



JOY UNIVERSITY
semper paratus

School of Computational Intelligence

Department of Computing & Information Systems

Bachelor of Computer Application (BCA)

Programme Structure

Program Educational Objectives (PEO)

- PEO1:** Demonstrate analytical and design skills including the ability to generate creative solutions and foster team-oriented, professionalism through effective communication in their careers.
- PEO2:** Expertise in successful careers based on their understanding of formal and practical methods of application development using the concept of computer programming languages and design principles in national and international level.
- PEO3:** Pursue advanced education, research and development moreover other creative and innovative efforts in science and technology, as well as other professional careers.
- PEO4:** Implement their exhibiting critical thinking and problem solving skills in professional practices or tackle social, technical and business challenges.
- PEO5:** Illustrate effective work conventionalities and be able to adapt as well as accept to the challenges of a dynamic job environment.

Program Outcomes (PO)

- PO1:** To identify, formulate, review literature and analyze complex engineering problems reaching substantiated conclusions.
- PO2:** To design solutions for designing system components or processes that meet the specified needs with appropriate consideration for cultural, societal and environmental considerations.
- PO3:** To use research-based knowledge for analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- PO4:** To create, select and apply appropriate techniques, resources, and modern automation tools.
- PO5:** To apply the knowledge of engineering specialization to solve complex problems.
- PO6:** To convert the real-world problems into computational problem to solve them by using various computational and problem-solving skills.

PROGRAM SPECIFIC OUTCOME (PSO)

- PSO1:** To develop programming skills, networking skills, learn applications, packages, programming languages and recent techniques in cybersecurity
- PSO2:** To understand the structure and development methodologies of software systems.
- PSO3:** To implement the analytical skills, decision making and problem-solving skill in the field of computational studies.

School of Computational Intelligence
Department of Computing & Information Systems

Bachelor of Computer Application (BCA)- Cyber Security

I Semester

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1111	Fundamentals of Computing	3	0	2	5	4
2.	BCCY1112	Introduction to Programming Language	3	0	2	5	4
3.	BCCY1113	Mathematics I	3	1	0	3	4
4.	AEEN1111	Effective Communication	3	0	0	3	3
5.	BCCY2111	Performing Arts	3	0	0	3	0
		TOTAL	18	1	4	24	15

II

Semester

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1121	Python Programming	3	0	2	5	4
2.	BCCY1122	Probability, Statistics and stochastic Processes	3	0	0	3	3
3.	BCCY1123	Mathematics II	3	1	0	4	4
4.	BCCY1125	Discrete Structures for Computer Science	3	0	0	3	3
5.	BCCY2121	Office Automation Tools	3	0	2	5	4
6.	AEEV1121	Environmental Science	2	0	0	2	2
7		Extended Reality and its applications	0	0	3	3	1
		TOTAL	17	1	7	25	21

III**Semester**

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1211	Fundamentals of Information Security	3	0	0	3	3
2.	BCCY1212	Computer Networks	3	0	2	5	4
3.	BCCY1213	Digital Design	3	0	2	5	4
4.	BCCY1214	Data Structure and Algorithms	3	0	2	5	4
5.	BCCY1215	Object Oriented Programming	3	0	2	5	4
6.	AEPH1213	Professional Ethics	2	0	0	2	2
		TOTAL	14	0	8	22	21

IV**Semester**

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1221	Data Mining and Data Warehousing	3	0	2	5	4
2.	BCCY1222	Database Management Systems	3	0	2	5	4
3.	BCCY1223	Design Analysis and Algorithm	3	0	2	5	4
4.	BCCY1224	Computer Organization	3	0	0	3	3
5.	BCCY1225	Operating System Concepts	3	0	0	3	3
		TOTAL	15	0	6	21	18

V**Semester**

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1311	Criminology and Cyber Crimes	3	0	2	5	4
2.	BCCY1312	Introduction to Cybersecurity	3	0	0	3	3
3.	BCCY1314	Software Engineering	3	0	0	3	3
4.	BCCY1315	Programming with Java	3	0	2	5	4
5.	BCCY3415	Industrial Internship	0	0	0	0	2
6.	PEAI131#	Programme specific Elective	3	0	0	3	3
		TOTAL	18	0	4	19	19

VI**Semester**

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	BCCY1321	Digital Forensics	3	0	0	3	3
2.	BCCY1322	Cryptography and Network Security	3	0	0	3	3
3.	BCCY1325	Web Technology	3	0	2	5	4
4.	BCCY3321	Capstone Project	0	0	0	0	20
		TOTAL	12	0	4	16	30

Programme Specific Electives I

Sl. No.	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Credits
1.	PEAI1311	Computer Graphics and Multimedia	3	0	0	3	3
2.	PEAI1312	Android Programming and Mobile Application (MA)	3	0	0	3	3
3.	PEAI1313	Cloud Computing	3	0	0	3	3
4.	PEAI1314	Fuzzy logic and Applications	3	0	0	3	3
5.	PEAI1315	R Language	3	0	0	3	3

Credit Summary

Semesters	Credits
Semester- I	15
Semester- II	21
Semester- III	21
Semester- IV	18
Semester- V	19
Semester- VI	30
Total	123

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY 1111	Number of Hours/Week	3			
Semester	I	Max. Marks	100			
Year	I	Credits	3			
Course						
Course Title	FUNDAMENTALS OF COMPUTING			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
<p>The main learning objective of this course is to prepare the students for:</p> <ul style="list-style-type: none"> • To have a comprehensive understanding of a foundational understanding of computer systems. • To learn about various number systems including decimal, binary, octal, and hexadecimal • To develop a comprehensive grasp of how computers function, the types of software used and the significance of networking in today's digital world. • To explore various types of software applications including operating systems, word processors, database management systems and Internet 						
UNIT	TOPICS				HOURS	
I	<p>Introduction to Computer Evolution of Computers, Generations of Computers, Classification of Computers, The Computer System, Computing Concepts, Applications of Computers.</p> <p>Memory and storage systems Computer Software and Hardware components and its requirements- Storage Devices,</p> <p>Computer Viruses Types Of Viruses – Spreading of Virus, Prevention of Computer Virus, Virus Detection, Computer Security, Maintenance, Desktop functions, Dialog boxes, Single Document Interface (SDI), Multiple Document Interface (MDI), Windows Controls, Main Menu Display, Categories of Menus, Main and Context Sensitive Menus, Booting/Shutting Down.</p>				12	
II	<p>Microsoft software MS DOS, MS Word System, MS Excel System, MS Power point System, MS Access System, MS Publisher.</p> <p>Number System Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System, BCD, XS,3, Gray Code, Alphanumeric Codes,(ASCII, EBCDIC).</p>				12	
III	<p>Computer Software Machine language, Mnemonics, High level Language, Assembler, Compiler, Interpreter, System Development Programs, System Management Programs , Standard Application Programs , Unique Application Programs, Problem</p>				12	

	Solving, Structuring the Logic.	
IV	Memory management Introduction, History, Functions, Process, Memory File, Management Device, Security Management, Types of Operating Systems, Providing User Interface, Popular Operating Systems.	12
V	THE INTERNET AND WORLD WIDE WEB History of the Internet-The Internet Applications-Understanding World Wide Web-Web Browsers-Browsing the Internet-Using a Search Engine-Email Service-Protocols used in the Internet. DATA COMMUNICATIONS AND NETWORKS Introduction-Data Communication Using Modem-Computer Networks-Network Topologies-Network Protocols and Software-Applications of Network.	12

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Understand the basic concepts of computers.
CO2:	Analyze the basics of number systems.
CO3:	Apply system development programs to create and manage simple software projects.
CO4:	Analyze the performance of different memory management techniques and their impact on system efficiency.
CO5:	Evaluate the knowledge of Internet history to understand current Internet technologies and to solve problems in communication and information access.

Text Books:

1. Fundamentals of Computers, E. Balagurusamy, Tata McGraw Hill Education Private Limited, 2009.

Reference Books:

1. Introduction to Computer Fundamentals, Bright Siaw Afriyie, Second edition, Trafford Publishing, Canada, 2003-2006.
2. Computer Fundamentals, P. K. Sinha, BPB Publications, Sixth Edition.
3. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley publishers, Ninth edition, 2013.
4. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Fifth edition, Prentice Hall, 2011.
5. Computing Fundamentals: Introduction to Computers, Faithe Wempen, Wiley 2014.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	0	3	0	0	2	3	1
CO2	3	3	3	2	3	2	2	2	1
CO3	3	3	2	3	2	2	3	2	3
CO4	3	2	2	3	1	1	3	1	1
CO5	3	2	2	2	1	3	2	1	1

3 – high, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code			BCCY
Course Code	BCCY 1111P	Number of Hours/Week			2
Semester	I	Max. Marks			100
Year	I	Credits			1
Course Title	FUNDAMENTALS OF COMPUTING LAB	L	T	P	
		0	0	2	
L-Lecture Hours T-Tutorial Hours P-Practical Hours					
LIST OF PROGRAMS					
<ol style="list-style-type: none"> 1. Basics of Microsoft Word. 2. Insert Table and Generating Chart. 3. Mail Merging. 4. Study on features of Microsoft Excel. 5. Incorporating the predefined functions in Excel. 6. Inserting table and generating chart in Excel. 7. Pivot chart, table and slicing in Excel. 8. Study on features in Microsoft PowerPoint. 9. Creating presentation incorporating the features of PowerPoint. 10. Study on HTML. 11. Basic web page design, formatting, inclusion of image and video. 12. Creation of Table. 13. Designing own web page. 					

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Understand the basic functionalities of Microsoft Word
CO2:	Apply advanced Excel features for data management.
CO3:	Create complex data presentations using Excel pivot tables, charts, and slicers.
CO4:	Develop professional presentations using advanced PowerPoint features.
CO5:	Design and develop basic web pages using HTML

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	0	3	0	0	2	3	1
CO2	3	3	3	2	3	2	2	2	1
CO3	3	3	2	3	2	2	3	2	3
CO4	3	2	2	3	1	1	3	1	1
CO5	3	2	2	2	1	3	2	1	1

3 – High, 2 – Average, 1 - Low, 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1112	Number of Hours/Week	3			
Semester	I	Max. Marks	100			
Year	I	Credits	3			
Course						
Course Title	INTRODUCTION TO PROGRAMMING LANGUAGE			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main aim of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To learn the fundamental concepts of programming, including algorithms, flowcharts, and the logical approach to problem solving that is applicable to any programming language. • To acquire comprehensive understanding of the syntax, semantics and the basic constructs of C language • Learn to use of pointers, Arrays, and dynamic memory allocation which are key to understanding data structure, memory management . • Build a foundation for advanced programming and software development. To develop skills to handle complex programming challenges such as file handling, Debugging. 						
UNIT	TOPICS				HOURS	
I	Introduction to programming Algorithm, Formalism, Flow chart, Assembly language, Introduction to program, Program components, structure, Execution path, Programming paradigms introduction, Syntax and Semantics				9	
II	Introduction to C language History of C, Prerequisites of C, Features and its applications, Structure of C, Preprocessor directives, Data types and constants, variables and its types, Tokens, Identifiers and format specifiers, Operators and Enums, Data I/O, Decision making and Branching, Loop Introduction, programs with looping structure, Control Flow programs with control flow				9	
III	Array and Strings Introduction to Array, Initialization, Single dimensional array, Multidimensional array, String, Functions with string: Read, Display string and string functions, String Arrays.				9	
IV	Functions and Pointers Function Introduction, Function calling, Return type, Function types, Recursion, Types of Recursion, Introduction to Pointers, Types Pointers, Programming exercises with pointers.				9	
V	Structures and Unions Introduction to structure and simple program using structure concepts, Introduction to Union and programs with union, Storage Classes- Introduction to DMA, Introduction to Pre-processor				9	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Acquiring foundational knowledge of programming including Algorithm, Flowcharts, assembly language basics, Program structure.
CO2 :	Understanding C language fundamentals
CO3 :	Applying various types of arrays and string manipulation technique to manage and process data in programming scenarios
CO4 :	Analyze and experiment with functions, develop recursive solutions, and apply pointers to solve complex problems.
CO5 :	Develop modular programs using control structures, unions

Text Book

1. Introduction to Programming Languages 1st Edition by Arvind Kumar Bansal, CRC Press, Taylor and Francis group, 2014.
2. C Programming Language by Brian Kernighan and Dennis Ritchie, Prentice Hall Software, 1988.
3. Programming with C 2 nd Edition Byron Gottfried Schaum's outlines, Tata McGraw-Hill publishers, 1998.

Reference Books

1. E. Balagurusamy, 'Programming in ANSI C', 3rd edition, Tata McGraw-Hill Publishers, 2004.
2. Eric C.R. Hehner, 'The Logic of Programming', Prentice hall of India, 1991.
3. C: Herbert Schildt, 'The Complete Reference', McGraw Hill, 4th edition, 2017

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	2	3	1
CO2	3	3	3	2	3	2	2	2	1
CO3	3	3	2	3	2	2	3	2	3
CO4	3	2	2	3	1	2	3	2	1
CO5	3	2	2	2	1	2	3	3	1

3 – High, 2 – Average, 1 - Low, 0 - Null

Programme	BCA(CY)	Programme Code			BCCY
Course Code	BCCY 1112P	Number of Hours/Week			2
Semester	I	Max. Marks			100
Year	I	Credits			
Course Title	INTRODUCTION TO PROGRAMMING LAB	L	T	P	
		0	0	2	
L-Lecture Hours T-Tutorial Hours P-Practical Hours					
LIST OF PROGRAMS					
1. Write a C program to print Integer, Float, Character values 2. a) Write a c program to demonstrate use of arithmetic operators 2. b) Write a C program using increment and decrement operators 3. a) Write a C program using Decision making constructs (Switch case statement) 3. b) Program to find if a number is Negative, Positive, or zero(using if..elseif..else statement) 4. C program to perform factorial of a number 5. a) Write a C program to print a message 5 times using”while” statement 5. b) Illustrate the Do-while statement using C program 5. c)Program using for loop statement 6. a) Program to implement break statement 6. b) write a program to demonstrate continue statement 7. Program to insert elements into an array and display the array elements using C language 8. Program to solve multiplication of 2 matrices 9. String a) Program to accept a string and display it as reverse using C language b) program to concatenate 2 string using C 10. Array a) Program to illustrate the concepts of arrays b) Program to illustrate pointer to 2-dimensional array 11. Program to take mark details of students and display the name of the students with highest marks using Structure concept 12. Program to implement union concept					

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Acquire foundational knowledge of programming including Algorithm, Flowcharts, assembly language basics, Program structure.
CO2 :	Understand C language fundamentals
CO3 :	Apply various types of arrays and string manipulation technique to manage and process data in programming scenarios
CO4 :	Analyze and experiment with functions, develop recursive solutions and pointers to solve complex problems.
CO5 :	Develop modular programs using control structures, unions

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	2	3	1
CO2	3	3	3	2	3	2	2	2	1
CO3	3	3	2	3	2	2	3	2	3
CO4	3	2	2	3	1	2	3	2	1
CO5	3	2	2	2	1	2	3	3	1

3 – High, 2 – Average, 1 - Low, 0 - Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1113	Number of Hours/Week	4			
Semester	I	Max. Marks	100			
Year	I	Credits	4			
Core Course						
Course Title	MATHEMATICS-I			L	T	P
			3	1	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To recall and remember basics of matrices, complex numbers, and differential calculus. • To understand the concepts of basic mathematical methods for matrices, complex numbers and differential calculus. • To apply methods to solve engineering problems. • To analyze engineering problems and evaluate. • To solve and evaluate the problems using matrices, complex numbers, and differential calculus. 						
UNIT	TOPICS				HOURS	
I	Introduction to Differentiation and its applications: Fundamentals of Differentiation, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders, Indeterminate forms and L'Hopital's rule, Maxima and Minima				10	
II	Integration and its applications: Double integral, Triple integral, Change of order of integration, Change of variables, Beta and Gamma functions and their properties, Dirichlet's integral and its applications to area and volume, Liouville's extensions of Dirichlet's integral.				12	
III	Sequence: Real number system, Convergence of sequence and series, Tests for convergence				8	
IV	Series: Power series, Taylor's series, Series for exponential, trigonometric and logarithm functions, Fourier series: Half range sine and cosine series, Parseval's theorem.				8	
V	Advanced Multivariable Calculus: Limit, continuity and partial derivatives, Directional derivatives, Total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers, Gradient, curl and divergence				10	
VI	Advanced Matrix Theory: Introduction, types of matrices-symmetric, skew-symmetric, Hermitian, skew-Hermitian, orthogonal, unitary matrices, Rank of a matrix - echelon form, normal form, consistency of system of linear equations (Homogeneous and Non-Homogeneous). Inverse and rank of a matrix, rank-nullity theorem				12	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Understand the concepts of mean value theorems, higher order derivative, series expansion and associated problems
CO2:	Acquire problem solving skills for finding area and volume using multiple integrals
CO3	Analyze sequences and series, including Fourier series
CO4	Apply the differentiation of functions of two variables for maximization and minimization
CO5	Evaluate basic matrix operations, linear systems of equations

Text Books

- 1: Advanced Engineering Mathematics, 10th Edition, Erwin Kreyszig
- 2: Calculus and Analytical Geometry, Thomas and Finney
- 3: Veerarajan T., Engineering Mathematics-I, Tata McGraw-Hill, New Delhi, 2008.
- 4: Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Reference Books

- 1: B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- 2: Principles of Mathematical Analysis, W. Rudin

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	1	0	0	0	1	0	0
CO2	2	2	0	0	0	0	2	1	1
CO3	1	2	1	0	0	0	1	2	1
CO4	2	2	2	0	1	0	1	1	2
CO5	3	3	1	0	0	0	2	2	0

Programme	BCA(CY)	Programme Code			BCCY
Course Code	AEEN 1111	Number of Hours/Week			2
Semester	I	Max. Marks			100
Year	I	Credits			
Course					
Course Title	EFFECTIVE COMMUNICATION			L	T
				2	0
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours			
COURSE OBJECTIVES:					
The main learning objective of this course is to prepare the students to:					
<ul style="list-style-type: none"> • To define and explain the fundamental concepts, types, and processes of communication. • To develop active listening and effective speaking skills to enhance interpersonal • To improve reading comprehension skills through different techniques. • To apply grammar and vocabulary rules and public communication for accurate sentence structure and effective written communication. • To prepare and deliver effective presentations by planning, structuring, and overcoming stage fright. 					
UNIT	TOPICS				HOURS
I	Introduction to Communication Definition of Communication, Types of Communication: Formal, Informal, Oral, Written, Verbal, non-verbal, interpersonal, intrapersonal Process of Communication: Sender, Message, Channel, Receiver, Feedback Barriers: Intrapersonal, Interpersonal, Organizational Overcoming Barriers				8
II	Listening and Speaking: Active Listening: Types of Listening, Reasons for poor listening Traits of the good listener, Effective Speaking: Achieving Confidence, Clarity, and Fluency, Public Speaking, Drafting the Speech				5
III	Reading and Writing: Reading Comprehension: Improving Comprehension Skills, Scanning and Skimming, Predicting the Content, Understanding the Gist, PQRSST Technique Grammar and Vocabulary: Sentence Structure, Preposition, Punctuation, Articles, Common errors and Correct Usage, Word formation: Affixes, Active and Passive Vocabulary				8
IV	Presentation Skills Planning: Occasion, Audience, Purpose, Thesis Statement, Material, Outlining and Structuring, Guidelines for Effective Delivery, Strategies for Reducing Stage Fright				6
V	Practice: Grammar Bites, English Fluency Drills				3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Identify and understand the different types and processes of communication and the barriers that may arise.
CO2:	Demonstrate active listening skills and apply strategies for confident and fluent public speaking.
CO3	Analyze and enhance reading comprehension through effective reading techniques.
CO4	Utilize proper grammar, sentence structures, and vocabulary for clear and correct written communication.
CO5	Create and present structured presentations, incorporating techniques to manage stage fright and engage the audience effectively.

Text Books

1. Kumar, Sanjay and Pushp Lata. *Communication Skills*. 2nd. ed., Oxford University Press, 2015.
2. Raman, Meenakshi and Sangeetha Sharma. *Technical Communication: Principles and Practice*, 4th ed., Oxford University Press, 2022.

Reference Books

1. Adair, John. *Effective Communication: The Most Important Management Skill of All*. Pan Books Publishers, 1997.
2. Gorrell, Robert M and Charlton Laird. *Modern English Handbook*. 6th ed., Pentice Hall Publications, 1976.
3. Rose, William. *GNVQ Core Skills Communication*. 2nd. ed., Pitman Publishing, 1995.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	0	0	0	0	0	0	0	0
CO2	1	0	0	0	0	0	0	0	0
CO3	3	0	0	0	0	0	0	0	3
CO4	3	0	0	0	0	0	0	0	2
CO5	3	0	0	0	0	0	0	0	0

3 – High, 2 – Average, 1 - Low , 0-Null

SEMESTER -II

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1221	Number of Hours/Week	3			
Semester	II	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	PYTHON PROGRAMMING			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To Understand the fundamentals of the Python programming language and its historical development • To Master Python basics, including data types, operators, tuples, dictionaries, and string manipulation. • To demonstrate object oriented concept in python • To familiarize with machine learning tools in python 						
UNIT	TOPICS				HOURS	
I	Introduction to python programming Introduction to python ; setting up python programming environment; variables; strings and its operations; special characters; stripping whitespace; numbers; comments; list and its operations; indexing; looping through lists; indentation; range function; slicing a list; copying list; looping through slice;				8	
II	Python datatypes Tuples and its operations; relational operators; conditional statements – if, if-else, if-elif-else; multiple conditional blocks; dictionaries; key-value pairs – adding, modifying, removing; looping through dictionary; list of dictionaries; dictionary in a dictionary; user input function; type casting;				8	
III	Loop and function While loop; break and continue; functions; arguments; passing arguments – positional arguments, keyword arguments, default values; optional arguments; returning from function; passing arbitrary number of arguments; storing functions in modules; import specific function or module;				8	
IV	OOPs in python Classes; __init__() method; instance of a class; accessing attributes; calling methods; creating multiple instances; inheritance – parent class,				8	

	child class; importing classes; files – reading a file, writing to a file, appending to a file; exceptions – try-except block, else block;	
V	Python machine learning tools Python tools for machine learning; python modules – numpy, pandas, matplotlib, scipy; python based machine learning libraries – pytorch, tensorflow; virtual environment; machine learning application using python tools;	8

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Comprehend the holistic view of programming language design and behavior
CO2 :	Understand the programming concepts in abstract and paradigm level
CO3 :	Structure python programs for solving problems
CO4 :	Develop python programs using OOP concept
CO5 :	Execute ML project using python tools

Text Books:

1. Eric Matthes. Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming. No Starch Press, Inc., 2019.

Reference Books:

1. Al Sweigart. Automate the Boring Stuff with Python. William Pollock, 2015.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	1	3	2	1
CO2	1	3	1	2	1	1	3	2	1
CO3	2	2	2	3	2	3	3	3	2
CO4	2	3	0	3	2	3	3	3	1
CO5	1	3	3	3	2	3	3	2	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY		
Course Code	BCCY1221P	Number of Hours/WK	2		
Semester	II	Max. Marks	100		
Part		Credit	1		
Course Title	PYTHON PROGRAMMING LABORATORY	L	T	P	
		0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours			
COURSE OBJECTIVE:					
The main learning objective of this course is to prepare the students for:					
<ul style="list-style-type: none"> • To learn fundamentals in python programming language • To introduce python modules for application • To familiarize python framework for machine learning applications • To develop machine learning application using python • To implement research topic as part of python project 					
LIST OF EXPERIMENTS					
<ol style="list-style-type: none"> 1. Implement basic algebraic problems to get into python programming 2. Implement string manipulations problems using python 3. Implement problems using python datatypes such as tuple, list, dictionary etc. 4. Implement problems for python loops, conditional statements and functions 5. Implement object oriented programming concepts in python to solve different problems 6. Implement problems for python file manipulations 7. Implement standard machine learning algorithms using python frameworks such as TensorFlow, PyTorch etc. 8. Implement advanced problems using python tools in a virtual environment as part of python project 					

COURSE OUTCOME:

On successful completion of this course, the student will be able to

CO1 :	Develop basic coding skills in python
CO2 :	Understand python datatypes, modules, frameworks etc.
CO3 :	Implement standard ML algorithms using python tools
CO4 :	Apply python frameworks for ML applications
CO5 :	Create ML model for existing problems

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	1	3	1	2
CO2	1	3	1	2	1	1	3	2	1
CO3	2	2	2	3	2	3	3	3	1
CO4	2	3	0	3	2	3	3	3	2
CO5	1	3	3	3	2	3	3	2	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(AI)	Programme Code	BCAI			
Course Code	BCAI1122	Number of Hours/WK	3			
Semester	II	Max. Marks	100			
Part		Credit	3			
Course						
Course Title	PROBABILITY, STATISTICS AND STOCHASTIC PROCESS			L	T	P
				3	0	0
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES						
<ul style="list-style-type: none"> • To understand the fundamental concepts of set theory, sigma algebras, and probability space including Borel sets and continuity of probability functions. • To develop proficiency in analyzing random variables, including their distribution functions, expectations, and inequalities like Markov and Chebyshev. • To apply knowledge of joint distributions, marginal and conditional probabilities • To apply special discrete and continuous probability distributions in statistical problems • To execute hypothesis testing procedures, including formulating null and alternate hypotheses and constructing confidence intervals for statistical inference. 						
UNIT	TOPIC				HOURS	
I	Introduction to set algebra-sigma algebra-Borel sigma algebra-sequence of sets and its limits-lim- sup and lim-inf of sequence of sets; Axiomatic definition of probability-probability space-properties of probability functions-conditional probability-Bayes' rule-independence of events-continuity of probability functions-Borel Cantelli lemmas.				10	
II	Random variables-distribution function and its property probability mass and density functions- symmetric distribution and its properties-expectation-moments moment generating function- Markov inequality-Chebyshev's inequality.				10	
III	Joint distributions-marginal and conditional distributions-moments-independence of random variables-covariance, and correlation joint moment generating functions-additive properties of random variables-functions of random variables-ordered Statistics.				8	
IV	Special distributions: Discrete uniform-Bernoulli-binomial-geometric negative binomial- hypergeometric-Poisson-exponential-gamma-normal-bivariate normal distribution; Population- sample-parameters-distributions of the sample mean and the sample variance for a normal population-Chi-Square-t and F distributions-law of large numbers– central limit theorem-point estimation-method of moments-maximum likelihood estimator-unbiasedness.				8	
V	Testing of hypothesis: Null and alternate hypothesis-Neyman Pearson fundamental lemma and its applications-tests for one sample and two sample problems for normal populations-tests for proportions-confidence interval estimation-confidence interval for parameters of normal population.				8	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand and Apply Basic Probability Concepts
CO2 :	Analyze Random Variables and Probability Distributions
CO3 :	Apply Joint Distributions and Conditional Probability
CO4 :	Implement the Central Limit Theorem and Law of Large Numbers
CO5 :	Perform Hypothesis Testing and Statistical Inference
CO6:	Use Regression and Correlation for Data Analysis
CO7:	Employ Statistical Tools in Engineering Applications
CO8:	Utilize Software Tools for Statistical Analysis

Text Books:

1. “First Course in Probability”, Sheldon Ross, Tenth Edition, Pearson, 2019.
2. “An Introduction to Probability and Statistics”, V.K. Rohatgi and A.K. Md. E. Saleh, Second edition, Wiley, 2008

Reference Books:

1. “Introduction to Probability and Statistics for Engineers and Scientists”, Sheldon M.Ross, Wiley, Fifth Edition, 2014
2. “Introduction to Mathematical Statistics”, R V Hogg, A Craig and J W McKean, Eighth edition, Pearson, 2019

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	1	1
CO2	2	0	1	1	0	2	1	2	1
CO3	2	2	2	2	1	1	0	2	2
CO4	2	2	2	1	2	0	2	2	2
C05	2	1	1	0	1	0	2	2	1

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code			BCCY
Course Code	BCCY1123	Number of Hours/WK			4
Semester	II	Max. Marks			100
Year	I	Credit			4
Course					
Course Title	MATHEMATICS -II			L	T
				3	1
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours			
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To develop a strong understanding of vector spaces, subspaces, basis, and dimension, as well as how linear transformations relate to matrices and their properties. To gain proficiency in solving systems of linear equations using techniques like Gaussian elimination, matrix operations, and determinants. To compute eigenvalues and eigenvectors, and apply them to diagonalize matrices, a critical tool for solving differential equations. To solve first-order and second-order ordinary differential equations (ODEs) with applications to physical, biological, and engineering problems. To understand the interplay between linear algebra and differential equations, especially in systems of linear differential equations, using matrix methods such as the Laplace transform and matrix exponentials. 					
UNIT	TOPIC				HOURS
I	Advanced Matrix Theory: Systems of linear equations: Elementary operations-row-reduced echelon matrices-Gauss elimination LU factorization-linear independence-rank of a matrix-solutions of linear systems-existence and uniqueness.				10
II	Vector spaces: Vector space-subspaces-spanning space-bases and dimensions. Linear transformation-matrix representations of linear transformations-range space and rank-null space and nullity-the rank and nullity theorem-invertibility.				6
III	Eigenvalues and eigenvectors: Eigen values-eigenvectors and some applications of eigenvalue problems-Hermitian, skew-Hermitian, unitary matrices and their eigenvalues-eigen bases.				8
IV	Elementary Canonical Forms: Diagonalization: Annihilating polynomial-the minimal polynomial and the characteristic polynomial-Cayley-Hamilton theorem-real quadratic form; Inner product spaces: Inner product spaces-orthonormal bases-Gram-Schmidt process.				8
V	Ordinary Differential Equations: Review of First Order ODE- Lipschitz condition-Picard`s theorem; Linear differential equations: Linear dependence and Wronskian-linear ODE with constant coefficients of higher order characteristic equations-Cauchy-Euler equations-method of undetermined coefficients-method of variation of parameters- solutions methods using Laplace Transform.				10

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Learn different types of matrices, concept of rank, methods of matrix inversion and their applications, systems of linear equations, and manipulate vectors in various dimensions.
CO2 :	Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
CO3 :	Apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems.
CO4 :	Understand the first- and second-order ordinary differential equations (ODEs), both analytically and numerically, with applications to real-world phenomena
CO5 :	Develop the skills to model physical systems using differential equations and linear algebra.

Text Books:

1. “Linear Algebra”, Hoffman Kunze, Prentice Hall. 1971
2. “Differential Equations”, S. L Ross, Third Edition, 2007

Reference Books:

1. “Introduction to Linear Algebra”, Gilbert Strang, Fifth edition, 2016
2. “Advanced Engineering Mathematics”, Erwin Kreyszig, Wiley Publishers, Tenth Edition, 2011

Mapping of Course Outcomes (CO's) with PO's & PSO's

3.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	1	1
CO2	2	0	1	1	0	2	1	2	1
CO3	2	2	2	2	1	1	0	2	2
CO4	2	2	2	1	2	0	2	2	2
CO5	2	1	1	0	1	0	2	2	1

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1125	Number of Hours/Wk	3			
Semester	II	Max. Marks	100			
Part		Credit	3			
Course						
Course Title	DISCRETE STRUCTURES FOR COMPUTER SCIENCE			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES						
<ul style="list-style-type: none"> • To get familiar and understand the fundamental notions in discrete structures focusing on aspects of computer science • To describe binary relations between two sets, combine relations using set operations and composition. • To understand and demonstrate the basic concept of algorithm and its application in combinatorial mathematics. • To identify the base step and the recursive or inductive step in applied problems and give a recursive and a non-recursive definition for an iterative algorithm. • To classify the basic properties of graphs and trees and model simple applications. 						
UNIT	TOPIC				HOURS	
I	Set Theory and Logic Sets – Functions – Relations - Equivalence Relation – Poset - Functions Logic: Propositional logic - Truth Tables – Tautologies - Resolution Proof System - Predicate Logic				9	
II	Induction and Combinatorics Peano's Axioms - Mathematical Induction - Pigeon-Hole Principle - Principle of Inclusion and Exclusion - Review of Permutations and Combinations - Distribution Problems - Derangements - Bijection Principle.				9	
III	Algebraic Structures Semi-Groups – Monoids – Groups - Subgroups and Their Properties - Cyclic Groups - Cosets - Permutation Groups - Lagrange's Theorem - Cayley's Theorem - Normal Subgroups - Homomorphism of Groups - Quotient Groups –Introduction to Rings and Fields				9	
IV	Linear Algebra and Recurrence Relations Linear Algebra: Vector Space – Basis, Dimension, Orthogonality - Recurrence Relations: Homogeneous and Inhomogeneous Recurrences and their Solutions - Solving Recurrences Using Generating Functions.				9	
V	Graph Theory Definitions and Basic Results - Representation of a Graph by a Matrix and				9	

Adjacency List - Trees - Cycles - Properties - Paths and Connectedness - Subgraphs - Graph Isomorphism - Operations on Graphs - Vertex and Edge Cuts - Vertex and Edge Connectivity.
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Andragogy

- Class Room Lectures, Power point presentation, flipped classroom sessions, Group Discussion, Seminar, Quiz, Formative Assessments.
- The students can get their doubts clarified at any time whenever the faculty is available.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1:	Understand the fundamental aspects of discrete and continuous mathematical structures.
CO2:	Demonstrate the principles of mathematical induction to prove statements.
CO3:	Differentiate between various algebraic structures and analyze their properties.
CO4:	Apply logical reasoning and mathematical techniques to solve problems in set theory, algebra, and graph theory.
CO5:	Construct new mathematical models and generate solutions to complex recurrence relations and graph problems.

Text Books

1. “Elements of Discrete Mathematics: A Computer Oriented Approach”, C. L. Liu, D. P. Mohapatra, McGraw Hill, Third Edition, 2012.
2. “Applied Discrete Structures”, Al Doerr, Ken Levasseur, LibreTexts, Third Edition, 2023

Reference Books

1. “Discrete Mathematical Structures with applications to Computer Science”, Tremblay J.P. and Manohar R., McGraw Hill International Edition, 1987.
2. “Discrete Mathematics and Its Applications”, Kenneth H. Rosen, Sixth Edition, Tata McGraw Hill, 2012.

Mapping of Course Outcomes (CO's) with PO's & PSO's

1.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	0	3	3	2	2	1	1	1
CO2	0	0	2	0	2	1	2	0	1
CO3	1	0	2	1	2	2	2	1	0
CO4	2	2	2	0	2	3	1	2	1
CO5	0	0	1	2	1	2	2	1	1

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(AI)	Programme Code			BCAI
Course Code	BCAI 1126	Number of Hours/WK			3
Semester	II	Max. Marks			100
Year	I	Credit			3
Course					
Course Title	OFFICE AUTOMATION TOOLS			L	T
				3	0
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours			
COURSE OBJECTIVES					
<ul style="list-style-type: none"> To gain comprehensive knowledge of various office automation tools and their applications in a professional setting. To develop proficiency in creating, formatting and managing documents using advanced features of word processing software. To acquire the ability to develop and analyze data using spreadsheet software. To manage email communications and calendar events efficiently with organizational tool in order to streamline workflow. To utilize cloud storage and collaboration tools to enhance team productivity. 					
UNIT	TOPICS				HOURS
I	Introduction to MS Word Introduction to MS Word: Overview of MS Word Interface, Creating, Saving, and Opening Documents, Basic Text Formatting (Font styles, sizes, and colors), Paragraph Formatting (Alignment, indentation, line spacing),				8
II	Basic Document Formatting Advanced Document Formatting, Using Styles and Templates, Creating and Managing Tables, Using Headers, Footers, and Page Numbers, Creating a Table of Contents and Index. Document Review and Collaboration- Track Changes and Comments, Comparing and Merging Documents, Using and Creating Forms, Managing References and Citations, Integrating MS Word with Other MS Office Applications, Creating a Professional Report or Resume				8
III	Data Management and Analysis with MS Excel Introduction to MS Excel: Overview of Excel Interface, Basic Operations (Entering Data, Basic Formulas), Cell Referencing and Basic Functions (SUM, AVERAGE), Data Analysis Techniques- Creating and Formatting Tables, Using Advanced Functions (VLOOKUP, INDEX-MATCH, IF Statements), Data Validation Techniques, Data Visualization- Creating and Customizing Charts, Using Conditional Formatting, Pivot Tables and Pivot Charts , Practical Applications and Project- Data Analysis Project: Import, Clean, Analyse, and Visualize Data, Automation with Macros: Recording and Running Basic Macros				8
IV	Designing Presentations with MS PowerPoint Introduction to MS PowerPoint: Overview of PowerPoint Interface, Creating and Formatting Slides, Using Slide Layouts and Themes, Enhancing Presentations- Adding and Customizing Text, Images, and Shapes, Applying Slide Transitions and Animations, Incorporating Multimedia Elements (Audio, Video), Advanced Presentation Techniques- Designing Effective Slide Masters, Creating Interactive Elements (Hyperlinks, Action Buttons), custom Animations and Timing, Practical Applications and Project- Creating a Professional Presentation on a Given Topic, Incorporating Feedback and Revising Presentation				10

V	Creating and Managing Forms- Google Forms, Microsoft Forms- Designing forms and surveys- Adding different types of questions- Setting up branching logic- Collecting and analyzing responses. Cloud storage- Collaboration tools, Desktop Publishing-Microsoft Publisher- Creating brochures, newsletters, and flyers-Using templates and design elements- Inserting and formatting text, images, and graphics- Preparing documents for printing.	10
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Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

CO1:	Create professional documents using word processing software, applying advanced features such as mail merge, styles, and templates.
CO2:	Utilize complex formulas, functions, pivot tables, and data visualization tools in spreadsheet software presenting data effectively.
CO3:	Design engaging presentations using presentation software, incorporating multimedia elements, custom animations, and utilizing presenter tools.
CO4:	Understand fundamental database concepts to manipulate and interpret data effectively
CO5:	Utilize cloud storage solutions and collaboration tools for file management, sharing, real-time collaboration, managing permissions, and ensuring data security and accessibility.

Text Books:

1. "Microsoft Office 2019 Step by Step", Joan Lambert and Curtis Frye, First Edition, Microsoft Press, 2018.
2. "Learning Microsoft Office", First Edition, Wiley, 2019.
3. "Google Workspace User Guide", Eric Butow First Edition, , Packt Publishing, 2021.
4. "Mastering LibreOffice", Jean Hollis Weber, Friends of OpenDocument, First Edition, 2014.
5. "Microsoft Excel 2019 Bible", Michael Alexander, Richard Kusleika, and John Walkenbach, First Edition, Wiley, 2018
6. "Google Sheets: The Comprehensive Guide", Ian Lamont, First Edition, i30 Media Corporation, 2020.
7. "Microsoft PowerPoint 2019 For Dummies", Doug Lowe, First Edition, Wiley, 2018.
8. "Access 2019 Bible", Michael Alexander and Richard Kusleika, First Edition, Wiley, 2018.

Mapping of Course Outcomes (CO's) with PO's & PSO's

2.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	1	2
CO2	3	3	3	2	2	2	2	1	2
CO3	2	2	2	2	1	2	2	1	2
CO4	2	1	2	2	2	3	1	1	2
CO5	3	3	2	3	2	2	2	1	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(AI)	Programme Code	BCAI			
Course Code	BCAI 1126	Number of Hours/WK	2			
Semester	II	Max. Marks	100			
Part		Credit	1			
Course						
Course Title	OFFICE AUTOMATION LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES						
<ul style="list-style-type: none"> • To gain comprehensive knowledge of various office automation tools and their applications in a professional setting. • To develop proficiency in creating, formatting and managing documents using advanced features of word processing software. • To acquire the ability to develop and analyze data using spreadsheet software. • To manage email communications and calendar events efficiently with organizational tool in order to streamline workflow. • To utilize cloud storage and collaboration tools to enhance team productivity. 						
<u>List of Experiment</u>						
1. Introduction to Office Automation Tools						
<ul style="list-style-type: none"> ○ Overview of different office automation tools. ○ Understanding the interface and basic functionalities of popular office suites (Microsoft Office, Google Workspace). 						
2. Word Processing (e.g., Microsoft Word, Google Docs)						
<ul style="list-style-type: none"> ○ Creating and formatting documents. ○ Using templates and styles. ○ Inserting and formatting tables, images, and charts. ○ Utilizing headers, footers, and page numbers. ○ Implementing document review features: track changes, comments, and comparing documents. ○ Mail merge for letters and labels. 						
3. Spreadsheet Management (e.g., Microsoft Excel, Google Sheets)						
<ul style="list-style-type: none"> ○ Creating and formatting spreadsheets. ○ Basic and advanced formulas and functions. ○ Data validation and conditional formatting. ○ Chart creation and customization. ○ Using pivot tables and pivot charts for data analysis. ○ Implementing macros to automate repetitive tasks. 						

4. Presentation Software (e.g., Microsoft PowerPoint, Google Slides)

- Creating and designing presentations.
- Using themes and templates.
- Adding and formatting text, images, audio, and video.
- Applying animations and slide transitions.
- Presenter view and slide show settings.
- Collaborating on presentations in real-time.

5. Database Management (e.g., Microsoft Access, LibreOffice Base)

- Introduction to database concepts.
- Creating and managing tables.
- Designing and running queries.
- Creating forms for data entry.
- Generating reports.

6. Email and Calendar Management (e.g., Microsoft Outlook, Google Calendar)

- Composing, sending, and organizing emails.
- Using folders, labels, and rules to manage emails.
- Scheduling, managing calendar events, setting up reminders and notifications.
- Sharing calendars and scheduling meetings.

7. Collaboration and Cloud Storage (e.g., Microsoft OneDrive, Google Drive)

- Uploading and managing files in cloud storage, sharing files and setting permissions.
- Real-time collaboration on documents.
- Version control and file recovery.

8. Creating and Managing Forms (e.g., Google Forms, Microsoft Forms)

- Designing forms and surveys.
- Adding different types of questions.
- Setting up branching logic- Collecting and analyzing responses.

9. Desktop Publishing (e.g., Microsoft Publisher)

- Creating brochures, newsletters, and flyers, using templates and design elements.
- Inserting and formatting text, images, and graphics, preparing documents for printing.

COURSE OUTCOMES

CO1:	Demonstrate proficiency in using various office automation tools for document creation, data analysis and presentation design.
CO2:	Manage data using spreadsheet software applying formulas, functions, and pivot tables.
CO3:	Collaborate with peers on projects utilizing cloud-based tools for file sharing, real-time editing and team communication.
CO4:	Design and thereby implementing forms and surveys for data collection analysis, present findings using appropriate software tools
CO5:	Utilize cloud storage solutions and collaboration tools for file management, sharing, real-time collaboration, managing permissions, and ensuring data security and accessibility.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	1	2
CO2	3	3	3	2	2	2	2	1	2
CO3	2	2	2	2	1	2	2	1	2
CO4	2	1	2	2	2	3	1	1	2
CO5	3	3	2	3	2	2	2	1	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(AI)	Programme Code	BCAI			
Course Code	AAEV1121	Number of Hours/Week	2			
Semester	II	Max. Marks	100			
Year		Credits	2			
Course						
Course Title	ENVIRONMENTAL SCIENCE			L	T	P
			2	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students to:						
<ul style="list-style-type: none"> • To understand the Environmental Foundations • To differentiate between renewable and non-renewable resources and assess the impacts of land use changes, land degradation, and water resource exploitation. • To study the causes and effects of pollution and its impacts on earth • To analyse the population causes, its effects and control measures. 						
UNIT	TOPICS				HOURS	
I	Introduction to Environmental studies Definition and Scope of Environmental Studies - Interdisciplinary Nature of Environmental Science-Historical Perspectives on Environmental Issues- Principles of Sustainability and Sustainable Development, Ecosystem- Structure and functions of ecosystem--Aquatic ecosystems				6	
II	Natural Resources- Renewable and Non-renewable Resources Land resources and land use change, Land degradation, soil erosion, Desertification- Deforestation- exploitation of surface and ground water, floods, droughts, conflicts over water Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.				6	
III	Biodiversity and Conservation Levels of biological diversity- genetic, species and ecosystem diversity, Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots.				6	
IV	Environmental Pollution Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution - Nuclear hazards and human health risks-Solid waste management: Control measures of urban and industrial waste. Pollution case studies, Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture, Environment Laws: Environment Protection Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD), Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.				12	
V	Human Communities and the Environment Human population growth: Impacts on environment, human health and welfare- Resettlement and rehabilitation of project affected persons, Disaster management: floods, earthquake, cyclones and landslides, Environmental movements- Chipko, Silent valley, Bishnoi's of Rajasthan				10	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Define environmental studies and its interdisciplinary nature
CO2:	Analyze the structure and functions of various ecosystems, including aquatic ecosystems.
CO3:	Evaluate the growing energy needs and the role of alternative energy sources
CO4:	Understand levels of biodiversity (genetic, species, and ecosystem) and identify biodiversity hotspots, with a focus on conservation strategies.
CO5:	Evaluate the effects of human population growth on the environment and the importance of disaster management, resettlement, and environmental movements

Textbooks

1. Environmental and Sustainable Development, Keiji Ujikawa, Mikio Ishiwatari, Eric van Hullebusch, 1st Edition springer publishers Singapore.
2. Environmental Science: Toward A Sustainable Future, Dorothy F. Bourse and Richard T. Wright, 13th edition, Pearson publishers.
3. Social Learning in Environmental Management: Towards a Sustainable Future, Meg Keen, Valerie A. Brown, Rob Dyball.
4. Principles of Environmental Science, William P. Cunningham and Mary Ann Cunningham, 10th edition, Mc graw hill publishers.
5. Visualizing Environmental Science, Linda R. Berg, Mary Catherine Hager and David M. Hassenzahl.

Reference Books:

1. Waste Water Treatment, Rao, M.N., Datta, A.K., Oxford and IBH Publishing Co. Pvt. Ltd, 1987.
2. Fundamentals of Ecology, Odum, E.P., Odum, H.T., and Andrews, J., , Saunders, Philadelphia, 1971, USA.

Mapping of Course Outcomes (CO's) with PO's & PSO's

3.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	0	1	0	0	0	1	0	0	0
CO2	0	0	0	0	0	1	0	0	0
CO3	0	0	0	0	0	1	0	0	0
CO4	0	0	0	0	0	1	0	0	0
CO5	0	0	0	0	0	1	0	0	0

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1211	Number of Hours/Week	3			
Semester	III	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	FUNDAMENTALS OF INFORMATION SECURITY			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main aim of learning this course is :						
<ul style="list-style-type: none"> • To introduce the fundamental concepts of Information security • Ability to identify key security principles, recognize common threats and vulnerabilities • Implement basic security measures and understand the importance of compliance and policies. 						
UNIT	TOPICS				HOURS	
I	Introduction to Information Security Overview of Information Security, Key Concepts and Terminology, Goals of Information Security, Security Threats and Attacks, Security Controls and Countermeasures				9	
II	Cryptography Principles of Cryptography, Symmetric and Asymmetric Encryption, Hash Functions and Message Digests, Digital Signatures and Certificates, Cryptographic Applications: SSL/TLS, PGP, VPNs				9	
III	Access Control and Authentication Access Control Models, DAC, MAC, RBAC, Authentication Methods, Passwords, Biometrics, Tokens, Single Sign On (SSO) and Federated Identity, Role Based Access Control (RBAC), Access Control Lists (ACLs) and Permissions				9	
IV	Security in Software Development Secure Software Development Lifecycle (SDLC), Common Software Security Vulnerabilities (OWASP Top 10), Secure Coding Practices, Code Review and Static Analysis Tools, Secure Development Frameworks and Libraries				9	
V	Security Management and Governance Security Policies, Standards, and Procedures, Risk Management and Assessment Security Incident Handling and Response, Security Awareness and Training Compliance and Regulatory Requirements.				9	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand the Information security system, mechanisms and CIA triad
CO2 :	Apply the different cryptographic operations of symmetric, asymmetric algorithms, authentication schemes
CO3 :	Evaluate and differentiate access control models along with various authentication methods.
CO4 :	Assess and Enhance security in SDLC by applying code reviews and utilizing static analysis tools.
CO5 :	Create and evaluate comprehensive security policies, Implement governance frameworks, ensure compliance to manage organizational security risks.

Text Book

1. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, 6th edition, 2017
2. Cryptography and Network Security: Principles and Practices, William Stallings, 7th edition, 2017

Reference Books

1. CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide, Mike Chapple, James Michael Stewart, Darril Gibson, 8th edition, 2018
2. Security Engineering: A Guide to Building Dependable Distributed Systems, Ross J. Anderson, 2 nd edition, 2018

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	0	0	2	2	2	2	1
CO2	3	2	0	2	2	0	2	1	2
CO3	0	3	0	0	3	2	3	2	2
CO4	0	0	3	2	0	1	2	1	0
CO5	2	0	0	0	2	2	2	2	1

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1212	Number of Hours/Week	3			
Semester	III	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	COMPUTER NETWORK			L	T	P
			3	0	0	
L-Lecture Hours T-Tutorial Hours P-Practical Hours						
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To understand the concept of Computer network • To impart knowledge about networking and inter networking devices 						
UNIT	TOPICS				HOURS	
I	Introduction – Network Hardware - Software - Reference Models - OSI and TCP/IP Models - Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer - Theoretical Basis for Data Communication - Guided Transmission Media.				8	
II	Wireless Transmission - Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues - Error Detection and Correction.				7	
III	Elementary Data Link Protocols - Sliding Window Protocols - Data Link Layer in the Internet - Medium Access Layer - Channel Allocation Problem - Multiple Access Protocols - Bluetooth.				12	
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms - IP Protocol - IP Addresses - Internet Control Protocols.				10	
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection - Simple Transport Protocol - Internet Transport Protocols (ITP) - Network Security: Cryptography.				8	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOME:

On successful completion of this course, the student will be able to

CO1 :	To Learn various principles & concepts of Computer networks.
CO2 :	To Analyze different network models.
CO3 :	To Evaluate the data flow through TCP/IP & ISO Layers.
CO4 :	To Assess key networking protocols and their hierarchical relationship In the conceptual model like TCP/IP and OSI
CO5 :	To Identify networking and inter-networking devices

Text Book :

1. A. S. Tanenbaum, “Computer Networks”, Prentice-Hall of India 2008, 4th Edition.

Reference Books:

1. Stallings, “Data and Computer Communications”, Pearson Education 2012, 7th Edition.
2. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill 2007, 4th Edition.
3. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education 2008.
4. D. Bertsekas and R. Gallager, “Data Networks”, PHI 2008, 2nd Edition. 5. Lamarca, “Communication Networks”, Tata McGraw Hill 2002.

Mapping of Course Outcomes (CO's) with PO's & PSO's

4.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	0	0	0	3	0	0
CO2	3	3	2	0	1	0	2	2	0
CO3	3	3	3	2	0	0	3	3	3
CO4	3	2	2	0	2	0	2	2	2
CO5	3	3	3	1	1	1	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1212P	Number of Hours/Week	2			
Semester	III	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	COMPUTER NETWORK LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To understand the concept of Computer network • To impart knowledge about networking and inter networking devices 						
<u>List of Experiment</u>						
<ol style="list-style-type: none"> 1. Implement the data link layer framing methods such as character, character stuffing and bit stuffing. 2. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP. 3. Implement Dijkstra’s algorithm to compute the Shortest path thru a graph. 4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing 5. table art each node using distance vector routing algorithm 6. Take an example subnet of hosts. Obtain broadcast tree for it. 7. Take a 64 bit playing text and encrypt the same using DES algorithm. 8. Write a program to break the above DES coding 9. Using RSA algorithm encrypt a text data and Decrypt the same. 						

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 :	To Learn various principles & concepts of Computer networks.
CO2 :	To Analyze different network models.
CO3 :	To Evaluate the data flow through TCP/IP & ISO Layers.
CO4 :	To Assess key networking protocols and their hierarchical relationship In the conceptual model like TCP/IP and OSI
CO5 :	To Identify networking and inter-networking devices

Mapping of Course Outcomes (CO's) with PO's & PSO's

5.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	0	0	0	3	0	0
CO2	3	3	2	0	1	0	2	2	0
CO3	3	3	3	2	0	0	3	3	3
CO4	3	2	2	0	2	0	2	2	2
CO5	3	3	3	1	1	1	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1213	Number of Hours/Week	3			
Semester	III	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	DIGITAL DESIGN			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main aim of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To teach various number systems, binary codes and their applications • To familiarize the students the importance of error detection and error correction codes. • To inculcate concepts of K-MAP to simplify a Boolean expression • To facilitate students in designing a logic circuit 						
UNIT	TOPICS				HOURS	
I	Number Representations: Binary numbers: binary, octal, and hexadecimal number systems; conversion between different number systems; signed and unsigned numbers; representation of negative numbers using 1's complement and 2's complement. Integer representation: fixed-point number representation; range and precision of fixed-point numbers; overflow and underflow conditions. Floating-point representation, Arithmetic operations in binary: binary addition, subtraction, multiplication, and division; overflow detection and handling.				7	
II	Combinatorial Circuits: Boolean Algebra: fundamental theorems and postulates; simplification of Boolean expressions using algebraic techniques. Logic Gates: basic gates (AND, OR, NOT), universal gates (NAND, NOR), XOR and XNOR gates. Minimization of Boolean functions: simplification using Boolean identities; Karnaugh map (K-map) technique for 2, 3, 4, and 5 variables; don't care conditions in K-maps. Combinational Circuits: design and analysis of arithmetic circuits (adders, subtractors); code converters (Binary to Gray, Gray to Binary, BCD to Binary, etc.); multiplexers, demultiplexers, encoders, decoders.				12	
III	Sequential Circuits: Introduction to sequential circuits: difference between combinational and sequential circuits; clock signals and timing diagrams. Latches and Flip-Flops: SR Latch, D Latch, JK Flip-Flop, D Flip-Flop, T Flip-Flop; timing constraints: setup time, hold time, propagation delay. Counters: asynchronous (ripple) counters and synchronous counters; modulus of counters; design of up-down counters, ring counters, Johnson counters. Shift Registers: serial-in serial-out (SISO) registers, serial-in parallel-out (SIPO) registers, parallel-in serial-out (PISO) registers; applications of shift registers.				12	
IV	Data Converters: purpose of sample and hold circuits in digital signal processing; working principle and block diagram. Analog to Digital Converters (ADCs): working principle of ADCs and Digital to Analog Converters (DACs): working principle of DACs				7	
V	Memory and Programmable Logic: Introduction to memory: classification of memory: volatile vs non-volatile, primary vs secondary; characteristics of memory: access time, memory cycle time, and bandwidth. Random Access Memory (RAM): types of RAM: Static RAM (SRAM) and Dynamic RAM (DRAM); memory cell architecture and organization. Memory decoding: address decoding techniques for RAM; row and column address selection. Read Only Memory (ROM): types of ROM: PROM, EPROM, EEPROM,				7	

Programmable Logic Array (PLA) architecture; Programmable Array Logic (PAL) structure

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand various number systems and their arithmetic operations.
CO2 :	Design and analyze combinatorial circuits using Boolean algebra, K-maps, and logic gates.
CO3 :	Work with sequential circuits like latches, flip-flops, counters, and shift registers.
CO4 :	Interface and design systems using data converters like ADCs and DACs.
CO5 :	Explore different types of memory and programmable logic devices and apply them in digital systems.

Text Book

1. "Digital Design" by M. Morris Mano, Michael D. Ciletti
2. Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss
3. "Microelectronics: Digital and Analog Circuits and Systems" by Jacob Millman and Arvin Grabel

Reference Books

1. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.
2. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson, 2nd Ed.
3. F. Vahid, Digital Design, 1st Ed., Wiley India, 2011

Mapping of Course Outcomes (CO's) with PO's & PSO's

6.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	1	2	1	1
CO2	3	3	3	3	3	2	3	2	1
CO3	3	2	3	3	3	3	3	3	2
CO4	3	2	3	3	3	3	2	3	2
CO5	3	3	3	3	3	3	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1213	Number of Hours/Week	2			
Semester	III	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	DIGITAL DESIGN LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main aim of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To teach various number systems, binary codes and their applications • To familiarize the students the importance of error detection and error correction codes. • To inculcate concepts of K-MAP to simplify a Boolean expression • To facilitate students in designing a logic circuit 						
<u>LIST OF EXPERIMENTS</u>						
<ol style="list-style-type: none"> 1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates. 2. Construction of half and full adder using XOR and NAND gates and verification of its operation. 3. To Study and Verify Half and Full Subtractor 4. Realization of logic functions with the help of Universal Gates (NAND, NOR) 5. Construction of a NOR gate latch and verification of its operation 6. Verify the truth table of RS, JK, T and D flip-flops using NAND and NOR gates 7. Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers 8. Implementation and verification of decoder or de-multiplexer and encoder using logic gates 9. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates 10. Design and verify the 4- Bit Synchronous or Asynchronous Counter using JK Flip Flop 11. Verify Binary to Gray and Gray to Binary conversion using NAND gates only 						

12. Verify the truth table of one bit and two bit comparator using logic gates

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand various number systems and their arithmetic operations.
CO2 :	Design and analyze combinatorial circuits using Boolean algebra, K-maps, and logic gates.
CO3 :	Work with sequential circuits like latches, flip-flops, counters, and shift registers.
CO4 :	Interface and design systems using data converters like ADCs and DACs.
CO5 :	Explore different types of memory and programmable logic devices and apply them in digital systems.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	1	2	1	1
CO2	3	3	3	3	3	2	3	2	1
CO3	3	2	3	3	3	3	3	3	2
CO4	3	2	3	3	3	3	2	3	2
CO5	3	3	3	3	3	3	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1214	Number of Hours/Week	3			
Semester	III	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	DATA STRUCTURE AND ALGORITHMS			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To Comprehensive understanding of fundamental data structures and algorithms. • To equip algorithms with the skills to analyze and implement various computational techniques. • Learn to select appropriate data structures for solving complex problems, optimize algorithm performance, and gain insight into advanced topics such as dynamic programming and NP-completeness. 						
UNIT	TOPICS				HOURS	
I	Introduction to Data Structures Algorithms- asymptotic notations and analysis- Analysing Algorithms - Insertion sort, Divide and Conquer approach, Sorting, Building Heaps, Heap sort, Quick sort, Analysis of sorting algorithms,				12	
II	Elementary data structures Stacks and Queues, linked lists and its operations, Hash Tables - Direct and Open addressing- Tree data structure Tree- Tree Traversals-Binary Search Trees-Red Black Trees - Red-black trees and its operations. B-Tree-Insertion-Deletion.				10	
III	Dynamic programming Memoization, Tabulation, Rod Cutting, Matrix Chain Multiplication, Longest common subsequence, Greedy Algorithms- Introducing greedy approach, activity selection problem, Huffman codes, Graphs, Trees and Algorithms				8	
IV	Introducing spanning trees, Minimum spanning tree, algorithms,Kruskal, Prims, Bellman-Ford algorithm, Single source shortest path in directed acyclic graphs, Dijkstra's algorithms, Floyd-Warshall algorithm				8	
V	NP-Completeness Polynomial time, Verification algorithms, NP-Complete, NP-Hard				7	

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand the Fundamental Data Structures.
CO2 :	Applying the concept of stack, queue, list, binary search tree and Red black tree.
CO3 :	Analyzing the dynamic programming , greedy algorithms and binary search trees, including performing tree traversals, insertions, and deletions..
CO4 :	Utilize graph representations and perform operations.
CO5 :	Evaluating the implications of computational complexity for algorithm design and problem-solving strategies, including approaches for handling NP-Complete and NP-Hard problems.

Text Book

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to algorithms. MIT press, 2022.
2. Data Structures And Algorithms In C++, 2nd Edition by Michael T. Goodrich
3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi.
4. Fundamentals of Data Structures by Ellis Horowitz and Sartaj Sahni

Reference Books

1. Chitra.A, Rajan.P.T , (2016), *Data Structures*, Vijay Nicol Imprints Pvt Ltd, McGraw-Hill Education of India Pvt Ltd, India, SecondEdition.
2. Pai.G.A.V,(2009), *Data Structures andAlgorithms*,TMH.
3. Samanta.D , (2006), *Classic Data Structures*, Prentice Hall of India Pvt Ltd, NewDelhi

Mapping of Course Outcomes (CO's) with PO's & PSO's

7.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	0	2	0	3	3	0	2
CO2	3	2	0	2	0	3	3	2	3
CO3	0	0	3	0	2	3	3	3	3
CO4	0	3	0	2	0	3	3	2	3
CO5	0	0	3	0	3	3	2	2	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(AI)	Programme Code	BCAI
Course Code	BCAI1214P	Number of Hours/Week	2
Semester	III	Max. Marks	100
Year	II	Credits	1

Course

Course Title	DATA STRUCTURE AND ALGORITHMS LAB	L	T	P
		0	0	2

L-Lecture Hours T-Tutorial Hours P-Practical Hours

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- To Comprehensive understanding of fundamental data structures and algorithms.
- To equip algorithms with the skills to analyze and implement various computational techniques.
- To select appropriate data structures for solving complex problems and optimize algorithm performance.
- To gain insight into advanced topics such as dynamic programming and NP-completeness.

List of Experiments

1. Insertion sort
2. Divide and conquer approach
3. Quick sort, Merge sort, Heap sort
4. Find mean , median , mode
5. Implement a stack using an array with push and pop operations. Find the top element of the stack and check if the stack is empty or not.
6. Implementation of swap() function using stack
7. Implement two stacks in an array by dividing the space into two halves
8. Sort a stack using a temporary stack
9. Implement a queue with push and pop operation.
10. Enqueue the elements in the queue using emplace() function.
11. Implementation of swap() function using queue.
12. Implement a singly linked list, double linked list with basic operations.
13. Implement a hash table using direct addressing and indirect addressing
14. Implement a binary search tree with insertion and traversal
15. Implement a red-black tree including:
 - a. Basic Red-Black Tree Properties
 - b. Rotations (Left and Right)
 - c. Insertion with Balancing
 - d. Deletion with Balancing
16. Memoization
 - a. Rod Cutting
 - b. Matrix Chain Multiplication
 - c. Longest Common Subsequence
17. Tabulation
 - a. Rod Cutting (Tabulation)
 - b. Matrix Chain Multiplication(Tabulation)
18. Greedy Algorithms
 - a. Activity Selection Problem
 - b. Huffman Codes
19. Graphs

- a. Depth First Search (DFS)
 - b. Breadth First Search (BFS)
 - c. Dijkstra's Algorithm (Shortest Path in Weighted Graph)
 - d. Kruskal's Algorithm (Minimum Spanning Tree)
20. Tree Algorithms
- a. Binary Search Tree (BST) Operations
 - b. AVL Tree (Balanced BST) Insertions
21. B-Tree and Its Operations
22. Prim's Algorithm
23. Shortest Path Algorithms
- a. Bellman-Ford Algorithm
 - b. Floyd-Warshall Algorithm
 - c. Single Source Shortest Path in Directed Acyclic Graphs (DAGs)
24. Polynomial Time Algorithm for Sorting
25. Verifying a Solution for the Knapsack Problem
26. NP-Complete Problem Example: 3-SAT Problem
27. NP-Hard Problem Example: Traveling Salesman Problem (TSP)

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1	Understand the Fundamental Data Structures.
CO2 :	Apply the concept of stack, queue, list, binary search tree and Red black tree.
CO3 :	Analyze dynamic programming, greedy algorithms and binary search trees including tree traversals, insertions and deletions.
CO4 :	Utilize graph representations and perform operations.
CO5 :	Evaluate the implications of computational complexity for algorithm design and problem-solving strategies, including approaches for handling NP-Complete and NP-Hard problems.

Mapping of Course Outcomes (CO's) with PO's & PSO's

8.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	0	2	0	3	3	0	2
CO2	3	2	0	2	0	3	3	2	3
CO3	0	0	3	0	2	3	3	3	3
CO4	0	3	0	2	0	3	3	2	3
CO5	0	0	3	0	3	3	2	2	3

3 – High, 2 – Average, 1 – Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1215	Number of Hours/WK	3			
Semester	III	Max. Marks	100			
Year	II	Credit	3			
Course						
Course Title	OBJECT ORIENTED PROGRAMMING			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES						
<ul style="list-style-type: none"> • To demonstrate a clear understanding of the necessity and principles of Object-oriented programming. • To create applications focusing on Object oriented programming concepts. • To manage memory using pointers leveraging C++ streams and STL container. • To develop reusable and modular code using the concepts learned. • To write diversified solutions using C++ language. 						
UNIT	TOPIC				HOURS	
I	Introduction Object Oriented Programming Necessity – Differences between procedural and Object-oriented programming- characteristics of object-oriented languages - C and C++, Functions Need of functions, Returning values from functions, Member functions -Types, Object oriented concepts- Introduction – Class, Objects, data abstraction, encapsulation, inheritance, polymorphism, Class and object creation, Simple class and object				I	
II	Operations with objects Initialization of class objects- Constructor and Destructor- constructor-Default- parameterized -Copy, Objects as function arguments-Returning objects from functions-Memory allocation for objects, Member function definition- Member functions defined- Inside and outside the class				II	
III	Overloading and Functions Operator overloading- Fundamentals of operator overloading- restriction- operator functions as class members-overloading unary and binary operators- Function Overloading- Friend and Virtual Functions- Data Abstraction, Encapsulation -its application				III	
IV	Inheritance and Polymorphism Base Class-Derived Class- Base-Class Access Control- protected base class- inheritance-Inheriting Multiple Base Classes-Virtual Base Classes- Types of Inheritance- Public and Private inheritance, aggregation: Classes within classes, inheritance and program development, Virtual Functions and polymorphism, Calling Virtual Function through Base Class Reference- Hierarchical- Pure virtual functions				IV	
V	Pointers and files Early binding and Late binding, Pointers- Addresses and pointers- the address of operator and pointer and arrays- Memory management: New and Delete, pointers to objects, debugging pointers, References and Dynamic Allocation Operators, Exception Handling-Try-catch class types - C++ Streams Stream classes-formatted I/O, File I/O, The Standard Template Library Overview of STL- Containers- associated programs.				V	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity

COURSE OBJECTIVES:

On successful completion of the program, our graduates will be able to

CO1 :	Recall the concepts of structured programming.
CO2 :	Understand the differences between structure programming and object-oriented programming
CO3 :	Able to execute C++ programs utilizing member functions
CO4 :	Implement operator and function overloading to extend the capabilities of the programs
CO5 :	Create classes and objects employing data abstraction, encapsulation, inheritance and polymorphism in real-world scenarios

Text Books

1. “C++ The Complete Reference” Herbert Schildt, Fourth Edition, Tata McGraw Hill Publication, 2017
2. “Object Oriented Programming in C++”, Robert Lafore, Fourth Edition, SAMS publications, 2002

Reference Books

1. “C++ How to Program”, Deitel and Deitel, Third Edition, Pearson Publication, 2000
2. “Object-oriented programming using C++”, Joyce Farrell, Fourth Edition, Cengage Learning, 2009

Mapping of Course Outcomes (CO's) with PO's & PSO's

9.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	1	2	2	1	1	2	1	1
CO2	1	1	2	1	2	2	1	1	2
CO3	2	2	2	3	3	3	1	1	2
CO4	2	2	2	3	3	3	1	1	1
CO5	2	2	2	2	2	2	1	2	2

3 – High, 2 – Average, 1 – Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1215P	Number of Hours/Week	2			
Semester	III	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	OBJECT ORIENTED PROGRAMMING			L	T	P
			0	0	2	
L-Lecture Hours		T-Tutorial Hours		P-Practical Hours		
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • To demonstrate a clear understanding of the necessity and principles of Object-oriented programming. • To create applications focusing on Object oriented programming concepts. • To manage memory using pointers leveraging C++ streams and STL container. • To develop reusable and modular code using the concepts learned. • To write diversified solutions using C++ language. 						
<u>LIST OF EXPERIMENTS</u>						
<ol style="list-style-type: none"> 1. Structure of a basic C++ object-oriented program and the difference between a structured program 2. Classes and Objects 3. Access specifiers 4. Member functions and types 5. Constructors and Destructors 6. Pointers (Referencing and Dereferencing) 7. Dynamic memory allocation 8. Data Abstraction along with encapsulation 9. Inheritance and its types 10. Polymorphism 11. Function overloading and operator overloading 12. Exception handling 13. Template class 14. Abstract Base Class with Concrete Methods 15. Virtual Functions 						

COURSE OUTCOMES

CO1 :	Demonstrate an understanding of the foundational principles of structured programming.
CO2 :	Differentiate between structured programming and object-oriented programming paradigms.
CO3 :	Develop C++ programs using member functions effectively.
CO4 :	Apply operator and function overloading techniques to enhance program functionality.
CO5 :	Implement classes and objects using principles of data abstraction, encapsulation, inheritance, and polymorphism in real-world applications.

Mapping of Course Outcomes (CO's) with PO's & PSO's

10.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	1	2	2	1	1	2	1	1
CO2	1	1	2	1	2	2	1	1	2
CO3	2	2	2	3	3	3	1	1	2
CO4	2	2	2	3	3	3	1	1	1
CO5	2	2	2	2	2	2	1	2	2

3 – High, 2 – Average, 1 – Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	AEPH 1213	Number of Hours/Week	2			
Semester	III	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	PROFESIONL ETHICS			L	T	P
			2	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To identify and understand key concepts of human values, including ethics, integrity, and professional responsibility. • To explore moral theories and frameworks related to engineering ethics, and analyze how these impact decision-making. • To evaluate the role of engineers in society through the lens of social experimentation, responsibility, and professional codes of conduct. • To assess safety and risk management principles, rights and responsibilities, including intellectual property and occupational ethics. 						
UNIT	TOPICS				HOURS	
I	Human Values Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character - Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.				8	
II	Engineering Ethics Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest, Customs and Religion – Uses of Ethical Theories.				8	
III	Engineering as Social Experimentation Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.				8	
IV	Safety, Responsibilities and Rights Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.				8	
V	Global issues Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.				8	

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Recognize the significance of human values and ethics in personal and professional life.
CO2 :	Analyze various moral theories and ethical dilemmas in engineering practices.
CO3 :	Evaluate the responsibilities of engineers as experimenters and decision-makers within legal and ethical frameworks.
CO4 :	Assess risk and safety issues, including intellectual property and employee rights in engineering contexts.
CO5 :	Apply ethical theories and frameworks to make informed engineering decisions.

Text Books:

Naagarazan, R.S. A Textbook on Professional Ethics and Human Values, New Age International Limited Publishers: New Delhi, 2006.

Reference Books:

1. Charles B. Fleddermann, —Engineering Ethics I, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, —Engineering Ethics – Concepts and CasesI, Cengage Learning, 2009.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	0	1	0	0	0	0	0	0	0
CO2	0	3	0	0	0	0	0	0	0
CO3	0	3	0	0	0	0	0	0	3
CO4	0	3	0	2	2	0	0	0	2
CO5	0	2	0	0	0	0	0	0	0

3 – High, 2 – Average, 1 – Low , 0-Null

IV SEMESTER

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY 1222	Number of Hours/WK	3			
Semester	IV	Max. Marks	100			
Year	II	Credit	3			
Course						
Course Title	DATA MINING AND DATA WAREHOUSING			L	T	P
			3	0	0	
COURSE OBJECTIVE						
<ul style="list-style-type: none"> • To understanding of data warehousing, data mining, and advanced analytics techniques essential for effective business decision-making. • To learn how to build, manage, and utilize data warehouses and apply various data mining techniques for insightful analysis. 						
UNIT	TOPIC				HOURS	
I	Data Warehousing and Business Analysis Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.				10	
II	Data Mining Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.				10	
III	Association Rule Mining Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.				8	
IV	Classification and Prediction Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.				8	
V	Cluster Analysis Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis				8	

Andragogy

Class Room Lectures, Power point presentation, YouTube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity

COURSE OUTCOME:

On successful completion of this course, the student will be able to

CO1 :	Understand Data Warehousing Concepts
CO2 :	Apply data extraction, cleanup, and transformation tools effectively. Utilize metadata in reporting and querying applications.
CO3 :	Analyze Data Using OLAP and Create and interpret reports that utilize OLAP capabilities.
CO4 :	Apply Data Mining Techniques and explain the functionalities of data mining and the processes of data preprocessing, cleaning, integration, and transformation.
CO5 :	Evaluate Data Analysis Techniques and assess the accuracy of classifiers and predictors through appropriate evaluation metrics. Utilize ensemble methods for improved prediction accuracy.

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011.

Reference Books:

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, TataMcGraw – Hill Edition, Tenth Reprint 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	3	2	3	3	3	3	1
CO2	3	2	2	3	3	2	3	3	2
CO3	3	2	2	3	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY 1222P	Number of Hours/WK	2			
Semester	IV	Max. Marks	100			
Year	II	Credit	1			
Course						
Course Title	DATA MINING AND DATA WAREHOUSING LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVE						
<ul style="list-style-type: none"> To understanding of data warehousing, data mining, and advanced analytics techniques essential for effective business decision-making. To learn how to build, manage, and utilize data warehouses and apply various data mining techniques for insightful analysis 						
LIST OF EXPERIMENTS						
<ol style="list-style-type: none"> Downloading and/or installation of WEKA Data Mining toolkit. Start working with WEKA tool kit and understand the features of WEKA tool kit. Loading Data from different sources in WEKA. Various File Formats supported by WEKA. And Study the ARFF file format. Demonstration of creating a Student dataset (student.arff) using WEKA tool in Data Mining. Demonstration of creating a Weather dataset (weather.arff) using WEKA tool in Data Mining Explore the available data sets in WEKA tool kit. View Solution Load a dataset from the available data sets in the WEKA tool. From the loaded dataset(weather.arff), observe the attribute names, attribute types, number of records in the dataset, Identify the class attribute (if any), and visualize the data in various dimensions. Conversion of a Text file into ARFF (Attribute-Relation File Format) using Weka tool. 						

COURSE OUTCOME:

On successful completion of this course, the student will be able to

CO1 :	Understand Data Warehousing Concepts
CO2 :	Apply data extraction, cleanup, and transformation tools effectively. Utilize metadata in reporting and querying applications.
CO3 :	Analyze Data Using OLAP and Create and interpret reports that utilize OLAP capabilities.
CO4 :	Apply Data Mining Techniques and explain the functionalities of data mining and the processes of data preprocessing, cleaning, integration, and transformation.
CO5 :	Evaluate Data Analysis Techniques and assess the accuracy of classifiers and predictors through appropriate evaluation metrics.Utilize ensemble methods for improved prediction accuracy.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	3	2	3	3	3	3	1
CO2	3	2	2	3	3	2	3	3	2
CO3	3	2	2	3	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1222	Number of Hours/Week	3			
Semester	IV	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	DATABASE MANAGEMENT SYSTEMS			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To learn data models, conceptualize and depict a database system using ER diagram • To understand the internal storage structures in a physical DB design • To know the fundamental concepts of transaction processing techniques • To understand the concept of Database Design in Normalization techniques • To know the manipulation of SQL Queries 						
UNIT	TOPICS				HOURS	
I	Data base System Applications, Purpose of Database Systems, View of Data, Data Abstraction, Instances and Schemas, data Models , the ER Model , Relational Model , Other Models , Database Languages , DDL , DML , database Access for applications Programs, data base Users and Administrator , Transaction Management , data base Architecture, Storage Manager , the Query Processor Data base design and ER diagrams , ER Model, Entities, Attributes and Entity sets , Relationships and Relationship sets , ER Design Issues, Concept Design , Conceptual Design for University Enterprise. Introduction to the Relational Model, Structure, Database Schema, Keys, Schema Diagrams.				8	
II	Relational Query Languages, Relational Operations. Relational Algebra, Selection and projection set operations, renaming , Joins , Division , Examples of Algebra overviews , Relational calculus , Tuple relational Calculus , Domain relational calculus. Overview of the SQL Query Language, Basic Structure of SQL Queries, Set Operations, Aggregate Functions , GROUPBY , HAVING, Nested Sub queries, Views, Triggers.				8	
III	Relational Query Languages, Relational Operations. Relational Algebra, Selection and projection set operations, renaming , Joins , Division , Examples of Algebra overviews , Relational calculus , Tuple relational Calculus , Domain relational calculus. Overview of the SQL Query Language, Basic Structure of SQL Queries, Set Operations, Aggregate Functions , GROUPBY , HAVING, Nested Sub queries, Views, Triggers.				8	
IV	Transaction State, Implementation of Atomicity and Durability, Concurrent, Executions, Serializability, Recoverability , Implementation of Isolation , Testing for serializability, Lock ,Based Protocols , Timestamp Based Protocols, Validation, Based Protocols , Multiple Granularity. Recovery and Atomicity, Log Based Recovery , Recovery with Concurrent Transactions , Buffer Management , Failure with loss of nonvolatile storage,Advance Recovery systems, Remote Backup systems.				8	

V	File organization, various kinds of indexes. Query Processing, Measures of query cost , Selection operation , Projection operation , Join operation , set operation and aggregate operation , Relational Query Optimization , Transacting SQL queries , Estimating the cost , Equivalence Rules.	8
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COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Install, configure, and interact with a relational database management system
CO2 :	Master the basics of SQL and construct queries using SQL
CO3 :	Design and develop a large database with optimal query processing
CO4 :	Develop efficient storage scheme of saving and retrieving Records and Files
CO5 :	Design the database with normalization techniques

Text Books:

1. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATAMcGrawHill 3rd Edition.

Reference Books:

1. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
2. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition for UNIT III.

Mapping of Course Outcomes (CO's) with PO's & PSO's

11.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	0	2	2	3	2	3	1	0	2
CO2	1	0	0	1	1	2	3	1	2
CO3	0	3	1	2	3	1	3	3	1
CO4	0	3	1	1	2	1	2	1	0
CO5	0	1	0	0	1	0	1	0	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY	Number of Hours/Week	2			
Semester	IV	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	DATABASE MANAGEMENT SYSTEMS LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • Understand and Apply SQL DDL and DML Commands • Utilize SQL Functions and Operators Effectively • Implement SQL Joins and Advanced Clauses • Work with Constraints, Views, and Subqueries in SQL • Master Database Management and PL/SQL Concepts 						
<u>LIST OF EXPERIMENTS</u>						
<ol style="list-style-type: none"> 1. DDL commands of SQL with suitable examples <ul style="list-style-type: none"> • Create table • Alter table • Drop Table 2. DML commands of SQL with suitable examples <ul style="list-style-type: none"> • Insert • Update • Delete 3. Different types of function with suitable examples <ul style="list-style-type: none"> • Number function • Aggregate Function • Character Function • Conversion Function • Date Function 4. Different types of operators in SQL <ul style="list-style-type: none"> • Arithmetic Operators • Logical Operators • Comparison Operator • Special Operator • Set Operation 5. Different types of Joins <ul style="list-style-type: none"> • Inner Join • Outer Join • Natural Join etc.. 6. Study and Implementation of <ul style="list-style-type: none"> • Group By & having clause 						

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1:	Understand and apply SQL Data Definition Language (DDL) commands.
CO2:	Understand and execute SQL Data Manipulation Language (DML) commands.
CO3:	Apply different SQL functions to manipulate and retrieve data.
CO4:	Understand and apply different types of constraints in SQL.
CO5:	Design and implement SQL triggers for automated actions.

Mapping of Course Outcomes (CO's) with PO's & PSO's

12.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	0	2	2	3	2	3	1	0	2
CO2	1	0	0	1	1	2	3	1	2
CO3	0	3	1	2	3	1	3	3	1
CO4	0	3	1	1	2	1	2	1	0
CO5	0	1	0	0	1	0	1	0	2

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCCY	Programme Code	BCCY			
Course Code	BCCY1223	Number of Hours/Week	3			
Semester	IV	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	DESIGN AND ANALYSIS OF ALGORITHMS			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
<p>COURSE OBJECTIVES:</p> <p>The main learning objective of this course is to prepare the students for:</p> <ul style="list-style-type: none"> • To prove correctness of algorithms • To analyse algorithms asymptotically • To demonstrate the efficiency of algorithms by using in existing problems • To utilize advanced algorithms and data structures in complex problems 						
UNIT	TOPICS				HOURS	
I	Algorithm analysis and height balanced BST Analysis of algorithms – introduction; solving recurrences – substitutions, recursion tree, and master method; binary search tree (BST) – insertion, deletion; BST applications – runway reservation; height balanced BSTs; AVL Tree – rotations, insertions, deletions;				8	
II	Divide and Conquer and Hashing Interval or activity scheduling; Divide and Conquer approach – Strassen’s algorithm for matrix multiplication; randomized algorithms, median and order statistics, Hashing – direct address tables, hash tables, chaining; Hash function; Universal hashing; Open addressing – linear probing, quadratic probing and double hashing;				8	
III	Dynamic and Greedy algorithms Dynamic and greedy algorithms, Matrix-chain multiplication, Longest common subsequence; Huffman codes; B Trees – searching, search, insertion, deletion; Data structures for disjoint sets – linked list representation, tree representation, union by rank and path compression;				8	
IV	Graph Algorithms Graph algorithms – depth first search, breadth first search, topological sort, strongly connected components, Kruskal and Prim algorithm for minimum spanning tree; Single source shortest paths – Bellman-Ford algorithm, Single-source shortest path in directed acyclic graphs; Dijkstra’s algorithm;				8	
V	P and NP Problems NP-Completeness – polynomial time, verification, NP-Completeness and reducibility, NP-Complete problems; Naïve string matching algorithm, Rabin-Karp algorithm;				8	

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Write correctness proofs for algorithms
CO2 :	Analyse asymptotic performance of algorithms
CO3 :	Implement efficient algorithms in engineering applications
CO4 :	Demonstrate the familiarity with advanced algorithms and data structures
CO5 :	Design algorithms in terms of asymptotic performance

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms, Third Edition. The MIT Press, 3rd edition, 2009

Reference Books:

2. Thomas H. Cormen. Algorithms Unlocked. The MIT Press, 2013
3. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran. Fundamentals of Computer Algorithms (Computer software engineering series). Galgotia Publications, new edition edition, 2001

Mapping of Course Outcomes (CO's) with PO's & PSO's

13.

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	0	2	0	3	3	0	2
CO2	1	2	0	2	0	3	3	2	3
CO3	0	0	2	0	2	1	3	3	3
CO4	0	3	0	2	0	3	3	2	3
CO5	0	0	3	0	3	3	2	2	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1223	Number of Hours/Week	2			
Semester	IV	Max. Marks	100			
Year	II	Credits	1			
Course						
Course Title	DESIGN AND ANALYSIS OF ALGORITHMS LAB			L	T	P
			0	0	2	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
Course Objectives:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> • To prove correctness of algorithms • To analyze algorithms asymptotically • To demonstrate the efficiency of algorithms by using in existing problems • To utilize advanced algorithms and data structures in complex problems 						
List of Experiments						
<ol style="list-style-type: none"> 1. Solving Recurrences using Recursion Tree. 2. Insertion and deletion operations in a Binary Search Tree. 3. Implementation of an AVL tree with insertion, deletion, and tree rotations. 4. Runway reservation system using a Binary Search Tree. 5. Implementation of Strassen's algorithm for matrix multiplication. 6. Randomized algorithm to find the median of an unsorted array. 7. Implementation of a hash table with chaining. 8. Open addressing with double hashing for collision resolution. 9. Huffman Coding. 10. Greedy algorithm. 11. Kruskal's algorithm to find the minimum spanning tree of a graph. 12. Dijkstra's algorithm to find the shortest path. 						

COURSE OUTCOMES:

By learning Design and Analysis of Algorithms students will be able to

CO1 :	Implement and demonstrate various algorithmic techniques in real-world scenarios.
CO2 :	Analyze and compare the efficiency of different algorithms and data structures.
CO3 :	Utilize recursion and tree structures effectively for solving computational problems.
CO4 :	Design and implement hashing methods for efficient data retrieval.
CO5 :	Apply greedy algorithms to optimize solutions for practical problems.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	0	0	2	0	3	3	0	2
CO2	3	2	0	2	0	3	3	2	3
CO3	0	0	3	0	2	3	3	3	3
CO4	0	1	0	2	0	3	2	2	2
CO5	0	0	2	0	3	3	2	2	3

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY1224	Number of Hours/Week	3			
Semester	IV	Max. Marks	100			
Year	II	Credits	3			
Course						
Course Title	COMPUTER ORGANIZATION			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVES:						
The main learning objective of this course is to prepare the students for:						
<ul style="list-style-type: none"> ● To understand the basic hardware and software issues of computer organization ● To understand the representation of data at machine level ● To understand how computations are performed at machine level ● To understand the memory hierarchies, cache memories and virtual memories ● To learn the different ways of communication with I/O devices 						
UNIT	TOPICS				HOURS	
I	Introduction, Technologies for building Processors and Memory, Performance, The Power Wall, Operations of the Computer Hardware, Operands Signed and Unsigned numbers, Representing Instructions, Logical Operations, Instructions for Making Decisions				10	
II	MIPS Addressing for 32, Bit Immediates and Addresses, Parallelism and Instructions: Synchronization, Translating and Starting a Program, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Subword Parallelism, Streaming SIMD Extensions and Advanced Vector Extensions in x86.				8	
III	Logic Design Conventions - Building a Datapath, A Simple Implementation Scheme, overview of Pipelining, Pipelined Datapath, Data Hazards: Forwarding versus Stalling, Control Hazards, Exception, Parallelism via Instructions, The ARM Cortex–A8 and Intel Core i7 Pipelines, Instruction, Level Parallelism and Matrix Multiply Hardware Design language.				10	
IV	Memory Technologies, Basics of Caches, Measuring and Improving Cache Performance, dependable memory hierarchy, Virtual Machines, Virtual Memory, Using FSM to Control a Simple Cache, Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks, Advanced Material: Implementing Cache Controllers.				10	
V	Disk Storage and Dependability, Parallelism and Memory Hierarchy: RAID levels, performance of storage systems, Introduction to multi-threading clusters, message passing multiprocessors.				8	

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1 :	Understand the architecture and functionality of central processing unit
CO2 :	Analyze the abstraction of various components of a computer
CO3 :	Analyze the hardware and software issues and the interfacing
CO4 :	Work out the trade-offs involved in designing a modern computer system
CO5 :	Understand the various memory systems and I/O communication

Text Books:

1. David A. Patterson, John L. Hennessey, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Edition, Morgan Kauffman/Elsevier, 2014.
2. Smruti Ranjan Sarangi, “Computer Organization and Architecture”, McGraw Hill Education, 2015.

Reference Books:

1. V. Carl Hamacher, Zvonko G. Varanescic, Safat G. Zaky, “Computer Organization”, Sixth Edition, McGrawHill Inc., 2012.
2. William Stallings, “Computer Organization and Architecture”, Eighth Edition, Pearson Education, 2010.

Mapping of Course Outcomes (CO's) with PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	2	3	1
CO2	3	3	3	2	3	2	2	2	1
CO3	3	3	2	3	2	2	3	2	3
CO4	3	2	2	3	1	2	3	2	1
CO5	3	2	2	2	1	2	3	3	1

3 – High, 2 – Average, 1 - Low , 0-Null

Programme	BCA(CY)	Programme Code	BCCY			
Course Code	BCCY 1225	Number of Hours/WK	3			
Semester	IV	Max. Marks	100			
Part		Credit	3			
Course Title	OPERATING SYSTEM CONCEPTS			L	T	P
			3	0	0	
L-Lecture Hours	T-Tutorial Hours	P-Practical Hours				
COURSE OBJECTIVE						
<ul style="list-style-type: none"> • To understand the fundamental concepts and role of Operating System. • To learn the Process Management and Scheduling Algorithms • To understand the Memory Management policies • To gain insight on I/O and File management techniques 						
UNIT	TOPIC				HOURS	
I	Introduction- Computer system organization- Operating System Structure and Operations-operating system services- System Calls, types of system calls-operating system structure. Processes : Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication;				8	
II	Threads: Overview, Multithreading models, Threading issues; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling;				8	
III	Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. Main Memory: Background, Swapping, Contiguous Memory Allocation, Paging- Segmentation with paging. Virtual Memory – Page Replacement, Allocation, Thrashing.				8	
IV	Mass Storage system – Overview of Mass Storage Structure- Disk Structure- Disk Scheduling and Management- RAID structure. File-System Interface - File concept-Access methods- Directory Structure- Directory Organization- File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management- I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.				10	
V	Virtual Machines: Benefits and features Types of VM and implementation- Virtualization and OS Components. Distributed Systems: Real time OS- Advantages of real time OS and distributed OS- Types of network-based Operating Systems- Network structure- Communication structure- Communication protocols.				10	

Andragogy

Class Room Lectures, Power point presentation, You Tube, Group Discussion, Seminar, Quiz, Formative Assessments, Brain storming, Activity.

COURSE OUTCOMES:

By learning Design and Analysis of Algorithms students will be able to

CO 1:	To Demonstrate the structure and functions of Operating System
CO 2:	To Compare the performance of Scheduling Algorithms
CO3 :	To Explain the various issues in Inter Process Communication.
CO4 :	To Identify the features of I/O and File handling methods
CO5 :	To Relate and differentiate the Memory Management policies

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne., (2018),”Operating System Concepts ”, John Wiley and Sons Inc., 9th Edition.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine.,(2010),”Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition.
2. Achyut S. Godbole, Atul Kahate.,(2016), “Operating Systems”, McGraw Hill Education.
3. Andrew S. Tanenbaum.,(2004),”Modern Operating Systems”, Pearson Education, 2nd Edition.

Mapping of Course Outcomes (CO’s) with PO’s & PSO’s

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	0	0	1	1
CO2	2	1	2	3	2	2	3	3	2
CO3	1	3	3	2	2	2	3	3	2
CO4	2	2	0	1	1	3	1	2	2
CO5	1	3	2	3	2	3	1	1	1

3 – High, 2 – Average, 1 - Low , 0-Null