Computing	4	0	0	4
3CCDE302	Soft Computing	4	0	0	4
3CCDE303	Data Mining and Warehousing	4	0	0	4
3CCDE304	Digital Image Processing	4	0	0	4
3CCDE305	Human Computer Interface	4	0	0	4
Common Value Added Courses					
3CUMC102	Community Engagement and Social Responsibility	1	0	2	2
	Total				23

SEM 6					
Core Courses-Compulsory					
3CCC304	Theory of Computation	3	0	0	3
3CCC305	PHP & MYSQL	2	0	0	2
3CCC305P	PHP & MYSQL Lab	0	0	2	1
3CCC306	Data Analytics	3	0	0	3
3CPROJ301	Major Project	0	0	16	8
3CUMC101	Managing Personal Finance##	2	0	0	0
Departmental Elective- (Students have to choose any one course)					
3CCDE306	Fundamentals of Data Science	3	0	0	3
3CCDE307	Digital Marketing	3	0	0	3
3CCDE308	Natural Language Processing	3	0	0	3
3CCDE309	Software Testing	3	0	0	3
	Total				**20**

SEM 7 (Honours)					
Discipline Specific Courses-Compulsory					
3CCC401	Research Methodology	4	0	0	4
3CCC402	Internet of Things	4	0	0	4
3CCC403	Blockchain Technology	4	0	0	4
3CPROJ401	Project-I	0	0	16	8
	Total				20

SEM 8 (Honours)					
Discipline Specific Courses-Compulsory					
3CCC404	Neural Network and Deep Learning	4	0	0	4
3CCC405	Cryptography and Network Security	4	0	0	4
3CCC406	Compiler Design	4	0	0	4
3CPROJ402	Project-II	0	0	16	8
	Total				20

SEM 7 (Honours with Research)					
Discipline Specific Courses-Compulsory					
3CCC401	Research Methodology	4	0	0	4
3CCC403	Blockchain Technology	4	0	0	4
3CDISS401	Dissertation-I	0	0	24	12

	Total				20

SEM 8 (Honours with Research)					
Discipline Specific Courses-Compulsory					
3CCC404	Neural Network and Deep Learning	4	0	0	4
3CCC405	Cryptography and Network Security	4	0	0	4
3CDISS402	Dissertation-II	0	0	24	12
	Total				20

3C - Information Technology (BCA/MCA)
C- Core Courses
AE - Ability Enhancement
VA - Value Added
CDE - Core Departmental Elective
SE - Skill Enhancement
MD - Multidisciplinary
VOC - Vocational
PROJ - Project
DISS - Dissertation
H - Honours
HR - Honours with Research

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Semester I

SEM 1					
Code	**Subject**	**L**	**T**	**P**	**Credits**
Core Courses-Compulsory					
3CCC101	Computer Fundamentals	3	0	0	3
3CCC101P	Computer Fundamentals Lab	0	0	2	1
3CCC102	Problem solving Techniques using C	3	0	0	3
3CCC102P	C Programming Lab	0	0	2	1
Multidisciplinary Courses					
3CMDC101	Mathematical Foundation for Computer Science	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC101	Functional English	2	0	0	2
Skill Enhancement Course- Compulsory					
3CSEC101	Basic Accountancy	3	0	0	3
Common Value Added Courses					
3CVAC101	Environmental Studies	2	0	0	2
3CVAC102	Character Building & Holistic Development of Personality-I (Spiritual & Mental Health)	2	0	0	2
					20

Program: BCA
Semester: First
Course: Computer Fundamentals
Course Code: 3CCC101

L	T	P	C
3	0	0	3

Course Objectives:
The objective of this course is:

- To introduce the fundamentals of computers, number systems, Boolean algebra, and computer languages.
- To explain the architecture, classification, and working of digital computers and microcontrollers.
- To provide foundational knowledge of operating systems and basic UNIX commands.
- To familiarize students with database management systems, SQL, and their applications.
- To introduce internet concepts, services, and web development basics using HTML5 and CSS.

Course Outcomes:
After the successful completion of the course, the students will be able to:

CO1: Understand and apply the basics of computer systems, number systems, Boolean logic, and programming planning tools like flowcharts and algorithms.
CO2: Analyze the structure and components of computer systems, including CPU, memory, and microcontrollers.
CO3: Demonstrate the role and types of operating systems and execute basic UNIX commands.
CO4: Apply basic DBMS concepts and use SQL commands for data manipulation and management.
CO5: Understand the fundamentals of internet architecture and create simple web pages using HTML5 and CSS.

Course Content:

Topics	Hours
Unit – 1	10
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organization of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples, **From Ancient Counting Systems to Modern Computing: Exploring the Evolution of Knowledge, Logic, and Communication**	
Unit-II	10
Introduction to computers: Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers. Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers.	
Unit-III	10
Operating System Fundamentals: Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel Based Operating System, Booting.	
Unit-IV	6
Introduction to Database Management Systems: Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL	
Unit-V	6
Internet Basics: Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System. **Web Basics:** Introduction to web, web browsers, http/https, URL, HTML5, CSS	

Text Books:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. David Riley and Kenny Hunt, Computational thinking for modern solver,Chapman & Hall/CRC

Reference:

1. J. Glenn Brook shear," Computer Science: An Overview", Addision-Wesley,Twelfth Edition,
2. R.G. Dromey, "How to solve it by Computer", PHI,

Program: BCA
Semester: First
Course: Computer Fundamentals Lab
Course Code: 3CCC101P

L	T	P	C
0	0	2	1

Part A: Hardware

1. Identification of the peripherals of a computer, components in a CPU and their functions.
2. Assembling and disassembling the system hardware components of personalcomputer.
3. Basic Computer Hardware Trouble shooting.
4. LAN and WiFi Basics.
5. Operating System Installation – Windows OS, UNIX/LINUX, Booting.
6. Installation and Uninstallation of Software –
   Office Tools, Utility Software (like Anti-Virus, System Maintenance tools);
   Application Software - Like Photo/Image Editors, Audio Recorders/Editors, Video Editors…); Freeware, Shareware, Payware and Trialware; Internet Browsers, Programming IDEs,

Part B: Software

1. Activities using Word Processor Software
2. Activities using Spreadsheets Software
3. Activities using Presentation Software
4. Activities involving Multimedia Editing (Images, Video, Audio …)
5. Tasks involving Internet Browsing

NOTE: In addition to the ones listed above, universities can include other activities so as for the student to become proficient in using personal computers for multiple purposes for which modern computers can be put to use.

Reference:

1. Computational Thinking for the Modern Problem Solver, By Riley DD, Hunt K.A CRC press, 2014
2. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer

Web References:

http://www.flowgorithm.org/documentation/

Program: BCA
Semester: First
Course: Problem Solving Techniques Using C
Course Code: 3CCC102

L	T	P	C
3	0	0	3

Course Objectives

The objective of this course is:

- To introduce the fundamentals of C programming and develop problem-solving skills using algorithms and flowcharts.
- To provide an understanding of C language elements such as data types, variables, expressions, operators, control structures, arrays, and strings.
- To develop the ability to write modular programs using functions, recursion, and parameter passing techniques.
- To explain the concept and application of pointers in C for efficient memory management and function interactions.

Course Outcomes

After the successful completion of the course, the students will be able to:

CO1: Understand the history of C, write basic C programs, and apply structured problem-solving approaches using algorithms and flowcharts
CO2: Demonstrate the use of data types, variables, operators, control structures, arrays, and strings in solving computational problems
CO3: Develop modular programs using functions and recursion, understanding parameter passing mechanisms
CO4: Apply pointers for accessing and manipulating data in memory and understand their role in C programming

Course Content:

Topics	Hours
Unit -I	7
History of C, Sample programming, Basic structure and execution of C Problem Solving: Problem Identification, Analysis, flowcharts, Decision Tables, Pseudo codes and algorithms, Program Coding, Program Testing and Execution. Steps for problem solving, computer as a tool for problem solving. Algorithm and its features. Flowcharts and their design, **How Ancient Indian Logical Methods Influenced Modern Algorithm Design in Programming.**	
Unit -II	9
Elementary data types, variables, constants and identifiers. Integer, character floating point and string constants. Variable declarations. Syntax and semantics. Reserved word. Initialization of variable during declarations Constant data types. Expression in C, precedence and associativity of C operators, unary, binary and ternary operators. C arithmetic operators, assignment operators, relational operators, logical operators and bit – wise operators. Side effects of operators. Expression statement. Conditional Statement-if, if-else, switch Iterative Statement-while, do-while, for Other Statement–break, continue, go to, return. Array and its application, Strings.	
Unit -III	8
Function: function declaration. Calling a function. Parameters call by value, Call by reference and its absence in C. Recursion and how it works. Pointers, definition, declaration, and initialization, accessing a variable through pointers.	
Unit -IV	6
Structure – Declaration and use. Structure member resolution and structure pointer member resolution operators. Programs to show the use of structure, Union – Declaration and use. Standard C library. Files in C opening, closing, reading and writing of files. Seeking forward and backward. Simple examples of file handling programs.	

Suggested Readings:

1. Let us C-Yashwant Kanetkar.
2. Programming in C- Balguruswamy
3. Structured programming approach using C-Forouzah & Ceilberg Thomson learning publication.
4. Pointers in C – Yashwant Kanetkar
5. How to solve it by Computer – R. G. Dromy
6. Introduction to algorithms – Cormen, Leiserson, Rivest, Stein

Program: BCA
Semester: First
Course: C Programming Lab
Course Code: 3CCC102P

L	T	P	C
0	0	2	1

Course Content:

Program:

1. To print the word "Hello".
2. To sum two nos. Where the numbers are taken through the keyboard.
3. To calculate Simple Interest where the principle, no. Of years and rate are given.
4. An employee basic salary is less than Rs. 1500, then HRA = 10% of basic salary and DA = 90% of BASICS. If this salary is either equal to or above Rs. 1500 then HRA = Rs. 500 and DA = 98% OF BASIC SALARY. If the employee's salary is input through the keyboard then write a program to find its Gross Salary, where Gross Salary = Basic Salary + HRA + DA
5. The marks obtained by a student in 5 different subjects are input through the keyboard. The student gets a division as per the following rules:
   Percentage above or equal to 60 – First Division Percentage between 50 and 59 – Second Division Percentage between 40 and 49 – Third Division Percentage less than 40 – Fail
6. To print numbers from 1 to 10 using for loop
7. Print: 1 2 3 4 4 3 2 1
   1 2 3 and 4 3 2
   1 2 4 3
   1 4
8. To find the factorial of a given number.
9. To print Fibonacci numbers.
10. To display reversing digit of an integer.
11. To demonstrate switch case.
12. To calculate the sum of three number using function.
13. To find the square of any number using function.
14. To swap two numbers using function.
15. To find the sum of 20 numbers using an array.
16. To print a 2D – array.

Program: BCA
Semester: First
Course: Mathematical Foundation for Computer Science
Course Code: 3CMDC101

L	T	P	C
3	0	0	3

Course Objectives

The objective of this course is:

- To introduce the fundamental concepts of matrix algebra and enable students to solve systems of linear equations and compute eigenvalues and eigenvectors.
- To develop an understanding of differentiation and integration techniques and apply them to analyze functions, optimize values, and calculate areas under curves.
- To provide the knowledge required to formulate and solve ordinary and partial differential equations encountered in engineering and science.
- To apply counting principles and probability theory for modeling and solving problems involving uncertainty and randomness.

Course Outcomes

After the successful completion of the course, the students will be able to:

CO1: Apply matrix operations, find matrix inverse, rank, and solve linear systems using matrix methods and eigenvalue techniques

CO2: Use differentiation and integration techniques to analyze mathematical functions, solve problems involving extrema, and evaluate definite and indefinite integrals

CO3: Solve first and higher-order ordinary differential equations as well as partial differential equations using standard methods

CO4: Apply counting principles, probability theory, and distributions such as binomial to analyze and solve real-life problems involving chance and uncertainty

Course Content:

Topics	Hours
Unit – 1	8
Matrices Algebra: Definition of matrix, Operations on matrices, square matrix and its inverse, Inverse of a matrix by Row operation, Rank of matrix by Echelon form, Solution of a System of Linear Simultaneous equation by matrix method, Eigen value and Eigen vector, Caley Hamilton theorem (without proof), to find the inverse of a non-singular matrix using Caley-Hamilton theorem, **Exploring How Ancient Indian Mathematics and Logical Reasoning Influenced Modern Techniques in Matrix Algebra, Calculus, Differential Equations, and Probability.**	
Unit-II	**7**
Differentiation: Derivative, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Rolle's Theorem, Mean Value Theorem, Expansion of Functions (Maclaurin's & Taylor's), Successive Differentiation & Liebnitz Theorem. Maxima and minima of one variable.	
Unit-III	8
Integration: Integral as Limit of Sum, Fundamental Theorem of Calculus(without proof.), Indefinite Integrals, Methods of Integration Substitution, Integration by Parts, Partial Fractions, Reduction Formulae for Trigonometric Functions, Gamma and Beta Functions(definition).	
Unit-IV	**7**
Differential Equation: Definition of Differential equation, Order and degree of a differential equation, First order and first degree Linear differential equation, Higher Order Linear differential equation with constant coefficients and variable coefficient Partial differential equations, Order and degree of partial differential equation, Lagrange's Linear Equations, Linear Homogeneous partial differential equation.	

Suggested Readings:

1. Engineering Mathematics- H. K. Dass

Program: BCA
Semester: First
Course: Functional English
Course Code: 3CAEC101

L	T	P	C
2	0	0	2

Course Objective:
The objective of this course is:

- To communicate effectively and appropriately in diverse real-life scenarios.
- To develop and integrate their reading, listening, speaking, and writing skills.
- To review and solidify their understanding of previously taught language structures.
- To acquire and apply English effectively in various contexts.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Students will be able to identify and explain the various factors that impact the effective use of grammar and vocabulary in both speech and writing.
CO2: Students will gain an understanding of the diverse theoretical approaches to describing grammar.
CO3: Students will comprehend the critical importance of all components of language acquisition.
CO4: Students will demonstrate the ability to use fluent English confidently in everyday situations.

Course Content:

Topics	Hours
Unit-I	3
Vocabulary Building: The concept of Word Formation, Synonyms, Antonyms and standard abbreviations, Homophones, Homonyms and Homographs, **The Evolution of Language and Communication: How Ancient Rhetoric and Grammar Influence Modern Writing, Vocabulary, and Professional Communication Skills.**	
Unit-II	6
Basic Writing Skills: Parts of Speech, Tense, Voice, Narration, Modals, Degree of Comparison, Article and Prepositions ,Letter Writing (Writing formal & informal letters, leave applications, filling simple forms for different purposes.) , Importance of proper Punctuation ,Organizing principles of paragraphs in documents , Techniques for writing precisely	
Unit-III	4
Reading Skills: Reading for Different Purposes, Reading Comprehension practices in reading short paragraphs, Reading Newspaper articles	
Unit-IV	6
Professional Writing: Importance of Professional Writing, Notice & Circular, Memo, Report Writing , Proposal Writing ,Minutes Writing , E- Mail writing	

Suggested Readings:

1. High School English Grammar & Composition, Wren & Martin,S. Chand & Co
2. Practical English Usage, Michael Swan, OUP, 1995
3. Remedial English Grammar F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book, 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press, 2006

Program: BCA
Semester: First
Course: Basic Accountancy
Course Code: 3CSEC101

L	T	P	C
3	0	0	3

Course Objective:
The objective of this course is:

- To introduce the principles, scope, and branches of financial accounting, and to explain the preparation of journal entries, ledgers, trial balance, and detection of errors.
- To explain the concept, objectives, and preparation of Bank Reconciliation Statement and the methods for rectification of accounting errors.
- To provide knowledge about bills of exchange and the methods of calculating depreciation, along with related concepts such as amortization and obsolescence.
- To enable students to prepare Profit & Loss accounts and Balance Sheets with necessary adjustments for determining financial performance and position.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Understand and apply fundamental accounting principles, journal entries, ledger posting, trial balance preparation, and error identification.
CO2: Prepare Bank Reconciliation Statements using both methods and apply rectification techniques for accounting errors.
CO3: Interpret and differentiate bills of exchange and promissory notes; compute depreciation using various methods.
CO4: Analyze and prepare financial statements with adjustments to assess business performance and financial position.

Course Content:

Topics	Hours
Unit -I	11
Introduction to Financial Accounting: Introduction; Scope and Objectives; Branches of Accounting; Generally Accepted Accounting Principles and Standards. Journalizing Transactions: Recording of Transaction, Advantages of Journal, Classification of Accounts and its Rules, Compound Entries; Ledger: Introduction, Posting and its Rules; Trial Balances: Trial Balance Preparation, Errors Disclosed by Trial Balance, Methods of Allocating Errors in Trial Balance, **Tracing the Journey of Accounting from Ancient Trade Practices to Modern Financial Reporting and Ethical Standards.**	
Unit -II	7
Bank Reconciliation Statement & Rectification of error: Meaning, special feature and objective, format and preparation according to balance method, total method and total and balance method. Types of errors, rectification of errors of omission, errors of commission, compensating errors, errors of principle, errors in the subsidiary books.	
Unit -III	8
Bills of Exchange & Depreciation: Definition, characteristics, parties-drawer, drawee and payee, specimen explanations of the constituents of bills of exchange, days of grace, and parties of bills of exchange and calculation of due date, difference between bills of exchange and promissory notes, payment, discounting, endorsement and sending the bill for collection, retiring the bill under rebate, dishonor of bill. **Depreciation:** Meaning, definition, obsolescence, depletion, amortization, fluctuation, causes of depreciation, factors affecting depreciation, methods of providing depreciation, accounting treatment, fixed and reducing installment system their advantages and change in method.	
Unit -IV	14
Financial Statements (With and without adjustments) : Meaning of financial statements, users, Capital and revenue expenditure, Limitations of financial statements, Trading Account, Profit and loss account, and Balance sheet; With Adjustments: Treatment of depreciation and appreciation in the value of assets, outstanding expenses, prepaid expenses, accrued and unearned income, interest and loan, bad debts, provision for bad and doubtful debts, provision for discount on debtors and creditors, abnormal losses of goods and property, managers commission, Deferred revenue expenditure.	

Suggested Reading:

1. Accounting for Management, Maheshwari. S.N (2009). 2nd Edition. Sultan Chand & Sons
2. BASIC Accounting, M.Y.Khan and P.K.Jain (2010) 5th Edition, Tata Mc Grew Hill.
3. Financial Accounting- Dr. Sanjeev Sharma, 1st Edition 2012), SharmaPublication

Program: BCA
Semester: First
Course: Environmental Studies
Course Code: 3CVAC101

L	T	P	C
2	0	0	2

Course Objective:
The objective of this course is:

- To help students gain foundational knowledge and understanding of the environment and its related issues.
- To develop environmental awareness and sensitivity toward ecological challenges and concerns.
- To instill positive attitudes and values that encourages concern for the environment and motivates students to engage in its protection and improvement.
- To provide opportunities for active student participation in addressing and resolving environmental problems at various levels.
- To equip students with the necessary skills to identify, analyze, and solve environmental issues effectively.
- To develop the ability to critically evaluate environmental actions, policies, and education programs from ecological, economic, social, and aesthetic perspectives.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Articulate the interconnected and interdisciplinary nature of environmental studies;
CO2: Demonstrate an integrative approach to environmental issues with a focus on sustainability;
CO3: Use critical thinking, problem-solving, and the methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving;
CO4: Communicate complex environmental information to both technical and non-technical audiences and recognize the interconnectedness of multiple factors in environmental challenges;
CO5: Understand and evaluate the global scale of environmental problems; and reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnect

Course Content:

Topics	Hours
Unit -I	10
Definition, scope and importance need for public awareness. **Renewable and non-renewable resources:** Natural resources and associated problems., **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies. **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 lifestyles, **The Relationship Between Nature, Society, and Sustainability: Lessons from Ancient Practices to Modern Environmental Challenges**	
Unit-II	12
Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Introduction – Definition: genetic, species and ecosystem diversity. Bio geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
Unit -III	10
Environmental Pollution, Social Issues and the Environment, Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution ,Marine pollution , Noise pollution , Thermal pollution ,Nuclear Hazards , Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides. 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. Case Studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.	

Unit -IV	
Human Population and the Environment, Field work, Population growth, variation among nations. Population explosion – Family Welfare Programme, Environment and human health. Human Rights. Value Education. HIV/AIDS Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies. Visit to a local area to document environmental assets-river /forest/ grassland/ hill/ mountain. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.	8

Suggested Reading:

1. G. Kiely – Environmental Engineering Irwin/ McGraw Hill International Edition, 1997
2. M. L. Davis and S. J. Masen, Principles of Environmental Engineering and Science, McGraw Hill International Edition, 2004

Program: BCA
Semester: First
Course: Character Building & Holistic Development of Personality-I (Spiritual & Mental Health)
Course Code: 3CVAC102

L	T	P	C
2	0	0	2

Course Objective:
The objective of this course is:

- To prepare the student to develop Manomaya Kosha (Development of mind).
- To enable the students to develop Vijnanamaya Kosha (Intellectual Development).
- To develop an understanding of Anandamaya Kosha (Spiritual Development).
- To help the students in understanding the virtue of Vasudhaiva-Kutumbakam (the whole world is one family) and also to transform students into ideal personalities by inculcating sanskaaras.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Gain a comprehensive understanding of **Manomaya Kosha**.
CO2: Integrate and practice **constructive roles**.
CO3: Interpret the dynamics of **spiritual development**.
CO4: See the connection between a global family perspective and the enhancement of **Manomaya Kosha, Vijnanamaya Kosha, and Anandamaya Kosha**.

Course Content:

Topics	Hours
Unit I	4
• Cognitive Intellectual Development (Manomaya Kosha) • Character Building : Meaning, Concept, Constituent elements of character and means/ways of character building. • Manomaya Kosha : General Introduction, Meaning and Concept. • Manomaya Kosha : Objectives, Characteristics and Significance. • Benefits of developed Manomaya Kosha and deficiencies due to underdeveloped Manomaya Kosha. • Means, Activities and Programmes to develop Manomaya Kosha, **Cultivating Mind, Intellect, and Spirit: How Ancient Indian Wisdom and Exemplary Personalities Inspire Holistic Development and Global Harmony.**	
Unit II	4
• Cognitive Intellectual Development (Vijnanamaya Kosha) • Vijnanamaya Kosha : General Introduction, Meaning and Concept. • Objectives, Characteristics and Significance. • Benefits of developed Vijnanamaya Kosha and deficiencies due to underdeveloped Vijnanamaya Kosha. • Means, Activities and Programmes to develop Vijnanamaya Kosha.	
Unit III	8
• Cognitive Intellectual Development (Anandamaya Kosha)	
Unit IV	8
• Moral Spiritual Development (To draw inspiration from important events of the lives of great men of India to serve the society and nation). • Social and National Awakening : Chanakya, Birsa Munda, Lala Lajpat Rai, Jyotiba Phule, Adi Shankaracharya, Veer Savarkar, • Women from other countries dedicated to India : Annie Besant, Emily Shankle Bose, Mary Reed. • Leading Scientists: Acharya Sushruta, Acharya Charak, Aryabhatta, Jagdish Chandra Basu, Homi Jahangir Bhabha, A.P.J Abdul Kalam • Women's Awakening : Lakshmi Bai, Rani Durgavati, Rani Chenamma, Rani Ahilya Bai Holkar • Those who sacrificed all: Bhagat Singh, Khudiram Bose, Chandrashekhar Azad, Mahatma Gandhi. • Seekers of Self-reliant India: Vinoba Bhave, Jai Prakash Narayan, Verghese Kurian, M.S.Swaminathan. • Unique Personality of India : Dr.Rajendra Prasad, Sardar Ballabh Bhai Patel.	

Suggested Reading:

1. My Idea of Education, Swami Vivekanand, Advaita Ashram, Kolkata
2. Rabindranath Tagore : An Interpretation, Sabyasachi Bhattacharya, Penguin Delhi
3. Women Who Created History, NCERT, New Delhi

JHARKHAND
Rai University
RANCHI

Semester II

SEM 2					
Core Courses-Compulsory					
3CCC103	Data Structure using C	3	0	0	3
3CCC103P	Data Structure using C Lab	0	0	2	1
3CCC104	Object Oriented Programming Using JAVA	3	0	0	3
3CCC104P	JAVA Programming Lab	0	0	2	1
3CCC105	Computer Architecture	3	0	0	3
3CCC106	Discrete Mathematics	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC102	Communication Skills	2	0	0	2
Multidisciplinary Courses					
3CMDC102	Entrepreneurship	3	0	0	3
Skill Enhancement Course- Compulsory					
3CSEC102	Computer Assembly and Repair	1	0	2	2
Common Value Added Courses					
3CVAC103	Character Building & Holistic Development of Personality- II (Yoga and Physical Fitness)	2	0	0	2
Vocational Courses (Summer): Only for students who wish to exit after the First Year with a Certificate					
3CVOC101	Advance Excel	2	0	4	4
Total without Vocational Course					**23**
Total with Vocational Course					**27**

Program: BCA
Semester: Second
Course: Data Structure Using C
Course Code: 3CCC103

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- Understand the fundamental concepts of algorithm complexity and evaluate algorithm performance using asymptotic analysis
- Learn the implementation and applications of arrays, stacks, queues, and key sorting and searching algorithms
- Develop skills to work with linked lists and trees using various traversal and recursive techniques
- Gain knowledge of multilevel indexing and B-trees to enhance data organization and retrieval efficiency

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Analyze algorithm efficiency using time and space complexity and apply asymptotic notations such as O and Θ
CO2: Implement and evaluate arrays, sorting and searching algorithms, and stack-queue operations with expression conversion and evaluation
CO3: Apply operations on linked lists and perform binary tree traversals and manipulations using recursive techniques
CO4: Understand and construct B-trees and apply multilevel indexing techniques for efficient data access

Course Content:

Topics	Hours
Unit -I	4
Time and Space complexity of algorithms, average case and worst-case analysis, asymptotic notation as a measure of algorithm complexity, O and Θ notations, **Applying Tarka Shastra and Panini's Analytical Methods to Data Structures: Optimizing Algorithm Efficiency, Recursive Thought, and Hierarchical Indexing for Enhanced Computation and Decision-Making**	
Unit -II	12
Arrays: Representation of single and multidimensional arrays; sparse arrays -lower and upper triangular matrices and Tri -diagonal matrices. Analysis of sorting algorithms- Selection sort, Bubble sort, Insertion sort, Heap sort, Quick sort and analysis of searching algorithms – linear search and binary search. Stacks and Queues: Introduction and primitive operations on stack; Stack application: Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix. Introduction and primitive operation on queues, D-queues and priority queues.	
Unit -III	8
Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion, searching, two way lists and Use of headers. Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion.	
Unit -IV	6
Multilevel indexing and B-Trees: Introduction: The invention of the B- tree; Statement of the problem; Indexing with binary search trees; Multilevel indexing, a better approach to tree indexes; B -trees: working up from the bottom; Example for creating a B -tree.	

Suggested Readings:

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Booksource Pvt. Ltd, 2003
2. R. S. Salaria, "Data Structure & Algorithms", Khanna Book Publishing Co. (P) Ltd., 2002.
3. P. S. Deshpande and O.G. Kakde, "C & Data Structure", Wiley Dreamtech, 1st Edition, 2003.
4. Y. Langsam et. al., "Data Structures using C and C++", PHI, 1999.
5. Schaum's outline series, "Data Structure", TMH, 2002

Program: BCA
Semester: Second
Course: Data Structure Using C Lab
Course Code: 3CCC103P

L	T	P	C
0	0	2	1

Course Content:

Program:

1. To read and display n numbers using an array.
2. To find transpose a 3 X 3 matrix.
3. To insert a number at a given location in an array.
4. To delete a number from a given location in an array.
5. To create a linked list and perform insertions
    a) At beginning
    b) At end
    c) Before a given node
    d) After a given node
6. To create a linked list and perform deletions
    a) From beginning
    b) From end
    c) At a given node
    d) After a given node
7. To create a circular linked list and perform insertion at the beginning of list.
8. To create a circular linked list and perform insertion at the end of list.
9. To create a circular linked list and perform deletion from the beginning of list.
10. To create a circular linked list and perform deletion from the end of list.
11. To perform Push, Pop and Peep operations on a stack.
12. To implement a linear queue.
13. To implement a linked queue.
14. To implement a priority queue.
15. To implement a Binary Search tree and perform the following:
a) Insert Element b) Preorder Traversal
16. To implement a Binary Search tree and perform the following:
a) Insert Element b) Post-order Traversal
17. To search an element in an array using linear search technique.
18. To search an element in an array using binary search technique.
19. To sort an array using insertion sort algorithm.
20. To implement quick sort algorithm.

Program: BCA
Semester: Second
Course: Object Oriented Programming Using Java
Course Code: 3CCC104

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the basic structure of Java programs, including variable declarations, data types, and operators.
- To learn control structures, expressions, loops, and the fundamentals of class and object creation in Java.
- To gain knowledge of object-oriented programming concepts such as constructors, inheritance, arrays, interfaces, and packages.
- To understand the concepts of multithreading and applet programming and apply them in developing web-based applications.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand Java program structure, JVM, variable scope, data types, and use various operators effectively
CO2: Apply control flow statements and loops in Java programs and define and use classes and methods
CO3: Create and manipulate objects, implement constructors and inheritance, and work with arrays, strings, interfaces, and packages
CO4: Develop multithreaded Java programs, design and run applets, and integrate them into HTML pages for web-based applications

Course Content:

Topics	Hours
Unit -I	7
JAVA environment. JAVA program structure, Tokens, Statements, JAVA virtual machine, Constant & Variables, Data Types, declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting. Operators: Arithmetic, Relational, Logical Assignments, Increment and Decrement, Conditional, Bitwise, Special, **Incorporating Nyaya's Logical Framework and Panini's Structured Grammar Principles into Object-Oriented Programming**	
Unit -II	8
Expressions & its evaluation. If statement, if…else… statement, Nesting of if…else… statements, else…if Ladder, Switch, Operators, Loops –While, Do, For, Jumps in Loops, Labeled Loops. Defining a Class, Adding Variables and Methods.	
Unit-III	8
Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods. Inheritance: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract methods and Classes, Visibility Control. Arrays: One Dimensional & two Dimensional, strings, Vectors, wrapper Classes, Defining Interface Extending Interface, Implementing Interface, Accessing Interface Variable, System Packages, Using System Package Adding a Class to a Package, Hiding Classes.	
Unit -IV	7
Creating Threads, Extending the Threads Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Executable Interface. Local and Remote Applets Vs Applications, Writing Applets, Applets Life Cycle, Creating an Executable Applet, designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing Parameters to Applets, Aligning the Display, HTML Tags & Applets, Getting Input from the User.	

Suggested Readings:

1. Programming with Java, E.Balaguruswamy, TMH.
2. Core Javafor beginners, RASHMI Kanta Das, Vikas pub.

Program: BCA
Semester: Second
Course: JAVA Programming Lab
Course Code: 3CCC104P

L	T	P	C
0	0	2	1

Lab Experiment:

1. To find square root of given number
2. To enter principal, rate & time and find simple interest
3. To find whether a year is leap year or not
4. To enter a number from keyboard and find out Fibonacci series
5. To enter a number from keyboard and find out factorial of the number
6. To enter a number from keyboard and check whether the number is palindrome or not
7. To enter a number from keyboard and print the prime numbers present within it
8. To enter a number from keyboard and determine whether it is Armstrong or not.
9. Program to demonstrate switch statement
10. To swap two numbers without using third variable
11. To find the greatest among 3 numbers
12. Program to sort an array in an ascending order
13. Program to find out the sum and average of the elements present in an array
14. Program to add the elements of two different two-dimensional array.
15. Program to find out the biggest and smallest number from a matrix.
16. To implement the concept of final class
17. To implement the concept of interface
18. Program to reverse a specified string.
19. Showing a program using package.
20. To create an applet
21. To implement the concept of thread

Program: BCA
Semester: Second
Course: Computer Architecture
Course Code: 3CCC105

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the basic structure, components, and functioning of a digital computer system.
- To learn the operation of the instruction cycle, CPU organization, and different addressing modes used in computer systems.
- To study computer arithmetic operations and comprehend input-output organization, including Direct Memory Access (DMA) and interrupt mechanisms.
- To explore the memory hierarchy and gain knowledge of the design, types, and management of various computer memory systems.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Describe instruction formats, computer registers, and timing and control mechanisms used in basic computer design
CO2: Explain the instruction cycle, memory-reference instructions, and CPU organization including addressing modes and stack operations
CO3: Perform arithmetic operations using standard algorithms and explain input-output organization and data transfer mechanisms
CO4: Understand the concepts of memory hierarchy and evaluate the role of cache, virtual, and associative memory in computer systems

Course Content:

Topics	Hours
Unit -I	10
Basic Computer Organizations and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, **Applying the Concept of 'Panchakosha' and 'Nyaya-Vaisheshika' Philosophical Systems to Computer Architecture**	
Unit- II	11
Basic Computer Organizations and Design: Instruction Cycle, Memory – Reference Instructions, Register reference instructions, Input -Output Instructions, Design of Accumulator Logic Shift Unit. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.	
Unit -III	10
Computer Arithmetic: Introduction, Multiplication Algorithms, Division Algorithms, for fixed Point-members. Input - Output Organization: Peripheral Devices, Input-Output Interfaces, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).	
Unit -IV	9
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.	

Suggested Readings:

1. Morris Mano, Computer System Architecture, 3rd Edition, Prentice -Hall of India Private Limited, 1999.
2. WIliam Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hall of India Private Limited, 2001
3. Harry & Jordan, Comput er Systems Design & Architecture, Addison Wesley, Delhi, 2000.
4. Malvino, "Digital Computer Electronics: An Introduction to Microcomputers", McGraw Hill, 1993.

Program: BCA
Semester: Second
Course: Discrete Mathematics
Course Code: 3CCC106

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the fundamental concepts of set theory and perform operations such as union, intersection, Cartesian product, and determine cardinality.
- To explore the properties and types of relations and functions, including composite and inverse functions.
- To learn partial order relations and lattices, and apply principles of mathematical logic using truth tables and logical connectives.
- To understand the basic concepts of graph theory, including trees, spanning trees, and graph representations through matrices.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Apply basic set theory concepts and operations to solve problems involving sets, subsets, and Cartesian products
CO2: Understand and analyze different types of relations and functions and compute their domains, ranges, and compositions
CO3: Represent partially ordered sets using Hasse diagrams and apply logical reasoning using truth tables and logical operations
CO4: Understand graph theory concepts, apply Kruskal's algorithm, and represent graphs using adjacency and incidence matrices

Course Content:

Topics	Hours
Unit -I	10
Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications,**Integrating Nyaya Logic and Vedic Combinatorics with Discrete Mathematics**	
Unit -II	11
Relations And Functions: Properties of Relations, Equivalence Relation, Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.	
Unit -III	10
Partial Order Relations and Lattices: Partial Order Sets, Representation of POSETS using Hasse diagram, Chains. Mathematical Logic: Truth Tables, logical Connectives, Basic logical operations, Conjunction, Disjunction and Negation, Logical Connectives.	
Unit -IV	9
Graphs: Introduction to graphs, graphs terminology and representation, path, cycle and connectivity, subgraphs, types of graphs, connected and disconnected graphs, Introduction of Trees, spanning tree, Kruskal's Algorithm for minimal spanning tree, Matrix representation of graph, Incidence and adjacency matrix.	

Suggested Readings:

1. Kolman, Busby and Ross, "Discrete Mathematical Structure", PHI, 1996.
2. H.K. Dass, "Advanced Engineering Mathematics"; S.Chand & Co., 9th Revised Ed.,2001.
3. S.K. Sarkar, "Discrete Math's"; S. Chand & Co., 2000

Program: BCA
Semester: Second
Course: Communications Skills
Course Code: 3CAEC102

L	T	P	C
2	0	0	2

Course Objectives
The objective of this course is:

- To help learners identify and overcome common communication barriers.
- To make learners aware of the impact of non-verbal communication and how it influences others.
- To develop effective communication skills through digital media platforms.
- To foster the ability to listen empathetically and respond appropriately in various contexts.
- To encourage exploration of communication methods beyond spoken and written language.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Overcome common communication problems
CO2: Effectively use non-verbal communication
CO3: Effectively use digital media to communicate messages
CO4: Become empathetic listeners and inculcate listening skills
CO5: Inculcate effective communication skills

Course Content:

Topics	Hours
Unit -I	2
Listening: Techniques of effective listening, Listening and comprehension, Probing questions Barriers to listening**, Traditional Indian Communication Systems and Dialogue Practices.**	
Unit -III	3
Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors	
Unit -III	6
Reading: Techniques of effective reading, Gathering ideas and information from a given text, Identify the main claim of the text, Identify the purpose of the text , Identify the context of the text	
Unit- IV	4
Writing and different modes of writing : Writing and different modes of writing : Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalizations and oversimplification of issues, Provide background information • Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured, Well-knit logical sequence, Narrative sequence, Category groupings, Different modes of Writing -E-mails, Proposal writing for Higher Studies, Recording the proceedings of meetings, Any other mode of writing relevant for learners	
Unit- V	3
Digital Literacy: Role of Digital literacy in professional life, Trends and opportunities in using digital technology in workplace, Internet Basics, Introduction to MS Office tools- Paint, Office, Excel, Power	
Unit -VI	3
Effective use of social media: Introduction to social media websites, Advantages of social media, Ethics and etiquettes of social media, how to use Google search better, Effective ways of using social media, Introduction to Digital Marketing	
Unit- VII	3
Non-verbal Communication: Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbelieves, Open and Closed Body language, Eye Contact and Facial Expression, Hand Gestures, Do's and Don'ts, Learning from experts Activities-Based Learning	

Bibliography &Suggested Reading including audio video material:

Books

1. Sen Madhu Chanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Program: BCA
Semester: Second
Course: Entrepreneurship
Course Code: 3CMDC102

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To develop an understanding of the concepts of project, types of projects, project
- Identification, and Project's life cycle, Forms of Project Organization and human aspectsof Project Management.
- To help students understand the importance of social cost and benefit analysis and itsUNIDO approach. It also includes network technique for project management, scheduling, PERT, CPM model and network cost system.
- To incorporate the understanding of capital budgeting of an organization, including discounted and no discounted techniques, cost over- run, Project control and informationsystem.
- To enable learners to understand the Significance of entrepreneurship in economic development qualities of entrepreneur, Entrepreneurship development programs and roleof various institutions in developing entrepreneurship, life cycles of new business and steps for setting up a new industry.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Understand the Concept of project, characteristics of projects, Identify the type of project and Project's life cycle, as well as steps for Successful Project Implementation.
CO2: Analyze the project from technical, financial, market- demand and economic feasibility and analyze the difference between the CBA and SCBA. Create and formulate linear programming and integer programming model, project network and estimation of time and critical path in PERT and CPM model.
CO3: Evaluate capital budgeting system of an organization through discounted and non-discounted techniques like NPV, IRR, Profitability index, ARR and Payback period.
CO4: Understand entrepreneurship Development and role of institution like SIDO, MDI, EDI, AISSIB, NIESBUD etc. Also the students will analyze all the factors for success and failure of a new business.

Course Content:

Topics	Hours
Unit-I	4
Introduction to Project Management: Concept, characteristics of projects, types of projects, project identification, and Project's life cycle, Forms of Project Organization, Human Aspects of Project Management, Pre-requisites for Successful Project Implementation, **Indigenous Business Models and Entrepreneurial Practices in Ancient India**	
Unit-III	8
Project Feasibility: Market feasibility, technical feasibility, financial feasibility, and economic feasibility, social cost-benefit analysis, project risk analysis Network Analysis, Requirements for Network Analysis, Critical Path Method (CPM), Programme Evaluation and Review Technique (PERT)	
Unit-III	8
Financial appraisal/evaluation techniques: Estimation of Cash Flows, discounted/non-discounted cash flows; Net present values, profitability index, Internal rate of returns; Cost benefits ratio; Accounting rate of return, Payback period, Project implementation; Cost overrun, Project control and information system	
Unit-IV	10
Entrepreneurship Development: Significance of entrepreneurship in economic development qualities of entrepreneur, entrepreneurship development programs and role of various institutions in developing entrepreneurship, life cycles of new business, environmental factors affecting success of a new business, reasons for the failure and visible problems for business, Developing effective business plans, Procedural steps in setting up of an industry	

Suggested Reading:

1. Chandra P. 2005. Project Management. Tata McGraw Hill.13
2. Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.
3. Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
4. Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
5. Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall.
6. Ramamoorthy VE. 2005. Textbook of Project Management. MacMillan

Program: BCA
Semester: Second
Course: Computer Assembly and Repair
Course Code: 3CSEC102

L	T	P	C
1	0	0	1

Course Objectives
The objective of this course is:

- To understand and identify various hardware components, ports, and system specifications of a computer system.
- To learn and apply basic troubleshooting techniques and configure BIOS settings for resolving common hardware-related issues.
- To gain practical experience in installing operating systems and essential application software.
- To develop the necessary skills for upgrading hardware components and assembling/disassembling a complete desktop system.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Identify hardware components, ports, and determine system specifications of a computer
CO2: Troubleshoot common hardware issues and configure BIOS settings for system optimization and recovery
CO3: Install operating systems, application software, and antivirus tools, ensuring proper system functionality
CO4: Upgrade system hardware, connect peripherals, and assemble or disassemble desktop systems efficiently

Course Content:

Topics	Hours
Unit-I	**7**
Introduction to Hardware Components and Ports: • Demonstration of hardware peripherals: CPU, RAM, SMPS, Motherboard, NIC card, Processor, Processor cooling fan, PCI card, HDD. • Demonstration of various ports: CPU, VGA, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio. • Identification of computer name and hardware specifications (RAM, processor type, HDD, 32/64-bit), **Ancient Indian Contributions to Mechanical Instruments and Device Design**	
Unit-II	**7**
Troubleshooting and BIOS Configuration: • Troubleshooting RAM (beep sound/blue screen), SMPS and motherboard issues (CPU not switching ON). • Configure BIOS settings – enable/disable USB and LAN. • Recover hidden files from corrupted pen drives using command-line. • Recover data from crashed hard disk using Disk Drill software.	
Unit-III	8
Operating System and Software Installation: • Install Windows (7/10) OS with disk partitioning. • Install Unix-based OS (Linux/Ubuntu). • Install application software: Python 3.8, MS Office, MySQL, TOAD, and OpenOffice, etc. • Install antivirus software (e.g., Avast, Kaspersky) and observe system behavior.	
Unit-IV	8
System Upgrades and Peripheral Setup: • Add new hardware devices: keyboard, mouse, speaker, and microphone. • Connect LCD projector with Laptop/CPU. • Add/expand system RAM. • Insert graphic card. • Assemble and disassemble a desktop system.	

References:

1. Dan Gookin, Troubleshooting & Maintaining Your PC ALL-IN-ONE, 3rd Edition, 2017, John Wiley & Sons.
2. Mike Meyers, Scott Jernigan, Dan Lachance,"CompTIA Fundamentals + Exam Guide (All-in-One), 2nd Edition, 2019, Mc Graw Hill Education.

L	T	P	C

Program: BCA
Semester: Second
Course: Computer Assembly and Repair (Lab)
Course Code: 3CSEC102P

0	0	2	1

Lab Experiment:

1. Demonstration of Hardware peripherals: CPU, RAM, SMPS, Motherboard, NIC card, Processor, Processor cooling fan, PCI card, HDD.
2. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio.
3. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
4. Identify and Troubleshoot the problems of RAM (beep sound with blue screen), SMPS and motherboard (CPU is not switched ON)
5. Configure BIOS settings- disable and enable USB and LAN.
6. Identify, how to recover the hidden files from corrupted pen drive using command.
7. Recover the contents from crashed Hard Disk using Disk Drill software.
8. Install Operating System – Windows family (Windows 7/ Windows 10) and also make partitions.
9. Install Operating System - Unix family (Linux/UBUNTU)
10. Install Application software – python 3.8, MS- Office 2010/2013, MySQL, TOAD, Open office, etc.,
11. Install any one of the antivirus software (Avast, Kaspersky, etc.,) and observe the variations before and after installation.
12. Add new Hardware device (keyboard, mouse, Speaker, Microphone)
13. Connect the LCD Projector with Laptop / CPU.
14. Adding additional RAM to the system. (Expanding RAM size).
15. Graphic Card insertion.
16. Assemble and Disassemble Desktop System.

References:

3. Dan Gookin, Troubleshooting & Maintaining Your PC ALL-IN-ONE, 3rd Edition, 2017, John Wiley & Sons.
4. Mike Meyers, Scott Jernigan, Dan Lachance,"CompTIA Fundamentals + Exam Guide (All-in-One), 2nd Edition, 2019, Mc Graw Hill Education.

Web References:

1. https://www.youtube.com/watch?v=ItxwyMR0SnY&list=PLeH4ngtDM7eE-1_mdWuXWyZrI_FMHnyJ0&index=5
2. https://www.cleverfiles.com/howto/crashed-hard-drive-recovery.html

Program: BCA
Semester: Second
Course: Character Building & Holistic Development of Personality- II (Yoga and Physical Fitness)
Course Code: 3CVAC103

L	T	P	C
2	0	0	2

Course Objectives

The objective of this course is:

- To generate awareness among students about health and yoga.
- To encourage students to be environmentally conscious, conserve water and practise good hygiene.
- To acquaint the students with the fundamental principles of national unity and integration through practicing yoga.
- To develop Annamaya Kosha (Physical Development) and Pranamaya Kosha (Development of Prana).

Course Outcome:

After the successful completion of the course, the students will be able to:

CO1: Develop a strong understanding of spiritual and mental health.
CO2: Apply the concept of sustainability and development.
CO3: Understand the importance of Yoga and integrate its practice into daily life.
CO4: Develop their Annamaya Kosha and Pranamaya Kosha.

Course Content:

Topics	Hours
Unit I	
Physical Vital Development • Health: Meaning, Concept, Dimensions of health (mental, physical, social and spiritual) and health related general habits. • Ideal daily routine/ Lifestyle: Meaning, Concept, Principles and its related practice • Balanced Diet : Meaning, Concept, Benefits, Alkali and Acid, Balanced Diet according to Desh (location), Kaal (time), Ayu (age) and Ritu (season) • Ritucharya (Seasonal Habits) : Meaning, general Introduction, Concept, Month and Festivities according to season, Nature of Earth, Lifestyle according to Shishir Season. • Sukshama Vyayama and Surya Namaskara : General Introduction, Precautions and Practice, **Panchakosha Framework for Holistic Personality Development**	
Unit II	
Yoga and its Importance • Yoga: Meaning, Concept, Aims and Objectives, Types. • Diet and Health : Conditions, Malnutrition (Undernutrition and Over Nutrition) causes, Problems and Solutions, Common points of consideration for nutrition. • Vasant Ritucharya: Lifestyle according to Spring season; Lifestyle- General Introduction, • Concept, Month and Festivities according to season. • Pranayama: General Introduction (Bandh, Nadi and Chakra), Importance, Eligibility, Time, Place, position, Principles of Practice and Precautions • Asana: General Introduction, Types, Benefits, Precaution and Practice (Asanas in Standing position) • Practice of Sukshama Vyayama and Surya Namaskara	
Unit III	
Yoga and Physical Fitness • Ashtanga Yoga: General Introduction, Parts, Meaning of Yama and Niyama, Concept, aims and Objectives. • Diet and Health: Nutrients of Food -Carbohydrates, Proteins and Fats – Structure/Elements, Requirement/Utility & Sources • Grisham Ritucharya: Lifestyle according to summer season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practice of Inhalation (Purak) Exhalation (Rechak) and Holding of Breath • Asanas: (Bending Asanas)- General Introduction, Benefits, Precautions and practice of Padhastasana, Utkataana, Garudasana, Tulasana and Ardg-Chandrasana	

• Practice of Sukshama Vyayama and Surya Namaskara • Varsha Ritucharya: Lifestyle according to rainy season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Diet and Health: Nutrients of Food – Vitamins, Mineral and Water structures/elements, Requirement & Sources. • Pranayama: Importance, Rules, Precautions and Practice of Anuloma-Viloma, Bhramari and Kapalbhati Pranayama • Asanas: (In Sitting Position) - General Introduction, Benefits, Precautions and practice . • Practice of Sukshama Vyayama and Surya Namaskara	
Unit IV	
Practices of Yoga • Sharad Ritucharya: Lifestyle according to Autumn season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practice of Chandrabhedi, Suryabhedi and Ujjai Pranayama. • Asanas: (asanas performed in Supine position) - General Introduction, Benefits, Precautions and practice. • Practice of Sukshama Vyayama and Surya Namaskara. • Hemant Ritucharya: According to Hemant season- Meaning, General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practices of Sheetali, Sheetkari and Nadi Shodhan Pranayama. • Asanas: (asanas performed in Prone position) - General Introduction, Benefits, Precautions and practice . • Practice of Sukshama Vyayama and Surya Namaskara • Self Defense: Meaning, Purpose, Required Capabilities; • Relaxation: Shoulder-movement exercise for Spine & maintaining the balance • Marmasthala – Common Vulnerable/Vital Points • Prahara : Meaning, Striking Organs, Types of Strikes, Precautions. • Preventing possible strikes, Preventing Organs and types/uses	

Suggested Reading:

1. Yoga for Everyone, B.K.S.Iyengar, Dorling Kindersley Ltd; New Delhi
2. Yoga the Path to Holistic Health, .B.K.S.Iyengar, Dorling Kindersley Ltd; New Delhi
3. Science of Yoga, Ann Swanson, Dorling Kindersley Ltd; New Delhi.

Program: BCA
Semester: Second
Course: Advance Excel
Course Code: 3CVOC101

L	T	P	C
2	0	4	4

Course Objectives:
The objectives of the course are:

- To provide foundational and advanced knowledge of Microsoft Excel for data handling, formatting, and efficient spreadsheet operations.
- To develop proficiency in applying advanced Excel functions and formulas for logical, statistical, text, and date/time operations in professional contexts.
- To enable learners to perform data analysis using tools such as PivotTables, Power Query, charting, and dashboard creation.
- To introduce automation techniques in Excel using Macros and basic VBA scripting for efficient and repetitive task management.

Course Outcomes:
After the successful completion of the course, the students will be able to:

CO1: Apply advanced formatting and data validation techniques to organize and present data effectively in Excel worksheets.

CO2: Use complex functions and formulas to solve logical, statistical, and analytical problems in a structured Excel environment.

CO3: Analyze and visualize large datasets using PivotTables, charts, and dashboards to support business decision-making.

CO4: Design and implement simple macros and automation scripts to streamline repetitive tasks and enhance productivity in Excel.

Course Content:

Topics	Hours
Unit I	5
Excel Essentials Review and Advanced Formatting: Overview of Excel Interface and Navigation, Data Types, Cell Referencing (Relative, Absolute, Mixed), Advanced Formatting Techniques: - Conditional Formatting (Custom Rules, Formulas), Data Validation (Lists, Custom Validation, Error Alerts), Named Ranges and Cell Protection, Custom Number Formats, Sorting and Filtering (Multi-level, Custom Sorts), **Indian Mathematical Logic and Algorithmic Thinking in Data Processing**	
Unit II	5
Functions, Formulas, and Logical Operations: Lookup & Reference Functions:- VLOOKUP, HLOOKUP, XLOOKUP, INDEX-MATCH, Logical Functions: -IF, IFS, AND, OR, NOT, IFERROR. , Text Functions: -CONCATENATE, TEXTJOIN, LEFT, RIGHT, MID, TRIM, UPPER, LOWER, Date & Time Functions: - TODAY (), NOW (), DATEDIF, NETWORKDAYS, Math & Statistical Functions:-SUMIF(S), COUNTIF(S), AVERAGEIF(S), ROUND, RANK, INT, MOD	
Unit III	5
Data Analysis Tools and Advanced Charting: Pivot Tables and Pivot Charts:- Creating, Formatting, Slicers, Grouping, Power Query Basics (Get & Transform), What-If Analysis:-Scenario Manager, Goal Seek, Data Tables, Data Consolidation and Subtotals, Advanced Charting Techniques:-Combo Charts, Dynamic Charts, Sparklines, Dashboard Design Basics	
Unit IV	5
Macros, Automation, and Integration: Introduction to Macros:-Recording and Editing Macros ,Assigning Macros to Buttons ,Introduction to VBA:- (VBA Editor, Modules, Simple Scripts) ,Error Checking and Formula Auditing ,Importing & Exporting Data (CSV, Text, Web) ,Integration with Microsoft Office Tools (Word, PowerPoint, Outlook) , Project: Build a Mini Dashboard with Dynamic Features	

Textbooks

1. **"Microsoft Excel 2019 Bible"** Michael Alexander, Richard Kusleika, John Walkenbach *Publisher:* Wiley
2. **"Excel 2021 for Dummies"** Greg Harvey , Wiley
3. **"Microsoft Excel Data Analysis and Business Modeling"** Wayne L. Winston Microsoft Press
4. **"Excel Power Pivot & Power Query For Dummies"** Michael Alexander,Wiley

Reference Books and Online Resources

1. **"Excel Formulas and Functions for Dummies"** Ken Bluttman , Wiley
2. **"Excel Dashboards and Reports"** Michael Alexander, John Walkenbach , Wiley
3. **Official Microsoft Excel Documentation:** *Website:* https://support.microsoft.com/excel
4. **Excel Jet :** *Website:* https://exceljet.net
5. **Chandoo.org :** *Website:* https://chandoo.org

JHARKHAND
Rai University
RANCHI

Semester III

SEM 3					
Core Courses-Compulsory					
3CCC201	Python Programming	3	0	0	3
3CCC201P	Python Programming Lab	0	0	2	1
3CCC202	Database Management System	3	0	0	3
3CCC202P	Database Management System Lab	0	0	2	1
3CCC203	Operating System	3	0	0	3
Multidisciplinary Courses					
3CMDC201	Non Computer Course Through MOOCs	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC201	Professional Skills	2	0	0	2
Common Value Added Courses					
3CVAC201	Character Building & Holistic Development of Personality- III (Universal Human Values and Ethics)	2	0	0	2
3CVAC202	Understanding India	2	0	0	2
					20

Program: BCA
Semester: Third
Course: Python Programming
Course Code: 3CCC201

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3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the basics of Python programming, including environment setup, variables, data types, and operators.
- To develop understanding of control structures, strings, and built-in data structures such as lists, tuples, sets, and dictionaries.
- To explore advanced Python programming concepts including functions, modules, object-oriented programming, file handling, and exception handling.
- To provide practical exposure to GUI programming, database operations, and data analysis using Python libraries.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Set up the Python environment and apply basic programming constructs using variables, data types, and operators
CO2: Implement conditional and loop structures, and work with strings and built-in data structures like list, tuple, set, and dictionary
CO3: Develop reusable code using functions and modules, apply object-oriented programming concepts, handle files and exceptions
CO4: Build simple GUI applications, perform database operations with MySQL, and analyze data using NumPy, Pandas, and visualization tools

Course Content:

Topics	Hours
Unit -I	6
Introduction to Programming, Choosing Python, Setting up Python environment, Python IDEs, Input/output, Comments, Variables, Data types, Typecasting, Arithmetic, Assignment, Comparison, Logical, Identity, Membership, Bitwise operators, **Ancient Indian logic systems and their influence on algorithmic thinking**	
Unit -II	8
Conditional statement:if, if-else, if- elif -else;loop: while, for, break, continue, pass, range; String: Creating, Formatting, Indexing, Slicing, String methods; List,Tuple,Set Dictionary	
Unit -III	9
Function: Creating, Calling, Arguments, Variables, Recursion, Lambda functions; Modules: Creating, Importing, Built-in modules ; Class & Object: Creating, Attributes, Methods, Inheritance, Polymorphism; Files: Opening, Reading, Writing, Closing files ; Exception: Syntax errors, Logical errors, try/except/finally	
Unit -IV	7
GUI Programming: Tkinter basic Programming ;Database Access :MySQL, CRUD operations ;Data Analysis: NumPy, Pandas, Visualization	

Suggested readings:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming (2nd Edition)
2. Head-First Python: A Brain-Friendly Guide (2nd Edition)
3. Learn Python the Hard Way: 3rd Edition
4. To learn and know the concepts of file handling, exception handling.

Program: BCA
Semester: Third
Course: Python Programming Lab
Course Code: 3CCC201P

L	T	P	C
0	0	2	1

List of experiments:

1. Write a program to calculate the average of three subject's mark of a student.
2. Write a program to swap two numbers.
3. Write a python program to convert temperature from Celsius to Fahrenheit.
4. Write a python program to find largest among three numbers
5. Write a python program to print all the prime numbers less than 20.
6. Generate Fibonacci series up to n term.
7. Write a program to display greatest common divisor of two numbers.
8. Enter any string and check whether it is palindrome.
9. Enter any string and count total number of vowel and consonant.
10. Write a python program to create, append and remove lists in python.
11. Write a program to demonstrate working with tuples in python.
12. Write a program to demonstrate working with dictionaries in python.
13. Write a python program to find factorial of a number using recursion.
14. Write a python program to define a module and import a specific function in that module to another program.
15. Display the average of three numbers using lambda function
16. Display the factorial of any number using tkinter.
17. Write a program for the crud operation.
18. Write a program using numpy module.
19. Write a program using panda module.
20. Write a program using matplotlib module.

Program: BCA
Semester: Third
Course: Database Management System
Course Code: 3CCC202

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the fundamental concepts, architecture, types of users, and data modeling techniques in database systems.
- To study various data models such as relational, network, and hierarchical, and apply relational algebra and relational calculus.
- To acquire practical knowledge of SQL for querying databases and understand normalization techniques for efficient database design.
- To learn the principles of transaction processing, concurrency control, and explore advanced topics like distributed and object-oriented databases.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Explain the goals of DBMS, its architecture, and design entity-relationship (ER) models with appropriate constraints
CO2: Apply relational algebra, calculus, and data manipulation techniques across different database models
CO3: Write SQL queries and perform normalization using various normal forms to design efficient database schemas
CO4: Understand transaction management, concurrency control mechanisms, and gain awareness of advanced database applications such as data mining and distributed databases

Course Content:

Topics	Hours
Unit -I	9
Concept and goals of DBMS, DBMS Architecture, Database Languages, Database Users, Database Abstraction. Basic Concepts of ER Model: Entity Type, Entity Set, Relationship type, Relationship sets, Constraints: Cardinality Ratio and Participation Constraint, Keys, Mapping, Design of ER Model, **Traditional Indian record-keeping systems: Palm-leaf manuscripts to temple accounting**	
Unit -II	8
Concepts, Data definition, Data manipulation and implementation. Network Data Model, DBTG Set Constructs, and Implementation, Relational database, Relational Algebra, Relational Calculus, Tuple Calculus.	
Unit -III	7
SQL, Normalization using Functional Dependency, 1NF, 2NF, 3NF, BCNF, Multivalued dependency and Join dependency.	
Unit -IV	6
Transaction basics: ACID property, Lifecycle of Transaction, Why Concurrency Control, Schedule, Serializability, Lock Based Protocols, Time Stamped Based Protocols, Deadlock Handling, Crash Recovery. Distributed Database, Object Oriented Database, Multimedia Database, Data Mining, Digital Libraries.	

Suggested Readings:

1. Data Base System Concepts, Silverchatz, Korth & Sudarshan, MH.
2. Data Base Management Systems, Majumder & Bhattacharyya, TMH
3. Oracle PL/SQL Programming, Feuerstein, SPD/O'Reilly
4. Fundamentals of Data Base Mgmt. System , Vig & Walia, ISTE/EXCEL
5. Data Base Management Systems,Leon, VIKAS
6. Data Base Processing:Fundamentals, Design & Implementation, Kroenke,PHI

Program: BCA
Semester: Third
Course: Database Management System Lab
Course Code: 3CCC202P

L	T	P	C
0	0	2	1

Course Content:

1. Database Schema for Emp_Details
Emp(Eid, Ename, Age, Dept, Salary, Adress, City, State)

For the above schema, perform the following—

a) Create the table with the appropriate data types and integrity constraints
b) Insert around 10 records in the **Emp** table
c) List all the employee names whose age is 40 years.
d) List all the employee names with their City name, whose salary is greater than 30000.
e) List the details of employees whose basic salary is between Rs. 10,000 and 25,000.
f) Display the names of only those employees who belong to Mumbai.
g) List the details for an employee whose Eid=5
h) Create a view which lists out the Eid, Ename and Dept.
i) List the names of employees having salary greater than Rs. 10000 or first alphabet of his name is 'B'
j) Delete the records of those employees whose salary is greater than Rs. 25000.

2. Database Schema for Std_Details
Std(Roll_no, Name, Age, Dept, Course, Semester, Fee, Result)

For the above schema, perform the following—

a) Create the tables with the appropriate data types and integrity constraints
b) Insert around 10 records in the **Std** table
c) Create a view which lists out the Roll_no and Name.
d) Create a view which will show the student names and their result.
e) List the students who have exactly five letters in their name.
f) Find out the total fee paid by the students.
g) Create a view which will display the table in ascending order with the names of student.
h) Display the names of students having at least five characters in their name.
i) Add a penalty of Rs. 1500 in the fee of second student
j) Create a view which will display the student details belonging to either Delhi, Mumbai or Kolkata.

3. Database Schema for Sports_Details Player(Reg_no, Name, Age, Sports_name, Fee)
For the above schema, perform the following-

a) Create the tables with the appropriate data types and integrity constraints
b) Insert around 10 records in the Player table.
c) Change the name of the fifth player to 'Ramesh'
d) List the players who play tennis or cricket.

e) Create a view which will display the player names and fee in descending order with their names.
f) Delete all the player's records whose age is below 20 years.
g) Count total number of rows in the table.
h) Add a new column Address to the existing table.
i) Delete all the details from the table Player.
j) Drop the table from its database.

4. Database Schema for Student_Library scenario

Std(Std_no, Std_name)
Membership(Mem_no, Std_no)
Book(book_no, book_name, author)
Iss_rec(iss_no, iss_date, Mem_no, book_no)

For the above schema, perform the following—

a. Create the tables with the appropriate data type and integrity constraints
b. Insert around 10 records in each of the tables
c. List all the student names with their membership numbers
d. Give a list of books taken by student with std_no as 7.
e. List the detail of the students who borrowed book whose author is 'Floyd'
f. List all the issues for the current date with student and book names
g. List the book details which are issued as of today
h. Give a count of how many books have been bought by each student
i. Create a view which lists out the iss_no, iss _date, std_name, book name
j. Create a view which lists the daily issues-date wise for the last one week.

5. Database Schema for a Customer_Sale scenario Customer(cust id, cust_name)

Item(item_id, item_name, price) Sale(bill_no, cust_id, item_id, qty_sold)

For the above schema, perform the following—

a) Create the tables with the appropriate data types and integrity constraints
b) Insert around 10 records in each of the tables
c) List the total Bill details with the quantity sold, price of the item and the final amount
d) List the details of the customer who have bought a product which has a price>500
e) List all the bills for the current date with the customer names and item numbers
f) Give a count of how many products have been bought by each customer
g) Give a list of products bought by a customer having cust_id as 5
h) List the item details which are sold as of today
i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount
j) Create a view which lists the daily sales date wise for the last one week

Program: BCA
Semester: Third
Course: Operating System
Course code: 3CCC203

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the fundamental concepts of operating systems, including process management, threads, and process synchronization.
- To understand and analyze various CPU scheduling techniques and deadlock handling strategies such as detection, prevention, and recovery.
- To explore memory management techniques, including paging, segmentation, and page replacement algorithms.
- To provide knowledge about file system architecture, file operations, disk management, and I/O subsystem design**.**

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain the purpose of an operating system, its types, and demonstrate understanding of processes, threads, and synchronization mechanisms
CO2: Apply scheduling algorithms and analyze deadlock handling methods including Banker's algorithm
CO3: Understand memory management strategies like paging, segmentation, virtual memory, and implement page replacement algorithms
CO4: Describe file system architecture, perform file and directory operations, and explain I/O management including device drivers and controllers

Course Content:

Topics	Hours
Unit -I	12
Introduction: What is an operating system, batch systems, multi programmed, time-sharing systems, personal- computer systems, parallel systems, distributed systems, real-time systems? **Processes:** Process Concept, Thread, design issues of thread, user space thread and kernel space thread. Usage of thread. Process states, Operation on Processes: - creation and termination. Implementation of process: process table. Process Synchronization, **Time-sharing and scheduling in traditional Indian astronomical systems (e.g., Panchang)**	
Unit -II	11
Scheduling: Basic Concepts, preemptive and non-preemptive scheduling. Scheduling Algorithms. Types of scheduling: - batch, interactive and real-time. Goals of scheduling algorithms. FCFS, SJF, RR, priority, multiple queues, three-level scheduling. **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. Banker's algorithm.	
Unit -III	9
Memory management: Multiprogramming. Address binding (relocation), and protection. Swapping. Virtual memory: - logical versus physical address space, paging, page fault, page table and its entries, demand paging, multi-level page table, TLB, its entries and working. Page replacement algorithms: LRU, optimal, NRU, FIFO, second chance, clock, NFU. Working set. What is segmentation, what are its benefits and drawbacks	
Unit -IV	8
File system: What is file, file naming, file types(directory, regular, device), sequential access and random access files, file attributes, operations on file, hierarchical directory structure, path name(relative and absolute), operation on directories, disk layout, disk partition, file system layout, disk block allocation:- contiguous allocation linked list allocation, **I/O management:** Basic principles and overall structure of I/O management subsystem, Device controllers, layers of the I/O subsystem: - interrupt handler's device driver, device independent I/O software and user space I/O software.	

Suggested Readings:

1. Operating Systems, Galvin, John Wiley
2. Operating Systems , Milankovic, TMH
3. An Introduction to Operating System, Bhatt,PHI
4. Modern Operating System, Tannenbaum,PHI

Program: BCA
Semester: Third
Course: Understanding India
Course code: 3CVAC202

L	T	P	C
2	0	0	2

Course Objectives

The objective of this course is:

- To provide knowledge about the cultural roots of India, including ancient civilizations, major religions, and contributions to education and literature.
- To introduce the contributions of key leaders and regional heroes in India's freedom struggle and familiarize students with India's physical geography.
- To explain India's population dynamics, diversity, and key elements of the Indian Constitution including fundamental rights and duties.
- To develop an understanding of core political values and trace the historical development of the Indian economy.

Course Outcome:

After the successful completion of the course, the students will be able to:

CO1: Understand the evolution of Indian culture and religion from the Harappan period to modern institutions of education and literature.

CO2: Recognize the roles of national and regional freedom fighters and describe India's major geographical features and their impact.

CO3: Analyze India's population structure, diversity, and constitutional framework, including the Preamble, rights, and duties.

CO4: Explain political ideas such as non-violence and social justice and summarize the evolution of the Indian economy in terms of agriculture, industry, and trade.

Course Content:

Topics	Hours
Unit -I	6
Background of India's Culture: • Harappan civilisation and Vedic age • Buddhism, Jainism, Sanatan (Hinduism) and Islam **Growth and development of Indian Education and literature:** • Bharat's Natyashastra, Kalidas, Panini, Patanjali • Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS, **Insights from Chanakya Neeti and Indian ethics in professional communication and behavior.**	
Unit -II	6
Leaders of India's freedom struggle: • Mahatma Gandhi • Jawaharlal Nehru • Subhash Chandra Bose • Freedom fighters of Jharkhand (Tilka Manjhi, Sidho-Kanho, Birsa Munda &Jatra Bhagat) **Geographical features of India:** • India on the map of world and its neighboring countries • Physical features of India including mountain, plateau, plain, coast, island, vegetation, rivers, soils, and climate	
Unit -III	4
The People of India: Racial diversities, Population, its growth, distribution, Migration. Indian Constitution: • Preamble • Salient features • Fundamental rights • Fundamental duties	
Unit -IV	4
Political ideas: Non-violence, Satyagraha and Social Justice The Indian Economy: The Indian Economy through the Ages (Agriculture, Industry and Trade-Transport)	

Suggested Readings:

1. A. L. Basham, A Cultural History of India, Oxford University Press, 1997
2. A. L. Basham, A Wonder that was India, Rupa, New Delhi, 1994
3. N. R. Ray, An Approach to Indian Art, Publication Bureau, Chandigarh, 1974
4. NayanjotLahiri, Marshaling the Past: Ancient India and its Modern Histories, Permanent Black, 2012
5. R.C. Majumdar (ed.), History and Culture of Indian People (Relevant Volumes and Chapters), Bhartiya Vidya Bhawan, Bombay.
6. S. C. Ghosh, History of Education in Modern India, 1758-1986, Orient Longman, Hyderabad, 1995
7. Tirthankar Ray, The Economic History of India 1857-1947, OUP, 2006
8. Vijay Joshi and I.M.D. Little, India's Economic Reforms, 1991-2001, OUP, 199
9. अभुत भारत, ए. एल. बाशम,

Program: BCA
Semester: Third
Course: Professional Skills
Course Code: 3CAEC201

L	T	P	C
2	0	0	2

A. Career Skills

Course Objective:
Students will be able to

- Acquire career skills and fully pursue to partake in a successful career path.
- Prepare good resume, prepare for interviews and group discussions.
- Explore desired career opportunities in the employment market in consideration of
- an individual SWOT

Course Outcome:
After the successful completion of the course, the students will be able to:

CO 1: Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
CO 2: Actively participate in group discussions and interviews towards gainful employment.
CO 3: Identify career opportunities in consideration of their own potential and aspirations.

Course Content:

Topics	Hours
Unit -I	4
Resume Skills: Preparation and Presentation, • Introduction of resume and its importance, • Difference between a CV, Resume and Bio data ,• Essential components of a good resume , common errors ,• Common errors people generally make in preparing their resume ,• Prepare a good resume of her/his considering all essential components , **Insights from Chanakya Neeti and Indian ethics in professional communication and behavior**	
Unit- II	4
Interview Skills : Preparation and Presentation- • Meaning and types of interviews (F2F, telephonic, video, etc.) ,• Dress Code, Background Research, Do's and Don'ts ,• Situation, Task, Approach and Response (STAR Approach) for facing an interview ,• Interview procedure (opening, listening skills, closure, etc.) ,• Important questions generally asked in a job interview (open and closed ended questions), Interview Skills: Simulation -• Observation of exemplary interviews ,• Comment critically on simulated interviews , Common Errors -• Discuss the common errors generally candidates make in interview ,• Demonstrate an ideal interview	
Unit -III	3
Group Discussion Skills: Meaning and methods of Group Discussion, • Procedure of Group Discussion, • Group Discussion- Simulation, • Group Discussion - Common Errors	
Unit- IV	3
Exploring Career Opportunities: Knowing yourself – personal characteristics, • Knowledge about the world of work, requirements of jobs including self- employment. • Sources of career information, • Preparing for a career based on their potentials and availability of opportunities	

Suggested Reading:

1. Monippally, Matthukutty. M. 2001. *Business Communication Strategies*. 11th Reprint. Tata McGraw-Hill. New Delhi
2. Soft Skills Dr. K. Alex
3. Managerial Skills Dr. K.Alex

B. Team Skills

Course Objective:

Students will be able to

- Understand the significance of Team Skills and help them in acquiring them.
- Help them design, develop and adapt to situations as an individual and as a team.
- Help students understand the techniques of individual and group brain storming.

Course Outcome:

After the successful completion of the course, the students will be able to:

CO 1: Use common technology messaging tools that are used in enterprises for flow of information and transition from command and control to informal communication during an online/offline team session.

CO 2: Appreciate and demonstrate Team Skills.

CO3: Generate, share and maximize new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates.

Course Content:

Topics	Hours
Unit I	4
Presentation Skills: • Types of presentations, • Internal and external presentation, • Knowing the purpose ,• Knowing the audience ,• Opening and closing a presentation ,• Using presentation tools ,• Handling questions ,• Presentation to heterogenic group ,• Ways to improve presentation skills over time, **Insights from Chanakya Neeti and Indian ethics in professional communication and behavior.**	
Unit II	2
Trust and Collaboration: • Explain the importance of trust in creating a collaborative team, • Agree to Disagree and Disagree to Agree – Spirit of Team work ,• Understanding fear of being judged and strategies to overcome fear	
Unit III	3
Listening as a Team Skill: • Advantages of Effective Listening, • Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre- think, use empathy, listen to tone and voice modulation, recapitulate points, etc.).	
Unit IV	3
Brainstorming: • Use of group and individual brainstorming techniques to promote idea generation. • Learning and showcasing the principles of documentation of team session Outcomes.	
Unit V	2
Social and Cultural Etiquette: • Need for etiquette (impression, image, earn respect, appreciation, etc), • Aspects of social and cultural/corporate etiquette in promoting teamwork ,• Importance of time, place, propriety and adaptability to diverse cultures	
Unit VI	2
Internal Communication: Use of various channels of transmitting information including digital and physical, to team members.	

Suggested Reading:

1. Monippally, Matthukutty. M. 2001. *Business Communication Strategies*. 11th Reprint. Tata McGraw-Hill. New Delhi
2. Soft Skills Dr. K. Alex
3. Managerial Skills Dr. K.Alex

Program: BCA
Semester: Third
Course: Character Building & Holistic Development of Personality- III (Universal Human Values and Ethics)
Course code: 3CVAC201

L	T	P	C
2	0	0	2

Course Objectives
The objective of this course is:

- To familiarize students with Indian cultural values.
- To inspire students to preserve and protect values and ethics.
- To build moral, ethical, energetic individual dedicated towards the service of humanity.
- To focus on holistic development of an individual.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Comprehend the significance of **Indian cultural values**.
CO2: Acquire the ability to adapt, safeguard, and uphold **ethical values**.
CO3: Contribute as **responsible citizens** for the betterment of mankind.
CO4: Foster **well-rounded and balanced personal growth**.

Course Content:

Topics	Hours
Unit I	4
Personality Development: Meaning, Concept, Constituent elements of personality and Means/Ways of Personality Development, Pancha kosha: General Introduction, Meaning, Objectives, Characteristics and Significance ,Benefits of Pancha kosha, development and deficiencies due to underdevelopment of Panch kosha, **Pancha Kosha model and the holistic development of personality as per Indian philosophical thought**	
Unit II	4
Mental Emotional Development: Values and Individual: Non-Possession, Non-Stealing, Self-Restrain, Enthusiasm, Dutifulness, Reticence, Silence, Self-study, Considerateness and Self-respect, Values and Family: Respectful Salutation, Obedience, Contentment, Patience, hospitality, Parent Service, Rectitude, Good Behaviour, Family feeling and worship.	
Unit III	8
Indian Values: Values and Society: - Discipline, Social Responsibility and Duties of Citizens, Altruism/ Charity, keeping good company, Gratefulness, Fraternity/ Friendship, Courtesy, Tactfulness, Soft Spoken and Feeling for the Oppressed. **Values and Constitution:** Dignity of an Individual, Fundamental Duties, Fundamental rights, Directive Principles of State Policies, Social Equality, Democracy, Justice, Freedom, Sarva-Pantha Samman and Scientific Approach.	
Unit IV	8
Practice of Values: Values and Indian Culture: - Integrity of the nation, Glory of the Past, Swadeshi, Nation Building, Patriotism, Mother Tongue, National Unity, Public Welfare, Equality and Spirituality. **Values and Vision of the World: -** Humanity, Integrity, Human rights, The Highest or Most Sublime Good, Vasudhaiva Kutumbakam, Tolerance, Peaceful Coexistence, World-Welfare, Environmental Protection, Swavalamban/Self-reliance	

Suggested Reading:

1. My Idea of Education, Swami Vivekanand, Advaita Ashram, Kolkata
2. Personality Development, Swami Vivekananda, Advaita Ashram, Kolkata.
3. The Man India Missed the Most; Subhash Chandra Bose, huvan Lall, Notion Press, Chennai

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Semester IV

SEM 4					
Core Courses-Compulsory					
3CCC207	Data Communication and Computer Networks	3	0	0	3
3CCC204	Artificial Intelligence	3	0	0	3
3CCC204P	Artificial Intelligence Lab	0	0	2	1
3CCC205	Computer Graphics and Multimedia	3	0	0	3
3CCC205P	Computer Graphics and Multimedia Lab	0	0	2	1
3CCC206	Software Engineering	3	0	0	3
Ability Enhancement Course- Compulsory					
3CAEC202	Seminar In Executive Communication *	2	0	0	2
Skill Enhancement Course- Compulsory					
3CSEC201	Statistics for BCA	3	0	0	3
Common Value Added Courses					
3CVAC203	Cyber Security	3	0	0	3
Vocational Courses (Summer): Only for students who wish to exit after the First Year with a Certificate					
3CVOC201	Full Stack Web Development	2	0	4	4
	Total without Vocational Course				22
	Total with Vocational Course				26

Program: BCA
Semester: Fourth
Course: Data Communication and Computer Networks
Course code: 3CCC207

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamental concepts and components of data communication, transmission models, and impairments.
- To explain the layered network architecture, protocols, and services with a comparison of OSI and TCP/IP models.
- To provide knowledge of transmission media, signal types, and switching techniques used in computer networks.
- To familiarize students with multiplexing techniques, data rate limitations, and data link layer control mechanisms.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Describe the components and data flow of communication systems, transmission models, encoding techniques, and impairments affecting data transmission.
CO2: Explain the layered network architecture, compare OSI and TCP/IP models, and evaluate different network topologies and classifications.
CO3: Identify and differentiate guided and unguided transmission media, and explain switching techniques and physical layer characteristics.
CO4: Analyze transmission impairments, calculate data rate limits using Nyquist and Shannon formulas, and apply flow control and error control techniques in the data link layer.

Course Content:

Topics	Hours
Unit -I	8
Introduction: Data Communication: Components, Data Flow; Network Categories: LAN, MAN, WAN (Wireless / Wired); Data Transmission Basic Concepts and Terminology: Data Communication Model, Communication Tasks, Parallel & Serial Transmission, Transmission Models, Transmission Channel, Data Rate, Bandwidth Signal Encoding Schemes, Data Compression, Transmission Impairments, **Ancient Indian communication systems (e.g., relay systems, postal systems, signalling through dhwajas).**	
Unit -II	7
Concept of layers, protocols, interfaces and services; Reference Model: OSI, TCP/IPand their Comparison, Computer Network: Network Topology, Performance of Network, Network Classification, Advantages & Disadvantages of Network	
Unit -III	7
Transmission Media (guided and unguided) Twisted pair, coaxial cable, fiber optics, wireless transmission (radio, microwave, infrared);Circuit Switching & Packet Switching. Physical Layer: Concept of Analog & Digital Signal; Bit rate, Bit Length	
Unit- IV	8
Transmission Impairments: Attenuation, Distortion, Noise; Data rate limits: Nyquist formula, Shannon Formula; Multiplexing: Frequency Division, Time Division, Wavelength Division; Data Link Layer: Need for Data Link Control, Frame Design Consideration, Flow Control & Error Control (Flow control mechanism, Error Detection and Correction techniques)	

Suggested Readings:

1. Andrew S. Tanenbaum: “Computer Networks”, Pearson Education
2. Behrouz A Forouzan : Tata Mcgraw Hill
3. William Stalling: ‘Data and computer Communications’ Pearson Education.
4. Douglas E. Coomer: “Internet Working with TCP/IP”, Pearson Education.
5. Kurose Ross : Computer Networking: A top down approach, 2nd Edition, Pearson Education

Program: BCA
Semester: Fourth
Course: Artificial Intelligence
Course Code: 3CCC204

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the foundational concepts of Artificial Intelligence and explore heuristic search techniques for problem-solving.
- To understand various knowledge representation methods and logic-based approaches used in AI.
- To develop an understanding of Natural Language Processing (NLP) and machine learning techniques such as rote learning, induction, and explanation-based learning.
- To provide insights into expert systems, domain-specific knowledge representation, and AI programming languages like LISP.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand the fundamentals of AI, describe problem-solving using search techniques, and apply heuristic methods like hill climbing and best-first search. **CO2:** Represent knowledge using logical and symbolic approaches, including predicate logic and computable functions.

CO3: Analyse the components of Natural Language Processing and demonstrate various machine learning approaches in AI problem-solving.

CO4: Describe the structure of expert systems, evaluate their use of domain-specific knowledge, and apply basic AI programming constructs using LISP.

Course Content:

Topics	Hours
Unit -I	7
Overview of A.I: Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success. Problems, 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 Heuristic search techniques Generate and test, hill Climbing, best first search technique, problem reduction, constraint satisfaction, **Indian contributions to logic, reasoning, and cognition (e.g., Nyaya Shastra and Panini's grammar system)**	
Unit -II	8
Knowledge representation: Definition and importance of knowledge, Knowledge representation, Various approaches used in knowledge representation, Issues in knowledge representation Using Predicate Logic Represent ting Simple Facts in logic, Representing instances and is a relationship, Computable function and Predicate.	
Unit -III	8
Natural language processing :Introduction syntactic processing, Semantic processing, Discourse and pragmatic processing Learning: Introduction learning, Rote learning, Learning by taking advice, Learning in problem solving, Learning From example-induction, Explanation based learning.	
Unit -IV	7
Expert System: Introduction, Repenting using domain specific knowledge, Expert system shells. LISP and other AI Programming Language.	

Suggested Reading:

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1999

Program: BCA
Semester: Fourth
Course: Artificial Intelligence Lab
Course Code: 3CCC204P

L	T	P	C
0	0	2	1

List of experiments:

1. Production System: Water Jug Problem
Solve the Water Jug problem using a production system approach.
Software: Python

2. Heuristic Search: 8-Puzzle Problem
Implement the 8-puzzle problem using a heuristic search algorithm.
Software: Python

3. Hill Climbing: Find Local Maxima
Write a hill climbing algorithm to find local maxima in a mathematical function.
Software: Python

4, Write a prolog program to represent few basic facts and perform queries
(eg elephant is an animal. Elephant is bigger than horse etc.

5. Write a prolog program to represent few basic facts and perform queries
(eg elephant is an animal. Elephant is bigger than horse etc.)

6. Predicate Logic: Representing Simple Facts
Create a program to represent simple facts using predicate logic.
Software: Prolog, SWI-Prolog

7. Predicate Logic: Family Tree Representation
Implement a family tree and represent relationships using predicate logic.
Software: Prolog, SWI-Prolog

8 .Syntactic Processing: Sentence Parser
Write a program to parse simple sentences using a context-free grammar.
Software: Python, NLTK (Natural Language Toolkit)

9. Expert System Shell: Simple Medical Diagnosis
Develop a simple expert system for medical diagnosis using an expert system shell.
Software: CLIPS, JESS

10. Expert System: Rule-Based Chatbot
Create a basic rule-based chatbot that responds to user queries.
Software: Python, AIML (Artificial Intelligence Markup Language)

11. Implement recursive functions in (e.g., factorial, Fibonacci).
Software: SWI-Prolog
Prolog: Solving Logic Puzzles

12. Use Prolog to solve simple logic puzzles (e.g., Sudoku).
Software: SWI-Prolog

Program: BCA
Semester: Fourth
Course: Computer Graphics and Multimedia
Course Code: 3CCC205

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals of computer graphics, its applications, and various display devices.
- To develop an understanding of graphic software, drawing algorithms, and 2D geometric transformations.
- To explore raster graphics techniques, clipping algorithms, and 2D viewing transformations.
- To provide knowledge of multimedia systems including text, audio, image, video processing, and related hardware.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Describe the basics of computer graphics and identify different types of display devices and their working principles.
CO2: Apply line and circle drawing algorithms and perform 2D geometric transformations using matrix operations.
CO3: Implement clipping algorithms for points, lines, and polygons and explain the 2D viewing pipeline.
CO4: Understand multimedia components such as text, audio, image, animation, and video along with related input/output hardware.

Course Content:

Topics	Hours
Unit -I	5
Computer Graphics and their applications. Overview of Graphics system. Display Devices: CRT Monitors (Random Scan and Raster Scan, DVST, Plasma Panal Display, LED and LCD Monitors, **Ancient Indian visual storytelling: from cave paintings to Kathakali – multimedia principles in tradition**	
Unit -II	8
Graphics Software. Elementary Drawing: Points and various line drawing Algorithms and their comparisons efficiency contact. Cycle generating algorithms other objects like ellipses, arcs, section spirits. Two Dimensional Geometric Transformations: Basic Transformations, Matrix Representations andHomogeneous coordinates, Composite Transformations, Reflection and Shear, Transformations between Coordinates Systems.	
Unit -III	6
Raster Methods for Transformations. Two-Dimensional Viewing: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-View Port coordinate Transformation. Clipping- Point, Line (Cohan-0Sutherland Line Clipping and Liang Barsky Line Clipping and Nicholl-Lee- Nicholl Line Clipping) and Polygon Clipping(Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping).	
Unit -IV	11
Multimedia: Text –Font, Faces, animating **Text, Hyper Text. Sound:** MIDI, Digital audio basics, auto file formats, audio editing, MCI-multimedia control interface. Image -Bitmap, Vector drawing, color palate, concept of 3D Modeling, Image file formats **(BMP,JPG);Animation :** principle of animation, cell animation, kinematics, morphing; Video –Broadcast video standards (NTSC, PAL), Integrating computer and television, video capture board, video, colour, shooting and editing video, recording formats 9S-VHS) video hardware resolution, video compression (JPEG, MPEG); Hard copy devices: Printers & plotters, Input devices : mouse, Trackball, Light pen, Scanner, Digital Camera.	

Suggested Readings:

1. Computer Graphics by Donal Hearn M. Pardive Baker (PHI) Easter Economy Edition.
2. Computer Graphics by Roy A. Plastockand Gordon Kalley-Schaum's Series.
3. Computer Graphics by Marc Berger.
4. J. F. Koegel Buferd -Multimedia Systems, Pearson Education, New Delhi,
5. J.D.Foley- Computer Graphics, 2ndEdn, Pearson Education, New Delhi
6. Computer Graphics: With an Introduction To Multimedia by Rajiv Chopra

Program: BCA
Semester: Fourth
Course: Computer Graphics and Multimedia Lab
Course Code: 3CCC205P

L	T	P	C
0	0	2	1

Program:

1. Program to draw a point
2. Program to draw line.
3. Program to draw a circle.
4. Program to draw a rectangle
5. Program to draw an arc.
6. Program to draw an ellipse. .
7. Program to draw a polygon.
8. Program to draw a filled polygon.
9. Program to draw a concentric circle.
10. Program to draw a sector.
11. Program to draw pie slice.
12. Program to draw a bar.
13. Program to draw a 3D bar.
14. Program to draw pie chart.
15. Program to draw bar chart.
16. Program to draw 3D Bar chart.
17. Program to draw a kite.
18. Program to draw a mesh ball.
19. Program to draw smiley face.
20. Program to draw a car.
21. To perform animation using any Animation software (Create Frame by Frame Animations Using multimedia authoring tools)
22. To perform basic operations on image using any image editing software
23. To create a Jpeg image that demonstrates the various features of an image editing tool.

Program: BCA
Semester: Fourth
Course: Software Engineering
Course Code: 3CCC206

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- **To** introduce the principles, paradigms, and models of software engineering along with the role of software metrics in measuring productivity and quality.
- **To** develop an understanding of Software Requirement Specification (SRS), including its structure, components, and related metrics.
- **To** impart knowledge of software project planning techniques such as cost estimation models, scheduling, quality assurance, and system design methodologies.
- **To** familiarize students with detailed design, coding practices, and software testing strategies including functional and structural testing.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain various software engineering paradigms and models, and apply software metrics for evaluating software productivity and quality.
CO2: Analyze and prepare Software Requirement Specifications (SRS) using structured analysis tools like DFDs and data dictionaries.
CO3: Estimate project costs using models like COCOMO, schedule tasks, and apply design methodologies for structured software development.
CO4: Design modules, apply coding standards, and perform software testing using appropriate levels, test cases, and criteria.

Course Content:

Topics	Hours
Unit- I	8
Introduction to Software Engineering: Definition, Software Engineering Paradigms, waterfall method, prototyping, interactive enhancement, The Spirit model, Fourth Generation Technique Software Metrics: Role of Metrics and measurement, Metrics for software productivity and quality, Measurement software, size-oriented metrics, function-oriented metrics, Metrics for software quality, Integrating metrics within the software engineering process, **Project planning and systematic documentation in ancient Indian architecture (e.g., temple construction).**	
Unit -II	8
Software Requirement Specification (SRS): Problem analysis, structuring information, Data flow diagram and data dictionary, structured analysis, Characteristics and component of (SRS), Metrics of SRS, and function point, Number of errors and found, change request frequency.	
Unit -III	8
Planning a Software Project: Cost estimation, uncertainties in cost estimation, Single variable model, COCOMO model, On software size estimation, Project scheduling and milestones, Software & Personal Planning, Rayleigh curve, Personal Plan, Quality Assurance Plan, Verification & Validation (V & V), inspection & review. System Design: Design Objectives, Design Principles, problem, Partitioning, Abstraction, Top Down and Bottom up techniques, Structure Design, Structure Charts, Design Methodology, Design Review, Automated Cross Checking, , total Number of modular, number of parameters.	
Unit -IV	6
Detailed Design: Module specification, Specifying functional module, specifying data abstraction, PDL And Logic/Algorithm Design. Coding: Coding by Top down and Bottom up, Structured Programming, Information Hiding, Programming style, Internal Documentation. Testing: Level of testing, Test cases and test criteria. Psychology of Testing, Functional Testing, Structural Testing.	

Suggested Readings:

1. Software Engineering, Roger S. Pressman.
2. Integrated Approach to Software Engineering, Pankaj Jalote
3. Fundamentals of Software Engineering, Rajiv mall PHI.

Program: BCA
Semester: Fourth
Course: Statistics for BCA
Course code: 3CSEC201

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the significance of statistics and develop skills in data collection, classification, and presentation.
- To learn and apply various measures of central tendency and dispersion for both grouped and ungrouped data.
- To acquire foundational knowledge of probability theory, including key probability distributions and theorems.
- To understand the concept of random variables, their types, probability functions, and statistical expectations**.**

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain the role of statistics, distinguish between data types, and apply appropriate data collection and presentation methods
CO2: Compute and interpret central tendency and dispersion measures for various data types, and analyze correlation
CO3: Apply probability rules, conditional probability, Bayes' theorem, and work with Binomial, Poisson, and Normal distributions
CO4: Define and differentiate types of random variables, and calculate probability functions, expectations, and variance

Course Content:

Topics	Hours
Unit -I	7
Introduction: Importance of Statistics, Primary and secondary data, data collection methods. Presentation of numerical and categorical data, **Statistical thinking in Indian astronomy and mathematics – work of Aryabhata, Brahmagupta.**	
Unit -II	9
Concepts Of Central Tendency and Dispersion: Mean, median, mode and partition values-quartiles for grouped and ungrouped data. Range, quartile deviation, standard deviation and coefficient of variation for grouped data, Correlation.	
Unit -III	9
Probability: Random Experiment- Sample space and events. Probability. Rules. Conditional probability, Binomial Distribution, Poison and Normal Distribution. **Random Variable**: Definition, types of random variables, probability functions, expectations and variance.	
Unit -IV	5
Counting Techniques: Basics of Counting, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction	

Text Books and Reference Books:

1. Berenson and Levine, Basic Business Statistics, New Jersey, 6th edition, Prentice- Hall India, 1996.
2. D.C. Montogomery and G.C.Runger, Applied Statistics and Probability for engineers, New Jersey, John Wiley and Sons, 3rd edition, 2003

Program: BCA
Semester: Fourth
Course: Cyber Security
Course Code: 3CVAC203

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the evolving landscape of cyber security threats, attack taxonomies, and cyber resilience frameworks across various sectors.
- To explore proactive threat detection, adversary frameworks, and enterprise-level protection strategies, including dark web crime and network security.
- To examine security concerns in mobile, IoT, and web applications, along with the impact of ransomware, insider threats, and phishing in critical industries.
- To understand cloud security challenges, the use of Security Intelligence tools like SIEM, and the role of SOC in threat detection and incident response.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Identify global cyber security trends, types of cyber-attacks, and apply cyber resilience lifecycle models across critical industry sectors.
CO2: Analyze adversary frameworks, threat hunting strategies, and advanced persistent threats using enterprise network protection techniques.
CO3: Evaluate security threats in mobile, IoT, and web applications, and assess the impact of cyber-attacks like ransomware and phishing on government and healthcare sectors.
CO4: Demonstrate understanding of cloud security risks, SIEM tools, and SOC operations for incident response and enterprise threat management.

Course Content:

Topics	Hours
Unit -I	7
Understand the current impact of cyber security threats: Research global cyber security trends in different geographies, Familiarize with the taxonomy of cyber-attacks, Explore the enterprise cyber security domains	
Explore the most frequently targeted industry sectors including: Government, Energy and Utilities, Retail and Telecom Explore the cyber resilience framework understand the cyber resilience lifecycle, **Ancient Indian concepts of information confidentiality and security (e.g., Kautilya's espionage systems).**	
Unit -II	8
Understand the need for a cyber-threat hunting approach: Explore cyber-attack adversary frameworks, Investigate enterprise threat protection methods, Explore industry case studies	
Understand network attack trends in the financial sector using crypto miners: Understand how cyber criminals use networks in the dark web to perform illicit crime activities, Learn network protection practices like DNS, VPN, Understand enterprise network security practices through the analysis of an advanced persistent threat	
Unit -III	8
Explore the mobile and IoT global phenomena: Understand mobile and IoT attack surface, Explore recent most threatening IoT cyber-attack scenarios, Learn to protect your home and organization with endpoint protection practices	
Understand the wide adoption of industry applications: Learn web application fundamentals, Investigate application security practices, Examine the anatomy of the most dangerous applications threats	
Understand the impact of data breaches and ransomware in Government and Health sectors: Research the anatomy and impact of Insider Threat and Phishing cyber-attacks, of Research the anatomy and impact Ransomware and Cyber Fraud cyber-attacks, Explore a Healthcare end-to-end industry case study.	
Unit -IV	7
Understand the reason of the global enterprise adoption of cloud computing: Understand the cloud security challenges brought by an integrated data, network, access infrastructure, Review the key cloud security practices for the enterprise, Explore a Telco cloud data breach scenario	
Understand the drivers behind the enterprise adoption of Security Intelligence methods and tools: Explore the characteristics of Security Information and Event Management (SIEM) platforms, Explore SIEM in Action through a real-life Phishing attempt scenario	
Understand the Incident Response and Threat hunting practice: Explore the benefits of establishing a SOC (security Operation Center), understand the roles and responsibilities of SOC Operations team	

Suggested Reading:

1. Cyber Security Practitioner by IBM Corporation
2. IBM QRadar SIEM Foundations by IBM Corporation
3. Applied Cryptography by Bruce Schneier.
4. Cyber security and Cyber war: What Everyone Needs to Know by P.W. Singer.

Program: BCA
Semester: Fourth
Course: Seminar in Executive Communication
Course Code: 3CAEC202

L	T	P	C
2	0	0	2

Course Objectives
The objective of this course is:

- To learn about the culture of corporate world.
- To develop the personality skills of the students and teach them to lead a corporate discipline life.
- To enable the students to plan their career on correct measures and motivate them to set their goals on prior basis.
- To create awareness among the students about the job market to prepare themselves at their own pace and potential.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: The students will have learnt about the overview of their goals and also gets to know diversities in the field of their career planning.
CO2: Students will understand the stress, time and emotional management. Also, they will be trained in overcoming the fear and uncomfortable situations such as public speaking.
CO3: The student will have developed and improved their personal and professional effectiveness and corporate culture
CO4: The students will gain knowledge about the higher education, types of competitive exams, getting placed and entrepreneur assertiveness.

Course Content:

Topics	Hours
Unit I	5
Introduction to Corporate Communication: •Definition -importance of corporate communication, •Role and responsibilities of corporate communication, •Professionals-Ethical considerations in corporate communication**, Rhetoric and persuasive techniques in ancient Indian texts (e.g., Bhagavad Gita, Arthashastra).** **ACTIVITY:** Role play based on Corporate Communication.	
Unit II	4
Communication Skills Development: •Public Speaking- Interpersonal communication and networking skills, •Non-verbal communication and body language **Activity:** Panel Discussion	
Unit III	5
Interview Skills: •Purpose of an interview, • Do‘s and Don’ts of an interview **Activity:** Mock interview	
Unit IV	6
Group Discussion & Presentation: •Introduction, • Communication skills in group discussion, • Do’s and don’ts of group discussion, •Planning your Presentation, •Structuring Your Presentation, •Delivering Your Presentation, •Techniques of Delivery, •Dealing with Fears, **Activity:** Group Discussion, PPT creation & delivery (Both solo & group Presentation)	

Suggested Reading:

1. "The Handbook of Corporate Communication and Public Relations" edited by Sandra Oliver
2. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI
3. Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education
4. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
5. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
6. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA
7. Soft skills by RAJ LAKSHMI SURYAVANSHI, Guru Kul Publishing

Program: BCA
Semester: Fourth
Course: Full Stack Web Development
Course code: 3CVOC201

L	T	P	C
2	0	4	4

Course Objectives
The objective of this course is:

- To learn the fundamentals of web development using HTML, CSS, and JavaScript for designing responsive user interfaces.
- To understand advanced front-end development concepts using ReactJS, including components, routing, and state management.
- To gain practical knowledge of back-end development with Node.js and MongoDB, focusing on database connectivity and API integration.
- To apply version control using Git and develop mini projects for implementing full-stack development concepts in real-world scenarios.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Develop responsive web pages using HTML and CSS, and apply JavaScript to add dynamic behavior to websites
CO2: Build interactive front-end applications using ReactJS with proper state, props, and routing management
CO3: Create server-side applications using Node.js, manage data with MongoDB, and integrate backend services with frontend
CO4: Use Git for version control, collaborate using remote repositories, and build mini-projects applying full stack development skills

Course Content:

Topics	Hours
Unit -I	8
HTML: Introduction to HTML, Browsers and HTML, Editor's Offline and Online, Tags, Attribute and Elements, Doctype Element, Comments, Headings, Paragraphs, and Formatting Text, Lists and Links, Images and Tables	
CSS: Introduction CSS, Applying CSS to HTML, Selectors, Properties and Values, CSS Colors and Backgrounds, CSS Box Model, CSS Margins, Padding, and Borders, CSS Text and Font Properties, CSS General Topics, **Structured information presentation in Indian knowledge systems (e.g., Sutra style – concise and layered)**	
Unit -II	12
JavaScript: Introduction to JavaScript , Applying JavaScript (internal and external) , Understanding JS Syntax, Introduction to Document and Window Object ,Variables and Operators , Data Types and Num Type Conversion , Math and String Manipulation, Objects and Arrays, Date and Time , Conditional Statements , Switch Case ,Looping in JS ,Functions	
ReactJs : Introduction ,Templating using JSX ,Components State and Props ,Lifecycle of Components ,Rendering List and Portals, Error Handling ,Routers ,Redux and Redux Saga , Immutable.js , Service Side Rendering , Unit Testing , Webpack	
Unit -III	12
Node.js : Node js Overview , Node js - Basics and Setup , Node js Console , Node js Command Utilities , Node js Modules , Node js Concepts , Node js Events , Node js with Express js ,Node js Database Access	
MongoDB : SQL and NoSql Concepts , Create and Manage MongoDB , Migration of Data into MongoDB , MongoDB with PHP , MongoDB with NodeJS ,Services Offered by MongoDB	
Python : Python Installation & Configuration , Developing a Python Application , Connect MongoDB with Python	
Unit -IV	8
VCS : Introduction to Git , Version Control/Revision Control system , The types of VCS , Getting Started With Git And Its Architecture , Install Git on Windows/Mac/Linux/Unix , Understand Git file life cycle , Remote Repositories. Work with remote repositories, Branching and Merging.	
MiniProject: Projects include topics like creating a personal portfolio page or a landing page for a product and shopping sites.	

Suggested Reading:

1. Full Stack Web Development with Angular JavaScript and Node.js" by Jon Duckett
2. HTML and CSS: Design and Build Websites" by Jon Duckett
3. Full Stack Web Development with Node.js and MongoDB" by Prashant Pant
4. "The Full Stack Developer's Guide to Building Web Applications" by Samarth Swaroop
5. "Full Stack Web Development with React and Node.js" by Prashant Pant

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Semester V

SEM 5					
Core Courses-Compulsory					
3CCC301	Machine Learning	3	0	0	3
3CCC301P	Machine Learning Lab	0	0	2	1
3CCC302	Internet Technologies using HTML,CSS & JAVAScript	3	0	0	3
3CCC302P	Internet Technologies using HTML,CSS & JAVAScript Lab	0	0	2	1
3CCC303	Design and Analysis of Algorithm	3	0	0	3
3CINT301	Internship/ Tour & Training/ Industrial Training	0	0	4	2
Departmental Elective- (Students have to choose any two course)					
3CCDE301	Cloud Computing	4	0	0	4
3CCDE302	Soft Computing	4	0	0	4
3CCDE303	Data Mining and Warehousing	4	0	0	4
3CCDE304	Digital Image Processing	4	0	0	4
3CCDE305	Human Computer Interface	4	0	0	4
Common Value Added Courses					
3CUMC102	Community Engagement and Social Responsibility	1	0	2	2
	Total				23

Program: BCA
Semester: Fifth
Course: Machine Learning
Course Code: 3CCC301

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals of Machine Learning, including key concepts from linear algebra, statistics, and linear regression.
- To explore supervised learning methods such as decision trees, logistic regression, SVM, and understand model evaluation and regularization techniques.
- To develop an understanding of neural networks, including perceptron's, multilayer architectures, and backpropagation algorithms.
- To study unsupervised and semi-supervised learning approaches including clustering algorithms and expectation-maximization.
- To explain ensemble learning methods such as bagging, boosting, and active learning for improving predictive performance.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Understand the basics of machine learning, including statistical foundations and apply linear regression for prediction tasks.
CO2: Apply supervised learning techniques like decision trees, logistic regression, and SVM, and evaluate models considering bias-variance trade-off.
CO3: Design and train neural networks using backpropagation and analyze issues related to overfitting and network architecture.
CO4: Implement clustering techniques such as K-means, hierarchical clustering, and EM algorithm for unsupervised and semi-supervised learning problems.
CO5: Analyze and apply ensemble methods like bagging, boosting, and active learning to enhance model accuracy and robustness.

Course Content:

Topics	Hours
Unit-I	6
Introduction to Machine learning: Machine Learning what and why? Basics of Linear Algebra and Statistics, Overview of target function representations; Linear Regression, **Pattern recognition in ancient Indian texts – e.g., Panini's grammar as a generative rule-based system.**	
Unit-II	7
Supervised Learning : Basics of Feature Selection and Evaluation, Decision Tree, Over fitting and Pruning , Logistic regression, Support Vector Machine and Kernel ;Noise, bias- variance trade-off, under-fitting and over-fitting concepts	
Unit-III	6
Neural Networks: Perceptions: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.	
Unit-IV	6
Unsupervised and Semi-Supervised Learning: Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. K-means partition clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data.	
Unit-V	5
Ensemble: Committees of multiple hypotheses, bagging, boosting, active learning with ensembles	

Suggested Text Books:

1. MitchellTom, Machine Learning, LatestEdition,Mc-GrawHill.

Suggested Reference Books:

1. Shalev-Shwartz Shai and Ben-David Shai, Understanding Machine Learning, Cambridge University Press. 2017.
2. Bishop Christopher, Pattern Recognition and Machine Learning, Springer, 2006.
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron – practical & widely used
4. Introduction to Machine Learning with Python" by Andreas Müller & Sarah Guido

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Program: BCA
Semester: Fifth
Course: Machine Learning Lab
Course Code: 3CCC301P

L	T	P	C
0	0	2	1

Lab Exercises

1) Write a Python program to find the average, median, and mode of a list of numbers.
2) Create a scatter plot of some sample data and draw a best-fit line using Linear Regression.
3) Show how to add and multiply two matrices using NumPy.
4) Use Linear Regression to predict marks based on study hours.
5) Calculate the error between actual and predicted values using Mean Squared Error.
6) Build a Decision Tree to classify flower types using the Iris dataset.
7) Show how overfitting happens by training on a small dataset and testing on a different one.
8) Create a Logistic Regression model to classify emails as spam or not spam.
9) Use Support Vector Machine (SVM) to classify two types of fruits based on weight and size.
10) Plot graphs to show how model accuracy changes with too little or too much training (underfitting vs overfitting).
11) Build a simple Perceptron that can learn the AND logic gate.
12) Use Keras to build a small neural network that can recognize handwritten digits (MNIST).
13) Show how the accuracy changes with one, two, or more hidden layers in a neural network.
14) Train a neural network and stop early to see how overfitting is avoided.
15) Try a simple RNN that can predict the next number in a sequence like 1, 2, 3, …
16) Use K-Means to group similar data points and show the results in a chart.
17) Try Hierarchical Clustering and draw its tree-like diagram (dendrogram).
18) Group data using Expectation Maximization (EM) and compare it with K-Means.
19) Use a small labeled set and a large unlabeled set to do semi-supervised learning with EM.
20) Compare results from K-Means and Hierarchical Clustering using simple data.
21) Use Random Forest to classify types of fruits using sample data.
22) Try bagging with Decision Trees and check how accuracy improves.
23) Use AdaBoost on a small dataset and compare its result with a single tree.
24) Compare the performance of 3 models: Decision Tree, Random Forest, and AdaBoost.

Program: BCA
Semester: Fifth
Course: Internet Technologies using HTML, CSS & JavaScript
Course Code: 3CCC302

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To understand the concepts of the Internet, Intranet, web architecture, domain systems, and IP addressing.
- To develop the ability to create structured web pages using HTML and incorporate basic text, lists, and multimedia elements.
- To design advanced HTML pages using tables, frames, hyperlinks, and apply CSS for visual styling.
- To introduce JavaScript fundamentals for client-side scripting and interaction with web content.
- To explore advanced JavaScript functionalities including functions, forms, DOM, and built-in objects.

Course Outcome:
After the successful completion of the course, the students will be able to:

CO1: Explain the functioning and structure of the Internet and Intranet, domain registration, IP addressing, and identify web communication components like browsers and servers.
CO2: Create basic HTML pages with formatted text, images, and lists using appropriate tags and attributes.
CO3: Design dynamic web pages using tables, hyperlinks, frames, and apply CSS to enhance layout and styling.
CO4: Develop client-side scripts using JavaScript for capturing input, applying logic, and manipulating webpage behavior.
CO5: Implement form validation, event handling, and interact with the Document Object Model (DOM) using advanced JavaScript techniques and built-in objects.

Course Content:

Topics	Hours
Unit -I	5
Overview of Internet and Intranet: Understanding internet and its need, concept of intranet, difference between internet and intranet, a brief history, internet applications, Internet Service Providers (ISP) concept of client and server, concept of a web browser and web server, communicating on the internet, concept of domain- Physical domain, virtual domain, registering a domain, need of IP addressing, process to assign IP addresses, World Wide Web, **Knowledge dissemination in traditional India – oral and visual coding systems (e.g., mandalas, yantras).**	
Unit -II	5
Introduction To HTM: Overview of HTML, need of HTML, Use of it **HTML Tags:** concept of Tag, types of HTML tags, structure of HTML program **Text formatting through HTML:** Paragraph breaks, line breaks, background and Foreground. **Emphasizing material in a web page:** Heading styles, drawing lines, text styles. Text styles and other text effects-centering, spacing, controlling font size & color **Lists:** Using unordered, ordered, definition lists **Adding Graphics To HTML Documents:** Using Image tag, attributes of Image tag, changing width & height of image	
Unit -III	7
Tables, Frames and Linking Documents: **Handling Tables**: To define header rows & data rows, use of table tag and its attributes. Use of caption tag **Linking Documents:** Concept of hyperlink, types of hyperlinks, linking to the beginning of document, linking to a particular location in a document, Images as hyperlinks **Frames:** Introduction To frames, using frames & frameset tags, named frames how to fix the size of a frame, targeting named frames. **Introduction to CSS:** Introducing CSS, font attributes, color and background attributes, text attributes, border attributes, margin related attributes, list attributes Using class and span tag , External Style Sheets	
Unit -IV	7
Introduction To JavaScript: **Introduction to scripting**: overview of Java Script, advantages, client side java Script, capturing user input, writing JavaScript into HTML **Basic JavaScript Techniques**: Data types, literals, variables and operators, Java Script arrays, dense array, operators, expressions **Java Script Programming Construct:** Assignment, data declaration, if, switch, while, for, do while, label, break, Continue, function call, return, with, delete, method invocation.	

Unit -V	
JavaScript Technical Issues: **JavaScript Functions:** Types of functions in Java Script- Built in functions, User defined functions, function declaration, passing parameters, variable scope, return values, recursive functions. **Dialog boxes:** Alert dialog box, prompt dialog box, confirm dialog box, window objects **JavaScript Document Object Model:** Understanding JDO: **Forms Used By Web Site:** Form object, properties of form elements, methods of form element, form object's Method **Different elements :** text, password, button, submit, reset, checkbox, Radio, Text Area, select & option, Other built-in Object-String object, math object, date object, **User defined objects:** creation, instances, objects within objects	6

Suggested books:

1. Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, Web Services, and E-Commerce" (Black Book) **by** Kogent Learning Solutions Inc.
2. "Web Enabled Commercial Application Development Using HTML; JavaScript, DHTML, and PHP" by Ivan Bayross

Suggested reference books

1. "HTML5 and CSS3: Visual QuickStart Guide" by Elizabeth Castro and Bruce Hyslop
2. "JavaScript and JQuery: Interactive Front-End Web Development" by Jon Duckett.

Program: BCA
Semester: Fifth
Course: Internet Technologies using HTML, CSS & JavaScript Lab
Course Code: 3CCC302P

L	T	P	C
0	0	2	1

Lab Exercises

1. Write an HTML program to demonstrate the use of lists:
    a. Unordered List
    b. Ordered List
    c. Definition List
    d. Nested List
2. Write an HTML program to demonstrate hyperlinks:
    a. Navigation from one page to another
    b. Navigation within the same page
3. Write an HTML program to create a time-table using tables.
4. Write an HTML program to develop a static home page using frames.
5. Write an HTML program to create a static registration form.
6. Write an HTML program to create a static login page.
7. Write an HTML program to create a static catalog web page.
8. Write an HTML program to create a static shopping cart page.
9. Write an HTML program to create sections within a page using appropriate tags and apply different background colors to each section. Use internal hyperlinks to navigate between sections.
10. Write an HTML program to demonstrate cascading style sheets (CSS):
    a. Embedded style sheets
    b. External style sheets
    c. Inline styles
11. Write a JavaScript program to validate a user login page.
12. Create a registration form for an email account with input elements like checkboxes, radio buttons, select options, and text areas. Implement validation for password fields.
13. Write a JavaScript program to generate the multiplication table for a number entered by the user.
14. Write a JavaScript program to generate a bill for five items purchased by the user.

15. Write a JavaScript program using the Date object to display a greeting message (e.g., "Good Morning", "Good Afternoon", and “Good night") based on the time of day, along with the user’s name from a prompt.
16. Create a JavaScript function to calculate the factorial of a number using both recursive and non-recursive approaches.
17. Implement form validation using JavaScript for a form with fields like Name, Email, and Password.
18. Write a JavaScript program to demonstrate the use of alert, prompt, and confirm dialog boxes.
19. Write a JavaScript program to manipulate DOM elements, changing text, style, and visibility of HTML elements on a button click.
20. Create a JavaScript program using built-in objects (String, Math, Date) to perform string manipulation, mathematical operations, and display the current date and time.

Program: BCA
Semester: Fifth
Course: Design and Analysis of Algorithm
Course Code: 3CCC303

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce algorithm characteristics and analyze algorithm complexity using asymptotic notations and recurrence relations.
- To explore various algorithm design strategies including brute-force, greedy, dynamic programming, backtracking, and branch-and-bound.
- To study fundamental graph and tree algorithms including traversal, shortest path, MST, and network flow.
- To understand the concept of tractability, computational complexity classes, NP-completeness, and problem reduction techniques.
- To expose students to advanced algorithmic approaches such as approximation and randomized algorithms, and problems beyond NP.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Analyze and evaluate algorithm efficiency using asymptotic notations and recurrence relation techniques.
CO2: Apply algorithmic design strategies to solve real-world problems using brute-force, greedy, dynamic programming, and backtracking methods.
CO3: Implement graph and tree algorithms such as DFS, BFS, shortest paths, MST, and topological sorting.
CO4: Classify computational problems into P, NP, NP-complete, and NP-hard categories and apply reduction techniques.
CO5: Understand and apply advanced algorithmic techniques like approximation and randomized algorithms to solve complex problems.

Course Content:

Topics	Hours
Unit-I	10
Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and master theorem, **Algorithmic thinking in ancient Indian texts – Aryabhata's computational rules.**	
Unit-II	10
Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics characteristics and their application domains.	
Unit-III	8
Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS), Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	
Unit-IV	5
Tractable and Intractable Problems: Computability of Algorithms, Computability classes P, NP, NP-complete and NP-hard. Cook's Theorem, Standard NP-complete problems and Reduction techniques.	
Unit-V	7
Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NPPSPACE	

Text/Reference Books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill. Fundamentals of Algorithms **–**E. Horowitz et al.
2. Algorithm Design, 1ST Edition, Jon Kleinberg and Éva Tardos, Pearson. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley. Algorithms. A Creative Approach, 3RD Edition, Udi Manber, Addison-Wesley, Reading, MA.

Program: BCA
Semester: Fifth
Course: Cloud Computing
Course Code: 3CCDE301

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the concepts of data centers, virtualization technologies, and their applications in cloud environments.
- To explain the fundamentals of cloud computing, including public and private cloud architectures and Infrastructure as a Service (IaaS).
- To explore the features and management of cloud platforms, particularly Amazon Web Services (AWS) and hybrid cloud environments.
- To provide an understanding of cloud security and privacy issues, including disaster recovery and quantum cryptography techniques.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand virtualization concepts, types, benefits, and implementation using platforms like VMware and KVM, including SAN and HA/DR strategies.

CO2: Describe cloud computing fundamentals and differentiate between public and private cloud environments, including IaaS infrastructure.

CO3: Deploy and manage AWS services such as EC2 and EBS, and explore hybrid cloud solutions including Tata Cloud.

CO4: Analyze cloud security challenges and apply concepts like disaster recovery and quantum cryptography to address privacy concerns.

Course Contents:

Topics	Hours
Unit -I	11
Data Centre foot prints & Concepts Introduction To cloud Virtualization concepts Types of Virtualization & its benefits Introduction to Various Virtualization OS VMware, KVM etc. HA/DR using Virtualization Moving VMs SAN backend Concepts, **Ancient Indian models of distributed data – e.g., oral transmission across gurukuls and regional mathas.**	
Unit-II	10
Cloud Fundamentals Cloud Building Blocks Understanding Public & Private cloud environments Cloud as IaaS Private Cloud Environment Basics of Private cloud infrastructure QRM cloud demo Public Cloud Environment	
Unit -III	9
Understanding & exploring Amazon Web services Managing and Creating Amazon EC2 instances Managing and Creating Amazon EBS volumes Tata Cloud details& demo Managing Hybrid Cloud environment	
Unit -IV	10
Security& Privacy concern: Disaster recovery, quantum cryptography, three stage quantum cryptography algorithms, qubits.	

Suggested Readings:

1. Distributed Cloud Computing- Hwang kai & others
2. Cloud Computing- Pandey Dr. Usand choudhary Dr,kavita

Program: BCA
Semester: Fifth
Course: Soft Computing
Course Code: 3CCDE302

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the fundamentals of fuzzy set theory, fuzzy operations, membership functions, and fuzzy reasoning principles.
- To explain fuzzy inference systems including Mamdani, Sugeno, and other models, and introduce the concepts of genetic algorithms and their operations.
- To provide a strong foundation in artificial neural networks, focusing on architectures, learning techniques, and training algorithms.
- To explore advanced neural network models and unsupervised learning techniques like competitive learning, Kohonen networks, and Hopfield networks.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand and apply fuzzy set concepts, operations, membership functions, and fuzzy reasoning in intelligent systems.

CO2: Analyze fuzzy inference systems and implement genetic algorithm techniques such as selection, crossover, and mutation.

CO3: Describe the architecture and learning methods of artificial neural networks including perceptron, Adaline, and backpropagation models.

CO4: Apply advanced neural network models and unsupervised learning methods such as Kohonen networks, Hebbian learning, and Hopfield networks.

Course Contents:

Topics	Hours
Unit -I	10
Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimension, Fuzzy Union, Intersection and Complement .Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning, **Approximate reasoning in Indian logic systems – e.g., Nyaya-Vaisheshika, Buddhist logic.**	
Unit -II	11
Fuzzy Inference System: Introduction, Mamdani Fuzzy Models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models. GENETIC ALGORITHMS .Fundamentals of Genetic Algorithms: Basic Concepts Creation, Off springs Encoding, Fitness functions, Reproduction, Genetic Modeling: Inheritance Operators, Crossover, Inversion and detection, Mutation operator, Bitwise Operators. ARTIFICIAL NEURALNETWORKS	
Unit -III	9
Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning. Supervised Learning of Neural Networks: Introduction, Perceptron's, Adaline, Back Propagation Multilayer perceptron, Back Propagation Learning Rules,	
Unit -IV	10
Methods of Speeding. Radical Basis Function Networks, Functional Expansion Networks. Unsupervised Learning: Competitive Learning Networks, Kohonen self- organizing networks, Hebbian Learning, The Hopfield Network.	

Suggested Readings:

1. J.S.R.Jang,C.T.SunandE.Mizutani,"Neuro-FuzzyandSoftComputing"PHI/Pearson Education, New Delhi 2004.
2. S.Rajasekaran&G.A.VijayalakshmiPai,PHI,NewDelhi2003

Program: BCA
Semester: Fifth
Course: Data Mining and Warehousing
Course Code: 3CCDE303

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the concepts, architecture, and processes involved in Data Warehousing and OLAP technologies.
- To provide foundational knowledge of data mining techniques, preprocessing methods, and the knowledge discovery process.
- To explain various association rule mining algorithms and their applications in large datasets.
- To explore classification and clustering techniques and evaluate their effectiveness in data analysis.
- To introduce advanced topics such as Web Mining, Spatial, Temporal, and Text Mining, along with associated security and ethical issues.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand the architecture, schemas, and processes of data warehousing and perform OLAP operations and data cube computations.
CO2: Apply data preprocessing, integration, and transformation techniques to prepare data for mining and identify challenges in the knowledge discovery process.
CO3: Implement association rule mining using algorithms such as Apriori and FP-Growth and analyze multi-level and time-series associations.
CO4: Apply classification and clustering techniques such as Decision Trees, K-Means, and Bayesian models, and evaluate classifier performance.
CO5: Analyze various types of web, spatial, temporal, and text mining techniques and understand related privacy, security, and ethical concerns.

Course Content:

Topics	Hours
Unit-I	7
Data Warehousing : Need for data warehousing, Basic elements of data warehousing, Data Mart, Data Warehouse Architecture, extract and load Process, Clean and Transform data ,Star ,Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning, Data Warehouse and OLAP technology, Multidimensional data models and different OLAP Operations, OLAP Server: ROLAP, MOLAP, Data Warehouse implementation, Efficient Computation of Data Cubes, Processing of OLAP queries, **Indexing data, Knowledge extraction and classification in Indian tradition – e.g., taxonomy in Ayurveda, Vedas.**	
Unit-III	6
Data Mining: Data Preprocessing, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining.	
Unit-III	6
Mining Association Rules in Large Databases: Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, Fp-Growth Algorithm, Time series mining association rules, latest trends in association rules mining.	
Unit-IV	6
Classification and Clustering: Distance Measures, Types of Clustering Algorithms, K-Means Algorithm, Decision Tree, Bayesian Classification, Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Outlier Analysis.	
Unit-V	5
Introduction of Web Mining and its types, Spatial Mining, Temporal Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.	

Suggested books:

1. Arunk Pujari "DataMiningTechnique"University Press
2. Han,Kamber, "Data Mining Concepts &Techniques",

Suggested reference books

1. M. Kaufman., P. Ponnian,"DataWarehousingFundamentals",John Wiley.
2. M.H.Dunham,"DataMining Introductory & Advanced Topics",Pearson Education.
3. Ralph Kim ball,"The Data Warehouse Lifecycle ToolKit",John Wiley.
4. E.G. Mallach,"The Decision Support &Data Warehouse Systems",TMH

Program: BCA
Semester: Fifth
Course: Digital Image Processing
Course Code: 3CCDE304

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the fundamentals, applications, and system components of digital image processing.
- To understand and apply image enhancement techniques in both spatial and frequency domains.
- To explore various color image processing techniques, including color models and segmentation methods.
- To provide knowledge of image compression techniques and differentiate between lossless and lossy compression standards.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain the basic concepts of image processing, including image acquisition, sampling, quantization, and pixel connectivity.
CO2: Apply image enhancement techniques such as histogram equalization and spatial/frequency domain filtering.
CO3: Analyze and implement color image processing methods using different color models and transformations.
CO4: Describe and differentiate image compression models and standards used for efficient image storage and transmission.

Course Content:

Topics	Hours
Unit -I	10
Introduction to image processing: Fundamentals, Applications, Image processing system components, Image sensing and acquisition , Sampling and quantization Neighbors of pixel adjacency connectivity , Regions and boundaries, Distance measure, **Indian contributions to pattern recognition in art – e.g., iconography (Shilpa Shastra), mural styles.**	
Unit -II	10
Image Enhancement: Frequency and Spatial Domain, Contrast Stretching, Histogram Equalization ,Low pass and High pass filtering	
Unit -III	10
Color Image Processing: Color models, Pseudo color Image processing, Color transformation and segmentation	
Unit- IV	10
Image Compression: Fundamentals, Models, Error free and lossy compression Standards.	

Suggested Readings:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital ImageProcessing",2 Edition, Pearson Education
2. Bhabatosh Chanda and Dwijesh Majumder, "Digital Image Processing" ,PHI
3. Anil K Jain, "Fundamentals of Digital Image Processing" ,PHI
4. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing using MATLAB", 2nd Edition, Pearson Education

Program: BCA
Semester: Fifth
Course: Human Computer Interface
Course Code: 3CCDE305

L	T	P	C
4	0	0	4

Course Objectives
The objective of this course is:

- To introduce the fundamentals of HCI, its interdisciplinary nature, and the role of human cognitive factors in design.
- To familiarize students with user interface design principles and guidelines for effective UI development.
- To develop skills in interaction design, prototyping, and the user-centered design process including accessibility considerations.
- To explore evaluation methods, usability testing, and emerging trends in HCI such as AR/VR, Voice UI, and BCI.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain the scope of HCI, its interdisciplinary foundations, and apply cognitive models and human factors like perception and memory in interface design.
CO2: Apply UI design principles such as affordance, feedback, and consistency to create intuitive mobile and desktop interfaces.
CO3: Develop interactive prototypes using tools like Figma or Adobe XD and apply user-centered design methods including personas and accessibility standards.
CO4: Evaluate user interfaces using heuristic evaluation and usability testing, and analyze modern HCI trends and ethical considerations.

Course Content:

Topics	Hours
Unit -I	11
Introduction to HCI: Definition and scope of HCI , Interdisciplinary nature (CS, Psychology, Design) , Importance in modern applications (web, mobile, AI) **Human Factors & Cognitive Models:** Human perception, attention, memory, Mental models, ergonomics, Fitts' Law and Hick's Law, **Human-centric design in Indian traditions – ergonomics in tools, scripts (Brahmi), and temple layouts.**	
Unit -II	10
User Interface (UI) Design Principles : Affordance, feedback, consistency , Visibility, mapping, constraints , UI design guidelines (mobile & desktop)	
Unit -III	9
Interaction Design & Prototyping : Interaction styles (command line, GUI, touch, speech) , Wireframes & mockups , Tools: Figma / Adobe XD / Balsamiq , **Usability & User-Centered Design (UCD) :** UCD process: analysis, design, evaluation , Personas, scenarios, user journeys , Accessibility (WCAG basics)	
Unit -IV	10
Evaluation Techniques : Heuristic evaluation , Cognitive walkthrough , Usability testing methods , Metrics: efficiency, effectiveness, satisfaction **Trends in HCI :** Voice UI, AR/VR, Brain-Computer Interface (BCI) , Ethics & privacy in HCI , Case studies (mobile apps, websites, smart devices)	

Suggested Readings:

1. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale *Human-Computer Interaction*, 3rd Edition Publisher: Pearson Education
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 6th Edition Publisher: Pearson Education
3. S. Shanmugam *Human-Computer Interaction* Publisher: McGraw Hill Education (India)

Program: BCA
Semester: Fifth
Course: Community Engagement and Social Responsibility
Course Code: 3CUMC102

L	T	P	C
1	0	2	2

Course Objectives
The objective of this course is:

- To develop an appreciation of rural culture, life-style and wisdom amongst students.
- To learn about the status of various agricultural and rural development programmes.
- To understand causes for rural distress and poverty and explore solutions for the same.
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Gain an understanding of rural life, culture and social realities.

CO2: Develop a sense of empathy and bonds of mutuality with local community.

CO3: Appreciate significant contributions of local communities to Indian society and economy.

CO4: Learn to value the local knowledge and wisdom of the community.

CO5: Identify opportunities for contributing to community's socio-economic improvements.

Course Content:

Topics	Hours
Unit I	8
Appreciation of Rural Society: Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure. **ASSIGNMENT:** Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village, **Indian models of social responsibility – e.g., dharma, seva, community-led education and healthcare systems.**	
Unit II	8
Understanding rural economy & livelihood: Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets. **ASSIGNMENT:** Describe your analysis of rural h o u s e h o l d economy, its challenges and possible pathways to address them.	
Unit III	8
Rural Institutions: Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration. **ASSIGNMENT:** How effectively are Panchayati raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio- visual)	
Unit IV	8
Rural Development Programmes: History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.	
ASSIGNMENT: Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving Implementation of the programme for the rural poor.	

Suggested Reading:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs/
4. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016.

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Semester VI

SEM 6					
Core Courses-Compulsory					
3CCC304	Theory of Computation	3	0	0	3
3CCC305	PHP & MYSQL	2	0	0	2
3CCC305P	PHP & MYSQL Lab	0	0	2	1
3CCC306	Data Analytics	3	0	0	3
3CPROJ301	Major Project	0	0	16	8
3CUMC101	Managing Personal Finance##	2	0	0	0
Departmental Elective- (Students have to choose any one course)					
3CCDE306	Fundamentals of Data Science	3	0	0	3
3CCDE307	Digital Marketing	3	0	0	3
3CCDE308	Natural Language Processing	3	0	0	3
3CCDE309	Software Testing	3	0	0	3
	Total				**20**

Program: BCA
Semester: Sixth
Course: Theory of Computation
Course Code: 3CCC304

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals of automata theory, focusing on Finite Automata, their types, and their applications in computing.
- To develop understanding of regular expressions, their algebraic properties, and their equivalence with finite automata.
- To familiarize students with formal grammars, including context-free grammars, Chomsky hierarchy, and normal forms.
- To explain the concept and working of Pushdown Automata and their relation to context-free languages and parsing.
- To introduce Turing Machines, decidability, computational complexity classes, and unsolvable problems**.**

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Design and analyze finite automata (DFA & NDFA), perform conversions, and apply them to solve real-time problems.
CO2: Apply regular expressions to define languages, use algebraic laws, and prove language regularity using pumping lemma.
CO3: Construct and convert grammars, distinguish between types in Chomsky hierarchy, and apply normal forms to CFGs.
CO4: Explain the concept of Pushdown Automata, differentiate between DPDA and NPDA, and apply parsing techniques.
CO5: Understand Turing Machines, classify languages based on decidability, and identify complexity classes like P, NP, NP-Complete, and NP-Hard.

Course Content:

Topics	Hours
Unit -I	**5**
Introduction to Automata: (mathematical model of digital devices, including real computer), State Transition Graph, Finite Automaton (FA) and its types, DeterministicFiniteAutomaton(DFA),Non-deterministicFiniteAutomaton (NDFA) Complement , Union ,Intersection of FA's Conversion Strategy from (NDFA) to DFA Minimization of FA, Finite Automaton with Output, Applications of FA, **Logic and computation in ancient Indian philosophies – Paninian grammar as formal language system, Nyaya system of logic**	
Unit -II	**7**
Regular Expressions(RE): Introduction , RF's and basic Operations, Algebraic Laws , on Regular Expression, Finite and Infinite Languages, Equivalence of finite Automaton and regular expressions, Constructing NDFA from Regular Expression ,Pumping Lemma for Regular Language, Closure properties of Regular Languages, Non-regular languages, Applications of Regular Expression.	
Unit -III	
Grammar: Introduction, Formal Definition of Grammar, The Chomsky Hierarchy of Grammar, Designing Regular grammar from DFA, Context Free Grammar, Closure properties of Context Free Languages, , CFG and Normal form: Chomsky Normal Form, Greibach Normal Form, Non-Context Free Language, Applications Of CFGs.	
Unit -IV	**7**
Push Down Automation (PDA): Introduction, Definition of PDA, Types of Pushdown Automata (DPDA and NPDA), Converting CFG to PDA, Derivation (Parsing), Parsing Techniques, Ambiguous and Unambiguous Grammar, Demerits Of Ambiguous Grammar.	
Unit- V	**5**
Turing Machine(TM): Single Tape TM,Variations of TM, Halting Problem, Turing Machine and Languages, Enumerable Languages, Decidable, Recognize able and Un-decidable languages, Solvable and Unsolvable problems, Post Correspondence Problems(PCP),Classes of Problems: P, NP,NP-C and NP-Hard	

Text Books:

1. MartinJohn"Introductionto Languages and the Theory of Computation",3rdEdition, TMH.

Reference Books:

1. "Theory of Computation" by K.L.P. Mishra and N. Chandrasekaran
2. Introduction to Automata Theory, Languages, and Computation" by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman

Program: BCA
Semester: Sixth
Course: PHP & MYSQL
Course Code: 3CCC305

L	T	P	C
2	0	0	2

Course Objectives
The objective of this course is:

- To introduce the fundamentals of PHP, including its syntax, variables, operators, arrays, and integration with HTML.
- To develop the ability to implement conditional statements, loops, and functions for dynamic web content using PHP.
- To provide knowledge on form handling, input validation, error handling, and session management in web applications.
- To enable students to connect PHP with MySQL for database operations such as data insertion, retrieval, and manipulation.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand and apply the basic syntax of PHP, use variables, arrays, and operators, and embed PHP within HTML to create simple scripts.
CO2: Implement control structures, loops, and user-defined functions with argument passing techniques to build logical web components.
CO3: Handle form data using $_GET and $_POST methods, perform input validation, and manage sessions and cookies securely.
CO4: Connect PHP with MySQL to perform database operations like inserting, updating, deleting, and retrieving data using queries.

Course Content:

Topics	Hours
Unit -I	5
Introduction to PHP, History of PHP, Versions of PHP, Features of PHP, Advantages of PHP over Other Scripting Languages, software requirements, Installation and Configuration of PHP, Installing and Configuring Apache to use PHP on Windows, Basic HTML, Embedding PHP in HTML, PHP Basic syntax, data types, comments, variables and constants, scope of variables, PHP arrays: creating array and accessing array elements, PHP String, PHP operators, precedence of operators, expressions, creating a PHP Script, running a PHP script, **Indigenous database practices – e.g., preservation and categorization of manuscripts in traditional Indian libraries (like Sarasvati Mahal)**	
Unit -II	5
PHP conditional statements, switch case, PHP looping statements, while, for and do while loop, break, continue, exit, PHP functions: built-in and user defined function, declaration and calling of a function, function argument with call by value, call by reference, string manipulation, mathematical, date and time functions.	
Unit -III	5
Introduction to a web form, processing a web form, capturing form data, passing information between pages, PHP $_GET, PHP $_POST, with multi value fields, validating a web form, input validation, exception and error handling, introduction to cookies and session handling.	
Unit -IV	5
Working with database: PHP supported databases, using PHP & MySQL: Installation and configuration of MySQL on windows, checking configuration, connecting to database, selecting a database, adding table and altering table in a database, inserting, deleting and modifying data in a table, retrieving data, performing queries, processing result sets.	

Text Books/ Reference Books:

1. Steven Holzner, The Complete Reference PHP, TMH
2. PHP and MySQL Programming" by Sourabh Sharma ,Publisher: Vikas Publishing House
3. Steve Suehring, Tim Converse and Joyce Park, Wiley-India Pvt Ltd
   Matt Doyle, Beginning PHP, Wiley-India Pvt Ltd Joel Murach and Ray Harris, Murach's PHP & MySQL, SPD Pvt Ltd

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Program: BCA
Semester: Sixth
Course: PHP & MySQL Lab
Course Code: 3CCC305P

L	T	P	C
0	0	2	1

Lab Exercises:

1. Write a program in PHP to display "Learning PHP" in bold format.
2. Write a program in PHP to demonstrate the use of comments, echo and print.
3. Create a program in PHP to demonstrate the use of If ... Else and switch statements.
4. Create an array named $sub, assign five elements to it and display the elements assigned using for loop and for each statement.
5. Create an array named $student that sores 5 element bounded to a different keys and access the same using the key element.
6. Write a program in PHP to demonstrate the use of multidimensional arrays.
7. Create two functions in PHP, parameterized and non-parameterized for implementing string concatenation operation.
8. Write a PHP program to display information of PHP in the browser.
9. Write a program in PHP to sort the array of given 5 numbers in ascending and descending order.
10. Write a program to count the total number of times a specific value appears in an array.
11. Create a form containing two input fields (Name, Email_ID) and a submit button. When the user clicks on submit button, the form data should be sent for processing to PHP file, which should display the welcome message with the email_id on the PHP page. Form data should be sent by HTTP GET/POST method.
12. Write a PHP script that creates a database named "DB-1"in MySQL.
13. Write a PHP script for creating a product table in the specified database with fields Pro_id, Pro_name, Pro_price, and QOH. Also display an acknowledgement for the same.
14. Create a form contaning four input fields (Pro_id, Pro_name, Pro_price, QOH) and Submit button. When the user clicks on the submit button a PHP script should be executed which inserts the record in the product table.
15. Create a form contaning one input field (Pro_id) and a search button. When the user clicks on the Search button a PHP script should get executed and should display the details of the product for the Pro_id specified.
16. Create a form contaning two input fields (Pro_id, QOH) and Update button. When the user clicks on the Update button the quantity of the Pro_id specified should get updated using a PHP script.

17. Create a form contaning one input field (Pro_id) and a Delete button. When the user clicks on the Delete button a PHP script should get executed and should delete the record of the product for the Pro_id specified.
18. Create a form containing one input field (Name). When the user enters his/her name and as any key is released, the form should display a welcome message for the user. Implement using AJAX.
19. Repeat the above question to demonstrate the use of keydown and keypress events.
20. Write a program for converting a string into uppercase using AJAX.

Program: BCA
Semester: Sixth
Course: Data Analytics
Course Code: 3CCC306

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals of data analytics, its types, applications, and lifecycle, including data sources and collection methods.
- To enable learners to perform data cleaning, preprocessing, and exploratory data analysis using tools like Excel and Python.
- To develop foundational knowledge in basic statistical analysis and hypothesis testing.
- To familiarize students with data visualization techniques, dashboard creation, and storytelling using tools like Power BI or Tableau.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain different types of data analytics, distinguish between structured and unstructured data, and outline the data analytics lifecycle and data collection methods.
CO2: Apply data cleaning, preprocessing, and exploratory data analysis techniques using tools such as Excel and Python (Pandas, Matplot lib / Seaborn).
CO3: Perform basic statistical analysis including measures of central tendency and dispersion, and apply correlation, regression, and hypothesis testing concepts.
CO4: Create dashboards and visualize data effectively using Power BI/Tableau, and interpret insights through case-based storytelling.

Course Content:

Topics	Hours
Unit -I	8
Introduction Data Analytics; Types: Descriptive, Diagnostic, Data Types: Structured vs. Unstructured Data; Predictive; **Applications:** business, healthcare, social media, etc.; Data Analytics Lifecycle; **Sources and Collection Methods:** Collecting data from files, APIs, forms, surveys, **Data analysis in ancient India – e.g., astronomical data in Aryabhatiya.**	
Unit -II	8
Data Cleaning & Preprocessing: - Missing data handling, Duplicate removal, Encoding & normalization, **Tools:** Excel, Python (Pandas) , **Exploratory Data Analysis (EDA):**- Summary statistics, Visualizations: bar charts, histograms, heat maps, Correlation matrix Tools: Python (Matplot lib/ Seaborn), Excel	
Unit -III	6
Basic Statistical Analysis: Mean, Median, Mode, Standard Deviation, Introduction to Hypothesis Testing, Concept of correlation & regression	
Unit -IV	8
Data Visualization & Reporting: Dash boarding basics, Power BI / Tableau demo, Storytelling with data; **Case Studies:** - Retail data analysis, Student performance analysis, Social media trends (Twitter/Kaggle datasets)	

Text Books:

1. “Data Analytics" by V.K. Jain ,Publisher: Khanna Publishing House
2. "Data Analytics Using Python" by Bhavani Thuraisingham, Publisher: Wiley India Pvt. Ltd.

Reference Books:

1. "Data Science and Analytics" by V.K. Jain, Publisher: Khanna Publishing House
2. "Python for Data Analysis" by Wes McKinney, Publisher: O'Reilly Media

Program: BCA
Semester: Sixth
Course: Major Project
Course Code: 3CPROJ301

L	T	P	C
0	0	16	8

Course Objectives
The objective of this course is:

- Identify and define real-world problems and formulate them into executable IT-based solutions.
- Apply programming knowledge and software development practices acquired throughout the BCA program to design, code, test, and deploy a project.
- Demonstrate proficiency in using modern tools, technologies, and development environments relevant to their project domain.
- Develop teamwork, leadership, time management, and communication skills through collaborative project work.
- Prepare detailed technical documentation and deliver professional project presentations, reflecting industry standards.

Program: BCA
Semester: Sixth
Course: Fundamental of Data Science
Course Code: 3CCDE306

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals of data science, its life cycle, and ethical considerations.
- To develop skills in data acquisition, cleaning, preprocessing, and exploratory data analysis.
- To provide a foundation in statistical techniques including hypothesis testing, regression, and correlation.
- To familiarize students with core machine learning algorithms and model evaluation techniques.
- To enable effective data visualization and communication of analytical findings.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Describe the data science process, its importance, and the ethical challenges in data-driven decision-making.
CO2: Apply data cleaning, normalization, and profiling techniques for effective data preparation.
CO3: Perform statistical analysis using descriptive statistics, hypothesis testing, and regression methods.
CO4: Implement basic machine learning algorithms and evaluate model performance using appropriate metrics.
CO5: Create meaningful visualizations and present data insights using storytelling techniques.

Course Content:

Topics	Hours
Unit -I	7
Introduction to Data Science ,Overview of data science and its significance, Data science process and life cycle, Ethical considerations in data science, **Ancient Indian approaches to classification and inference – e.g., Ayurveda, Nyaya epistemology, Jain mathematical models**	
Unit -II	7
Data Manipulation and Preparation, Data acquisition and data cleaning techniques ,Data pre-processing: handling missing data, outliers, and data normalization ,Exploratory data analysis and data profiling	
Unit -III	7
Data Analysis and Statistical Methods, Descriptive statistics and summary measures, Hypothesis testing and statistical inference ,Regression analysis and correlation	
Unit -IV	7
Machine Learning for Data Science, Introduction to machine learning algorithms, Supervised and unsupervised learning techniques, Model evaluation and selection.	
Unit-V	7
Data Visualization and Communication ,Principles of data visualization and visual perception, Data visualization techniques and tools, Communicating data findings and storytelling	

Recommended Books:

1. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python “by Wes Mc Kinney.
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett

Program: BCA
Semester: Sixth
Course: Digital Marketing
Course Code: 3CCDE307

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals and evolution of digital marketing, comparing it with traditional marketing and exploring the digital consumer landscape.
- To develop an understanding of digital marketing strategies, consumer behavior, POEM framework, and digital marketing planning.
- To provide knowledge of key digital marketing techniques such as SEO, PPC, social media, email, affiliate, and mobile marketing.
- To explain display advertising models, formats, tools, and programmatic digital advertising concepts.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Understand the significance of digital marketing, distinguish it from traditional marketing, and analyze digital consumer behavior and trends.
CO2: Apply digital marketing strategy frameworks such as the consumer decision journey and POEM, and design targeted marketing plans.
CO3: Demonstrate the use of digital marketing tools and techniques including SEO, PPC, social media, email, and mobile marketing.
CO4: Analyze various display advertising models, ad formats, and apply key concepts in programmatic digital advertising.

Course Content:

Topics	Hours
Unit -I	8
Fundamentals of Digital marketing & Its Significance , Traditional marketing Vs Digital Marketing , Evolution of Digital Marketing ,Digital Marketing Landscape, Key Drivers ,Digital Consumer & Communities ,Gen Y & Netizen's expectation & influence with respect to Digital Marketing, **Traditional Indian marketing – e.g., village haats, barter systems, influence of storytelling (Kathas) and folk art for product promotion.**	
Unit -II	8
The Digital users in India, Digital marketing Strategy-Consumer Decision journey, POEM Framework, Segmenting & Customizing messages, Digital advertising Marketing India, Skills in Digital Marketing, Digital marketing Plan.	
Unit -III	8
Terminology used in Digital Marketing , PPC and online marketing through social media , Social Media Marketing , SEO techniques , Keyword advertising , Google web-master and analytics overview ,Affiliate Marketing ,Email Marketing ,Mobile Marketing	
Unit-IV	8
Display adverting , Buying Models , different type of ad tools , Display advertising terminology ,types of display ads, different ad formats, Ad placement techniques, Important ad terminology, Programmatic Digital Advertising.	

Text Books:

1. Digital Marketing , **Seema Gupta,** Publisher: **McGraw Hill Education**
2. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation , **Damian Ryan ,**Publisher: **Kogan Page**
3. Digital Marketing Strategy: An Integrated Approach to Online Marketing, Simon **Kingsnorth ,** Publisher: **Kogan Page**

Program: BCA
Semester: Sixth
Course: Natural Language Processing
Course Code: 3CCDE308

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamentals, applications, and components of Natural Language Processing and perform basic text preprocessing using Python's NLTK.
- To understand and apply syntactic parsing techniques, including dependency and phrase structure trees, and explore algorithms for ambiguity resolution.
- To explore language modeling approaches such as N-gram models, model evaluation, adaptation, and address language-specific modeling challenges.
- To study semantic interpretation techniques, word sense systems, and various paradigms used in semantic parsing.
- To understand discourse-level NLP tasks including predicate-argument structures, meaning representation, and cohesion analysis.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Apply fundamental NLP concepts and perform preprocessing tasks like tokenization, stemming, POS tagging, and named entity recognition using Python's NLTK.
CO2: Analyze syntactic structures using parsing algorithms (e.g., CYK, shift-reduce) and resolve ambiguity using probabilistic and discriminative models.
CO3: Build and evaluate language models using N-gram techniques and handle parameter estimation and adaptation for different language requirements.
CO4: Interpret sentence meaning using semantic parsing approaches and implement word sense disambiguation systems.
CO5: Examine discourse structures using cohesion and reference resolution techniques and apply predicate-argument structure analysis.

Course Content:

Topics	Hours
Unit -I	7
Natural Language processing(NLP) : Introduction , Applications or Use cases of NLP , Components of NLP , Steps in NLP , Finding the Structure of Words : Words and Their Components ,Lexemes , Morphemes ,Morphology , Problems in morphological processing, Typology, Morphological Typology, Natural Language Processing with python NLTK package (Text Preprocessing Tasks) : Word Tokenization, Sentence Tokenization, Filtering Stop words , Stemming ,Tagging Parts of Speech ,Lemmatization ,Chunking ,Chinking ,Named Entity Recognition ,Term Frequency and Inverse Document Frequency (TF-IDF), **Panini's Ashtadhyayi as the world's first NLP system – rule-based syntactic and morphological analysis.**	
Unit -II	7
Syntax Analysis : Parsing Natural Language , Tree banks :A Data-Driven Approach to Syntax , Representation of Syntactic Structure : Syntax Analysis using Dependency Graph , Syntax Analysis using Phrase Structure Trees , Parsing Algorithms: Shift Reduce Parsing , Hyper Graphs and Chart Parsing (CYKParsing) ,Models for ambiguity Resolution in Parsing : Probabilistic Context Free Grammar, Generative Models ,Discriminative models for Parsing.	
Unit -III	6
Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems.	
Unit -IV	5
Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.	
Unit -V	5
Predicate-Argument Structure, Meaning Representation Systems, Software. **Discourse Processing:** Cohesion, Reference Resolution, Discourse Cohesion and Structure.	

Text Books:

1. Multi lingual natural Language Processing Applications: From Theory to Practice-Daniel M. BikelandImed Zitouni, Pearson Publication.
2. Speech and Natural Language Processing-Daniel Jurafsky & James H Martin, Pearson Publications.

Reference Books: Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

Program: BCA
Semester: Sixth
Course: Software Testing
Course Code: 3CCDE309

L	T	P	C
3	0	0	3

Course Objectives
The objective of this course is:

- To introduce the fundamental concepts, principles, and lifecycle of software testing including verification and validation.
- To explore different types of testing techniques such as black-box, white-box, and their associated methods.
- To understand various levels of testing and their application in ensuring software quality and reliability.
- To develop the ability to plan, manage, and report software testing activities effectively within a software development lifecycle.

Course Outcomes
After the successful completion of the course, the students will be able to:

CO1: Explain the key concepts and objectives of software testing, including the differences between error, fault, and failure, and describe verification and validation processes.
CO2: Apply black-box and white-box testing techniques like boundary value analysis, equivalence class testing, and coverage/path analysis to evaluate software behavior.
CO3: Identify and differentiate levels of testing such as unit, integration, system, and acceptance testing and apply appropriate techniques in each stage.
CO4: Prepare test plans, manage test processes, and generate test reports to support software release decisions and ensure product quality.

Course Content:

Topics	Hours
Unit- I	10
Introduction to Software Testing : Definition of Software Testing and its Role, Terms:-Failure, Error, Fault, Defect, Bug , Goals of Testing , Principles of Testing , Software Testing Life Cycle , Verification and Validation:-V-testing Lifecycle , Static and Dynamic Testing, **Concepts of validation and verification in Indian epistemology – Pramanas (means of knowledge), error analysis in logic schools**	
Unit -II	9
Types of Testing: Black Box Testing - Overview: What is & When? , Techniques , Boundary Value Analysis , Equivalence class testing , Decision Table , **White Box Testing -** What is white box Testing , Need of white box Testing , Classification , Structural: Coverage, Path	
Unit -III	8
Levels of Testing : Unit Testing : Overview , Integration Testing : Overview , Techniques: Graph based &Path based , Functional Testing , System Testing : Overview , Categories : Reliability Security Performance Recovery , Acceptance Testing: Overview, Types of Acceptance Testing	
Unit -IV	8
Test Planning: Preparing a Test plan, Scope management, Decide Test Approach, Setting Up Criteria for testing, Identifying responsibilities, Staffing , training needs ,Resource requirements ,Test deliverables ,Testing Tasks **Test Management:** Choice of standards, Test infrastructure management, Test people management, Integrating with product release , Test Process: Baseline test plan, Test case specification ,Update of traceability , Test reporting :Recommending product release	

Textbook/S:

1. Software Testing : Principles and Practice by Srinivasan Desikan, Gopala swamy Ramesh ,Pearson
2. Software Testing: Principles and Practice by Naresh Chauhan, Oxford

Web Resources:

1. "http:/ /www.softwaretestingsoftware.com
2. https:/ /www.guru99.com›software-testing-introduction-importance

Program: BCA
Semester: Sixth
Course: Managing Personal Finance##
Course Code: 3CUMC101

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Course Content:

Topics	Hours
Unit I	1
Basics of Human Resource Management to step into the Corporate World: Overview of Joining Formalities, Induction, Difference between Offer Letter & Appointment Letter, Components of CTC, Deductions & Claims, Types of Leave, Types of Separation, Exit Procedure, **Indigenous financial systems – ancient Indian practices of wealth management, Arthashastra principles, guild-based banking (Shrenis)**	
Unit II	2
Savings, Budgeting & Fundamentals of Investment: Understanding Personal Finance, Managing Cash Flows, Preparing Personal Budget, Tips for tracking & Saving Money, Importance of Bargain shopping & Negotiation strategies, Insurance: Basics & Types Identification of Investment Need, Short term & Long-term Investment products: Capital Market, Money Market, Commercial Banks, Post Office Schemes; Mutual Funds: Types of Schemes, Concept of SIP's, Fees & Charges; Planning & saving for Retirement	
Unit III	1
Building & Maintaining Good Credit: Setting Debt Limit, Credit approval process & elements of Credit Score, Sources of Consumer Loan, Calculating Interest on Consumer Loans, Types of Credit Card, Managing Credit Cards: Computation of Finance Charges & Credit card average daily balance	
Unit IV	2
Managing Income Taxes: Basics of Income Tax for beginners, Government Benefits, Deductions available for salaried employees, HRA Exemptions, Basics of Income Tax for beginners, Government Benefits, Deductions available for salaried employees, HRA Exemptions, Calculation of Tax payable, Tax Deduction at Source, Procedure for filing ITR, Applicable Forms	