BIRLA INSTITUTE OF TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) CURRICULUM

(Effective from Academic Session: Monsoon 2021)

BACHELOR IN COMPUTER APPLICATION

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research, and technological service to the National needs.

Institute Mission

- To educate students at Under Graduate, Post Graduate, Doctoral, and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.
- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education, and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

Department Vision:

The department strives to be recognized globally for outstanding education and research, leading to excellent professionals and innovators in the field of Computer Science and Engineering, who can positively contribute to the society.

Department Mission

1. To impart quality education and equip the students with strong foundation that could make them capable of handling challenges of the new century.
2. To maintain state of the art research facilities and facilitate interaction with world's leading universities, industries and research organization for constant improvement in the quality of education and research.

Graduate Attributes

1. **Engineering Knowledge**: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Programme Educational Objectives (PEOs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

(A) **Programme Outcomes (POs)**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(B) Programme Specific Outcomes (PSOs)

1. The ability to analyze, design, code and test application specific or complex engineering problems in Cryptography and Network Security, Design and Analysis of Algorithm, Computer Networks, Cloud Computing, Mobile Computing, Data Mining and Big Data by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.
2. The ability to adapt for rapid changes in tools and technology with an understanding of societal and ecological issues relevant to professional engineering practice through life-long learning.
3. Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.

PROGRAMME COURSE STRUCTURE (ALL SEMESTERS)

BIRLA INSTITUTE OF TECHNOLOGY-MESRA, RANCHI
NEW COURSE STRUCTURE – To be effective from academic session 2022-23
Based on CBCS & OBE model
Recommended scheme of study (**BACHELOR OF COMPUTER APPLICATIONS**)

Semester / Session of Study (Recommended)	Course Level	Category Of Course	Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial; P-Practical*			Total Credits *C-Credits*
					L (*Periods/week*)	T *(Periods/week)*	P *(Periods/week)*	C
			THEORY					
FIRST Monsoon	FIRST	CORE	CA111	Fundamentals of C programming	3	1	0	4
		CORE	CA103	Logical Organizations of Computers	3	1	0	4
		GE-1		Annexure I/ II/ III *	4	2	0	6
			LABORATORIES					
	FIRST	CORE	CA112	C programming Lab	0	0	4	2
		CORE	CA114	UNIX Programming Lab	0	0	4	2
		AECC	MT132	Communication Skills- I	0	0	3	1.5
		TOTAL						**19.5**

SECOND Spring			**THEORY**					
	FIRST	CORE	CA155	Data Structures	3	1	0	4
		CORE	CA163	Discrete Mathematics	3	1	0	4
		CORE	CA165	Fundamentals of Operating System	3	1	0	4
		AECC	CE101	Environmental Science	2	0	0	2
		GE-2		Annexure I/ II/ III *	4	2	0	6
			LABORATORIES					
	FIRST	CORE	CA156	Data Structures Lab	0	0	4	2
		CORE	CA166	Fundamentals of Operating Systems Lab	0	0	4	2
		CORE	CA168	MATLAB Programming Lab	0	0	4	2
		TOTAL						**26**
THIRD Monsoon			**THEORY**					
	SECOND	CORE	CA203	Database Management Systems	3	1	0	4
		CORE	CA205	Java Programming	3	1	0	4
		CORE	CA207	Introduction to Computer Algorithms	3	1	0	4
		GE-3		Annexure I/ II/ III *	4	0	0	4
			LABORATORIES					
	SECOND	CORE	CA204	DBMS Lab	0	0	4	2
		CORE	CA206	Java Programming Lab	0	0	4	2
		CORE	CA208	Computer Algorithms Lab	0	0	4	2
		GE-3		Annexure I/ II/ III *	0	0	4	2
		SEC-I		Paper I (Skill Enhancement Course)	0	0	4	2
		TOTAL						**26**

FOURTH Spring			**THEORY**					
	SECOND	CORE	CA251	Web Programming Concepts	3	1	0	4
		CORE	CA253	Principles of Software Engineering	3	1	0	4
		GE -4		Annexure I/ II/ III *	4	2	0	6
			LABORATORIES					
	SECOND	CORE	CA252	Web Programming Concepts Lab	0	0	4	2
		CORE	CA254	Principles of Software Engineering Lab	0	0	4	2
		(SEC-II)		Paper II (Skill Enhancement Course)	0	0	4	2
		TOTAL						**20**
FIFTH Monsoon			**THEORY**					
	THIRD	CORE	CA305	Computer Graphics	3	1	0	4
		CORE	CA307	Introduction to Computer Networks	3	1	0	4
		DSE 1		Annexure I/ II/ III *	4	0	0	4
		DSE 2		Annexure I/ II/ III *	4	0	0	4
			LABORATORIES					
	THIRD	CORE	CA306	Computer Graphics Lab	0	0	4	2
		CORE	CA308	Computer Networks Lab	0	0	4	2
		DSE 1		Annexure I/ II/ III *	0	0	4	2
		DSE 2		Annexure I/ II/ III *	0	0	4	2
		AECC	MT133	Communication Skills- II	0	0	3	1.5
		TOTAL						**25.5**

SIXTH Spring			**THEORY**					
	THIRD	CORE	CA351	Introduction to Distributed Computing	3	0	0	3
		CORE	CA353	Data Mining &Warehousing	3	1	0	4
		DSE 3		Annexure I/ II/ III *	3	0	0	3
		DSE 4		Annexure I/ II/ III *	3	0	0	3
			LABORATORIES					
	THIRD	CORE	CA352	Distributed Computing Lab	0	0	4	2
		CORE	CA354	Data Mining Lab	0	0	4	2
			CA360	Project	0	0	0	6
	TOTAL							**23**
	TOTAL PROGRAM CREDITS							**140**

PROGRAM ELECTIVES (LIST OF SKILL ENHANCEMENT COURSES)							
PE/ LEVEL		Code No	Subjects	Mode of delivery & credits *L-Lecture; T-Tutorial; P-Practical*			Total Credits
				L (*Periods / week*)	T *(Periods/ week)*	P *(Periods / week)*	C
1	SEC-I	CA212	Office Automation Tools Lab	0	0	4	2
		CA214	Desktop Publishing Lab	0	0	4	2
		CA216	HTML Programming Lab	0	0	4	2
2	SEC-II	CA260	Visual Basic Lab	0	0	4	2
		CA262	Computerized Accounting Lab	0	0	4	2
		CA264	Graphic Design and Photo Editing Lab	0	0	4	2

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Annexure I: BCA
Annexure II: BCA with AI & ML Specialization
Annexure III: BCA with Data Science Specialization

ANNEXURE I

General Electives

	Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial; P-Practical*			Total Credits *C-Credits*
			L (*Periods/ week*)	T *(Periods/ week)*	P *(Periods/week)*	C
GE-1	CA105	Basics of Mathematics	3	0	0	3
	CA115	Introduction To Computer Science	3	0	0	3
GE-2	CA169	Mathematics for Computing	3	0	0	3
	CA171	Concepts of Programming Languages	3	0	0	3
GE-3	CA209	Computer oriented Numerical and Statistical Methods	4	0	0	4
	CA210	Computer oriented Numerical and Statistical Methods Lab	0	0	4	2
GE-4 (Any 1)	CA265	Fundamentals of Optimization Techniques	3	1	0	4
	CA267	Business Intelligence	3	1	0	4
GE-4	CA269	Human Values and Professional Ethics	2	0	0	2

Department Specialization Specific Electives

- From DSE1 *Any One with the Corresponding Lab- Total Credit 06*
- From DSE2 *Any One with the Corresponding Lab- Total Credit 06*
- From DSE3 *Any One - Total Credit 03*
- From DSE4 *Any One – Total Credit 03*

	Course Code	Courses	Mode of delivery & credits *L-Lecture; T-Tutorial; P-Practical*			Total Credits *C-Credits*
			L (*Periods/week*)	T *(Periods/week)*	P *(Periods/ week)*	C
DSE 1 (Any One Theory and Corresponding Lab)	CA309	Introduction to Python Programming	3	1	0	4
	CA310	Introduction to Python Programming Lab	0	0	4	2
	CA311	Introduction to Android Programming	3	1	0	4
	CA312	Introduction to Android Programming Lab	0	0	4	2
	CA313	Mobile Application	3	1	0	4
	CA314	Mobile Application Lab	0	0	4	2
DSE 2 (Any One Theory and Corresponding Lab)	CA315	Soft Computing	3	1	0	4
	CA316	Soft Computing Lab	0	0	4	2
	CA317	Introduction to Internet Technologies	3	1	0	4
	CA318	Internet Technologies Lab	0	0	4	2
	CA329	Data Analytics	3	1	0	4
	CA330	Data Analytics Lab	0	0	4	2
DSE 3 (Any 1)	CA357	Introduction to Cloud Computing	3	0	0	3
	CA359	Internet of Things	3	0	0	3
DSE 4 (Any 1)	CA361	System Programming	3	0	0	3
	CA363	Decision Support System	3	0	0	3

ANNEXURE II
(Artificial Intelligence & Machine Learning)

General Electives

	Course Code	Courses	Mode of delivery & credits *L- Lecture; T-Tutorial; P- Practical*			Total Credits *C- Credits*
			L (*Periods/ week*)	T *(Periods/ week)*	P *(Periods/ week)*	C
GE-1	CA105	Basics of Mathematics	3	0	0	3
	CA115	Introduction To Computer Science	3	0	0	3
GE-2	CA169	Mathematics For Computing	3	0	0	3
	CA173	Introduction to Artificial Intelligence	3	0	0	3
GE-3	CA309	Introduction to Python Programming	3	1	0	4
	CA310	Introduction to Python Programming Lab	0	0	4	2
GE-4	CA335	Data Visualization	3	1	0	4
	CA269	Human Values and Professional Ethics	2	0	0	2

Department Specialization Specific Electives

	Course Code	Courses	Mode of delivery & credits *L- Lecture; T-Tutorial; P- Practical*			Total Credits *C- Credits*
			L (*Periods/ week*)	T *(Periods/ week)*	P *(Periods/ week)*	C
DSE 1	CA333	Machine Learning	3	1	0	4
	CA334	Machine Learning Lab.	0	0	4	2
DSE 2 (Any One Theory and Corresponding Lab)	CA329	Data Analytics	3	1	0	4
	CA330	Data Analytics Lab	0	0	4	2
	CA337	Natural Language Processing	3	1	0	4
	CA338	Natural Language Processing Lab	0	0	4	2
DSE 3	CA369	Deep Learning	3	0	0	3
DSE 4 (Any 1)	CA357	Introduction to Cloud Computing	3	0	0	3
	CA365	Image Processing	3	0	0	3
	CA367	Cryptography & Network Security	3	0	0	3

ANNEXURE III
(Data Science)

General Electives

	Course Code	Courses	Mode of delivery & credits *L- Lecture; T-Tutorial; P- Practical*			Total Credits *C- Credits*
			L (*Periods / week*)	T *(Periods / week)*	P *(Periods / week)*	C
GE-1	CA105	Basics of Mathematics	3	0	0	3
	CA115	Introduction To Computer Science	3	0	0	3
GE-2	CA169	Mathematics for Computing	3	0	0	3
	CA175	Foundations of Data Science	3	0	0	3
GE-3	CA309	Introduction to Python Programming	3	1	0	4
	CA310	Introduction to Python Programming Lab	0	0	4	2
GE-4	CA279	Statistical Data Analysis	3	1	0	4
	CA269	Human Values and Professional Ethics	2	0	0	2

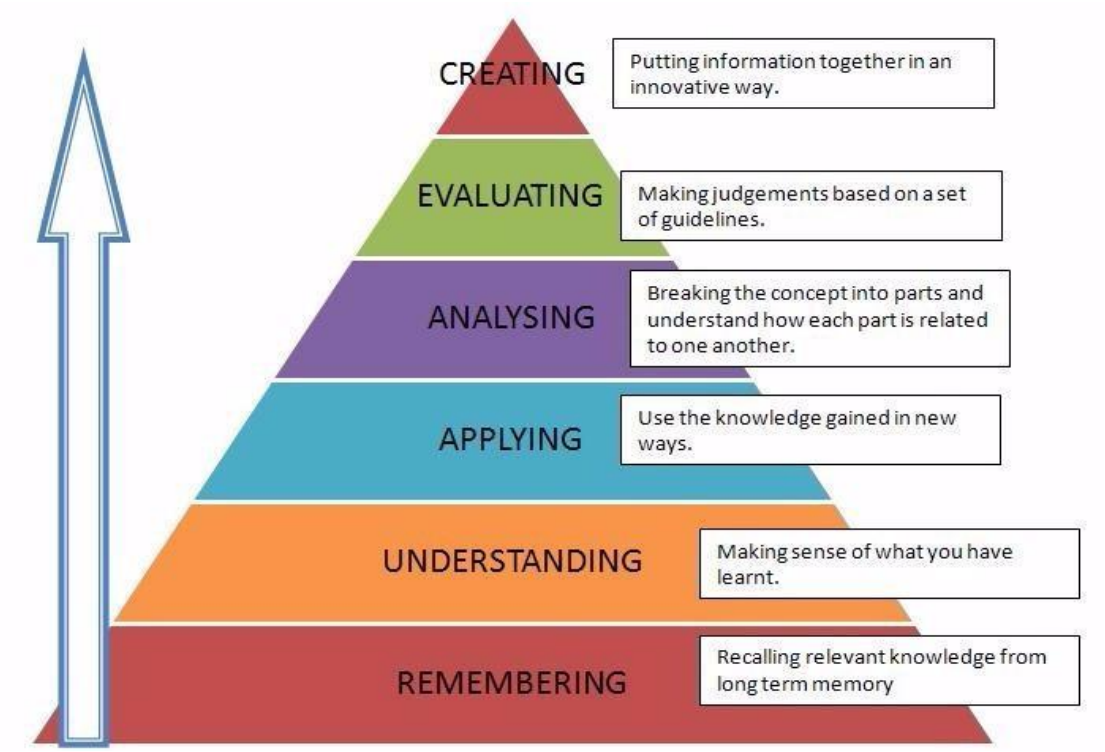
Department Specialization Specific Electives

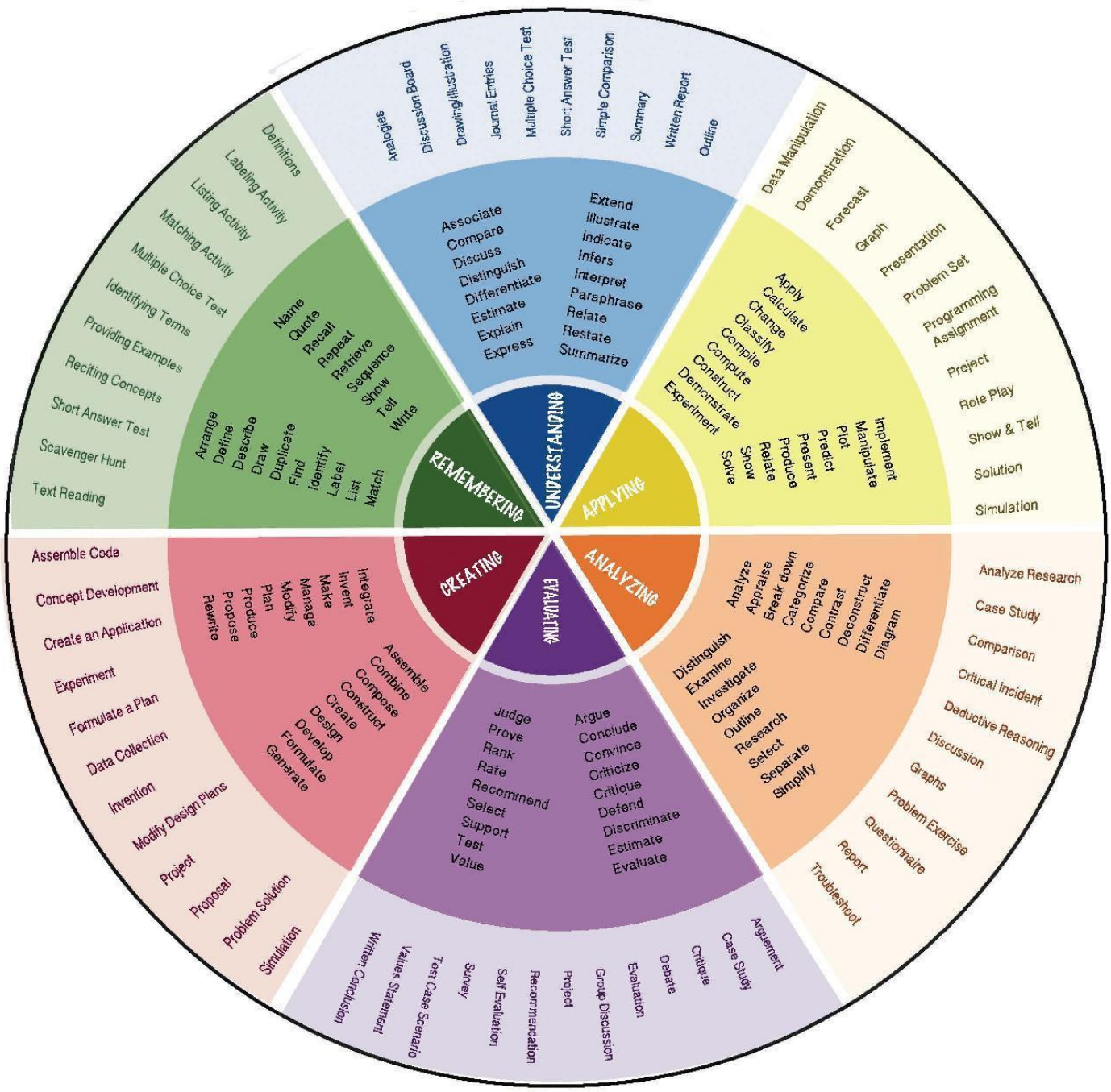
	Course Code	Courses	Mode of delivery & credits *L- Lecture; T-Tutorial; P- Practical*			Total Credits *C- Credits*
			L (*Periods/ week*)	T *(Periods/ week)*	P *(Periods / week)*	C
DSE 1	CA329	Data Analytics	3	1	0	4
	CA330	Data Analytics Lab	0	0	4	2
DSE 2 (Any One Theory and Corresponding Lab)	CA335	Data Visualization	3	1	0	4
	CA336	Data Visualization Lab	0	0	4	2
	CA339	NoSQL Database	3	1	0	4
	CA340	NoSQL Database Lab	0	0	4	2
DSE 3	CA373	Introduction to Machine Learning	3	0	0	3
DSE 4 (Any 1)	CA357	Introduction to Cloud Computing	3	0	0	3
	CA359	Internet of Things	3	0	0	3
	CA371	Big Data Analytics	3	0	0	3

BLOOM'S TAXONOMY FOR CURRICULUM DESIGN AND ASSESSMENT:

Preamble

The design of curriculum and assessment is based on Bloom's Taxonomy. A comprehensive guideline for using Bloom's Taxonomy is given below for reference.




REMEMBERING
UNDERSTANDING
APPLYING
ANALYZING
EVALUATING
CREATING
Definitions
Labeling Activity
Listing Activity
Matching Activity
Multiple Choice Test
Identifying Terms
Providing Examples
Reciting Concepts
Short Answer Test
Scavenger Hunt
Text Reading
Name
Quote
Recall
Repeat
Retrieve
Sequence
Show
Tell
Write
Arrange
Define
Describe
Draw
Duplicate
Find
Identify
Label
List
Match
Analogies
Discussion Board
Drawing/Illustration
Journal Entries
Multiple Choice Test
Short Answer Test
Simple Comparison
Summary
Written Report
Outline
Associate
Compare
Discuss
Distinguish
Differentiate
Estimate
Explain
Express
Extend
Illustrate
Indicate
Infers
Interpret
Paraphrase
Relate
Restate
Summarize
Data Manipulation
Demonstration
Forecast
Graph
Presentation
Problem Set
Programming Assignment
Project
Role Play
Show & Tell
Solution
Simulation
Apply
Calculate
Change
Classify
Compile
Compute
Construct
Demonstrate
Experiment
Implement
Manipulate
Plot
Predict
Present
Produce
Relate
Show
Solve
Assemble Code
Concept Development
Create an Application
Experiment
Formulate a Plan
Data Collection
Invention
Modify Design Plans
Project
Proposal
Problem Solution
Simulation
Integrate
Invent
Make
Manage
Modify
Plan
Produce
Propose
Rewrite
Assemble
Combine
Compose
Construct
Create
Design
Develop
Formulate
Generate
Analyze
Appraise
Break down
Categorize
Compare
Contrast
Deconstruct
Differentiate
Diagram
Distinguish
Examine
Investigate
Organize
Outline
Research
Select
Separate
Simplify
Analyze Research
Case Study
Comparison
Critical Incident
Deductive Reasoning
Discussion
Graphs
Problem Exercise
Questionnaire
Report
Troubleshoot
Judge
Prove
Rank
Rate
Recommend
Select
Support
Test
Value
Argue
Conclude
Convince
Criticize
Critique
Defend
Discriminate
Estimate
Evaluate
Written Comparison
Values Statement
Test Case Scenario
Survey
Self Evaluation
Recommendation
Project
Group Discussion
Evaluation
Debate
Critique
Case Study
Arguement

COURSE INFORMATION SHEET

Course Code: CA111
Course Title: FUNDAMENTALS OF C PROGRAMMING
Pre-requisite(s):
Co- requisite(s): C Programming Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the fundamentals of C programming.
B.	Learn about different problems and the approach to solve them.
C.	Gain proficiency with the fundamental concepts of the C programming Language
D.	Be able to apply these concepts to solve real world problems
E.	Able to program in C programming for a given application

Course Outcomes

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

CO1	Choose the loops and decision-making statements to solve the problem.
CO2	Implement different Operations on arrays.
CO3	Use functions to solve the given problem.
CO4	Understand pointers, structures and unions.
CO5	Implement file Operations in C programming for a given application.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Problem Solving and Programming Concepts**: Problem Solving in Everyday Life, Types of Problem, Problem Solving with Computers. **Overview of C:** History of C, Importance of C, Structure of C program, Sample of C programs. Constant, Variable and Data types: C Tokens – keywords, identifier, constant, string, and operators, and symbols, Data types – primary data types, user defined data types, and derived data types, Declaration of variables, assign values to variables. **Operators and Expressions:** Different types of operators – arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, bitwise operators, conditional operators and special operators, Arithmetic expressions – precedence of arithmetic operators, Type conversions in expressions. **Managing input and output operations:** Reading a character, Writing a character, Formatted input, Formatted output.	**10**
Module – II **Decision making and Branching:** Decision making with if statement - Simple if statement, The if …. Else statement, Nesting of if …. Else statement, The else if ladder, The switch statement, The ? : Operator, The go-to statement. **Decision making and Looping:** The while statement, The do statement, The for statement, Jumps in loops.	**10**
Module – III **Arrays:** One - dimensional arrays, Declaration of one – dimensional arrays, Two-dimensional arrays, Declaration of two – dimensional arrays, Multi – dimensional arrays. **Character Arrays and String:** Declaring and initializing string variables, Reading string from terminal, Writing string to screen, Putting string together, Comparison of two strings, String handling functions, Other features of strings.	**7**
Module – IV **User defined functions:** A multi – function program, Definition of function, Function calls, Function declaration, Category of functions, Nesting of functions, Recursion, Passing arrays to functions, Passing strings to functions	**8**
Module – V **Structures and Unions**: Defining a structure, Declaring structure variables, Accessing structure members, Arrays of structures, Arrays within structures, Structures within structures, Structures and functions, Union.	**5**

Pointers: Understanding pointers, Accessing the address of a variable, Declaring pointer variables, Pointer expressions, Array of pointers, Pointers to function, Pointers and structures. **File Management:** Defining and opening a file, Closing a file, Input/ Output operations on files, Error handling during I/O operations	

TEXT BOOKS:

1. Balagurusamy E., "Programming in ANSI C", 5th Edition, TMH, 2010.**(T1)**
2. Sprankle M., "Problem Solving and Programming Concepts", 7th Edition, Pearson Education, New Delhi, 2006.**(T2)**

REFERENCE BOOKS:

1. Gottfried B. S., "Programming with C", Schaum Series, McGraw Hill, 2005. **(R1)**
2. Kanetkar Y., "Let us C", 4th Edition, BPB publication, New Delhi, 2002.**(R2)**

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping between COs and Course Delivery (CD) methods

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA103
Course Title: LOGICAL ORGANIZATIONS OF COMPUTERS
Pre-requisite(s): Basic Electronics
Co- requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the Truth Table.
B.	Identify the number of variables and their simplification importance.
C.	Understand different circuits for the implementation of Boolean equations.
D.	Identify Register Transfer, Micro-operations and Central Processing Unit
E.	Describe performance evaluation of computers, computer architecture and organization, computer arithmetic, Memory and CPU design.

Course Outcomes

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

CO1	Minimize the circuit diagrams by use of K-Map concepts and Boolean Algebra.
CO2	Analyse the outcome of the circuit designed.
CO3	Create complex circuit with use of modular block interconnection.
CO4	Analyse I/O system and interconnection structures of computer.
CO5	Develop independent learning skills and be able to learn more about different computer architectures and hardware.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Digital Logic Circuits: Digital Computers, Logic Gates, Boolean algebra, Complement of a Function, Map Simplification, Product-of-sum simplification, Don't care conditions, Combinational Circuits, Half Adder, Full Adder, Flip-Flops, Sequential Circuits.	**10**
Module – II Digital Components: Integrated Circuits, Decoders, NAND Gate Decoder, Encoders, Multiplexers, Registers, Register with parallel load, Shift Registers, Bidirectional Shift register with parallel load, Binary Counters, Binary counter with parallel load, Memory Unit, RAM, ROM, Types of ROMs. Data Representation: Data Types, Number System, Complements, Subtraction of Unsigned Numbers, Fixed-Point Representation, Floating-Point Representation, Other Binary Codes, Other Decimal Codes, Error Detection Codes	**10**
Module – III Register Transfer and Micro-operations: Register Transfer language, Register Transfer Bus and Memory Transfers, Three-State Bus Buffers, Memory Transfer, Arithmetic Micro-operations, Binary Adder, Binary Adder-Subtractor, Binary incrementer, Arithmetic Circuit Logic, Micro-operations, Shift Micro-operations, Hardware Implementation, Arithmetic Logic Shift Unit.	**7**
Module – IV Central Processing Unit: Introduction, General Register Organization, Stack Organization, Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, Types of Interrupts, Reduced Instruction Set Computer (RISC).	**8**
Module – V Memory Organization: Memory Hierarchy, Main Memory, RAM and ROM Chips, Memory Address Map, Memory Connection to CPU, Auxiliary Memory, Magnetic Disks and Tape, Associative Memory, Hardware Organization, March Logic, Read/Write Operation, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory, Address Space and Memory Space, Address Mapping Using Pages, Associative Memory Page Table, Page Replacement, Memory Management Hardware.	**5**

TEXT BOOKS:

1. Mano M., "Computer System Architecture", Prentice Hall of India, New Delhi, 1995.**(T1)**

REFERENCE BOOKS:

1. Morris Mano M &Ciletti M.D., "Digital Design", 4th Edition, PHI, 2008.**(R1)**
2. Hayes, J.P., "Computer Architecture and Organization", 3rdEdition, McGraw-Hill, London, 2000, **(R2)**
3. Ram. B., "Computer Fundamentals: Architecture and Organization", 3rdEdition, New Age International Publication, New Delhi, 2000.**(R3)**

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA112
Course Title: C PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s): Fundamentals of C Programming
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn computer language.
B.	To Learn coding for problems.
C.	To learn the problem-solving process through computer.
D.	To know the limitations of system during program execution.
E.	To know the practical application of various programming techniques.

Course Outcomes

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

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs.
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To apply programming to solve simple numerical method problems, differentiation of function and simple integration.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

SYLLABUS

List of Programs as Assignments:

1. Write an interactive program that will read in a +ve integer value and determine the following
i) If the integer is a prime number ii) If the integer is a Fibonacci number

2. WAP in C to compute $\sin x = x - x^3/3! + x^5/3! - x^7/7!$ ….. Continue adding successive terms in the series until the value of the next term becomes smaller (in magnitude) than 10^{-5}. Test the program for x = 1, x = 2, and x = 3. In each case display the number of terms used to obtain the final answer.

3. WAP to generate every 3rd integer beginning with I = 2 and continue for all integers that are less than 150. Calculate the sum of those integers that are evenly divisible by 5.

4. WAP to find whether a given year is a leap year or not. Modify it to generate a list of leap years between two year limits given by user.

5. WAP to display the following pattern:

11

11 10 11

11 10 9 10 11

11 10 9 8 9 10 11

6. Using Ternary / Conditional operator find the greatest among 3 numbers.
7. WAP to convert a decimal number into an equivalent number of the input base. Test your program for base 2,8,10 & 16.
8. WAP to read a number n, and print it out digit-by-digit, as a series of words. For e.g. 123 would be printed as "one two three".
9. WAP to check whether any input +ve integer is palindrome or not.
10. WAP to simulate a simple calculator (+ - / * %) that takes two operands and an operator as input and displays the result.
11. WAP to find the GCD of two input +ve integer numbers.
12. WAP to swap the values of two variables without using a third variable.
13. Read a line of mixed text, and then write it out with all lower case and uppercase letters reversed, all digits replaced by 0s and all other characters (non-letters and non- digits) replaced by '*'.
14. WAP to find the product of two matrices A and B. Display the source matrices and product matrix C in matrix format.
15. WAP to find whether a given matrix is a triangular matrix or not.
16. WAP to find the transpose of a matrix. Display the source and the transposed matrix in matrix format.
17. Implement Prob. No. – 14 to 16 using functions for reading, manipulating and displaying the corresponding matrices in matrix form.
18. WAP to sort a list of strings alphabetically using a 2-dim. Character array.
19. WAP to display the row sum and the column – sum of an input 2- dim. Matrix. Display the source matrix with row and column sum.
20. Write a recursive function to calculate S = 2 + 4 + 6 + 8 + …… +2N. Implement the function in a complete C program.
21. Write a function that accepts two arguments an array and its size n. It performs Bubble up sort on the array elements. Using indirection operator '*' implement this in a complete C program. Display the source and the sorted array.
22. Using pointer, write a function that receives a character string and a character as argument. Delete all occurrences of this character in the string. The function should return corrected string with no holes.
23. Write a function for reading character string using pointer. Calculate the length of the string (without using strlen ()). Finally print the string in reverse order, using pointer.
24. Implement prob. No. 14 using pointers representation of 2 – dim. array.
25. Implement prob. No. 15 using pointer representation of 2 dim. array.
26. Implement prob. No. 16 using pointer representation of 2 dim. array.
27. WAP to sort a list of strings into alphabetical order using array of pointers.
28. Create records of 60 students, where each record has fields-name, roll, gpa and fees. Write a function update () to reduce the fees of those students who have obtained gpa greater than 8.5 by 25% of the original fees. Write a complete program to exercise this function in the main program and display all the records before and after updation.
29. Define a structure that describes a hotel. It should have members that include the name, address, grade, average room charge and number of rooms. Write a function to perform the following operations:
a) To print out hotels of a given grade in order of charges.
b) To print out hotels with room charges less than a given value.
30. WAP to concatenate the contents of two files into a third file.

31. WAP to copy the content of one file into another file. Names of both the files are to be input as command line arguments

TEXT BOOKS:

1. Jery R Hanly, "Problem solving and Program design in C", Paerson Education, 7th Edition. **(T1)**
2. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill. **(T2)**
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill. **(T3)**
4. R.G.Dromey, How to Solve it by Computer, Pearson Education. **(T4)**

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall India Learning Private Limited.**(R1)**

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA114
Course title: UNIX PROGRAMMING LAB
Pre-requisite(s): C/C++; Knowledge of programming languages
Co- requisite(s): Nil
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students:

A.	To understand the basic concepts of UNIX & shell programming
B.	To understand the structure of a file system.
C.	To explore the function of a kernel.
D.	Use a UNIX text editor to create a shell script and run scripts effectively from the command line

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

CO1	Will be able to describe and use the UNIX operating system.
CO2	Will be able to describe and use the fundamental UNIX system tools and utilities.
CO3	We will able to describe and write shell scripts in order to perform basic shell programming.
CO4	Will be able to describe and understand the UNIX file system

SYLLABUS

1. Write a shell script to check if the number entered at the command line is prime or not.
2. Write a shell script to modify "cal" command to display calendars of the specified months.
3. Write a shell script to modify "cal" command to display calendars of the specified range of months.
4. Write a shell script to accept a login name. If not a valid login name display message "Entered login name is invalid".
5. Write a shell script to display date in the mm/dd/yy format.
6. Write a shell script to display on the screen sorted output of "who" command along with the total number of users.
7. Write a shell script to display the multiplication table of any number.
8. Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.
9. Write a shell script to find the sum of digits of a given number.
10. Write a shell script to merge the contents of three files, sort the contents and then display them page by page.
11. Write a shell script to find the LCD(least common divisor) of two numbers.
12. Write a shell script to perform the tasks of basic calculator.
13. Write a shell script to find the power of a given number.
14. Write a shell script to find the greatest number among the three numbers.
15. Write a shell script to find the factorial of a given number.
16. Write a shell script to check whether the number is Armstrong or not.

TEXT BOOK

1. Michael Randal K., "Mastering Unix Shell Scripting", 2nd Edition, Wiley publication.

REFERENCE BOOK

1. Venkateshmurthy M.G., "Introduction to Unix and Shell Programming", Paperback, Pearson. 2005.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Incorporation of advance level of shell scripting and shell programming may be done to meet industry requirement.

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Advanced design level questions solving skills by lab work should be incorporated.
2. Kernel compilation may be introduced.

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
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CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA155
Course Title: DATA STRUCTURES
Pre-requisite(s): C/C++; Knowledge of programming languages
Co- requisite(s): Data Structures Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester/ Level: II/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To know details about the data structure.
B.	Applications, advantages and limitations of various data structures.
C.	Real life use of various data structures.
D.	Implementations of various data structures.
E.	Analyse and compare the different algorithms

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

CO1	Understand the properties of various data structures
CO2	Identify the strength and weaknesses of different data structures
CO3	Design and employ appropriate data structures for solving computing Problems
CO4	Analyze and compare the efficiency of algorithms
CO5	Solve computing problems independently

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Algorithms and Analysis of Algorithms**: Definition, Structure and Properties of Algorithms, Development of an Algorithm, Data Structures and Algorithms, Data Structure – Definition and Classification, Efficiency of Algorithms, Asymptotic Notations, Polynomial Vs Exponential Algorithms, Average, Best and Worst case Complexities, Open source software development process.	**10**
Module – II **Arrays, Stacks and Queues**: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack, Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues.	**10**
Module – III **Linked List, Linked Stacks and Linked Queues**: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Applications of Linked Lists, Introduction to Linked Stack and Linked Queues, Operations on Linked Stacks and Linked Queues, Implementations of Linked Representations, Applications of Linked Stacks and Linked Queues.	**7**
Module – IV **Trees, Binary Trees, BST, AVL Trees and B Trees**: Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees: Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Applications. Introduction, BST: Definition and Operations, AVL Trees: AVL Definition and Operations, B Trees: Introduction, m-way search trees: Definition and Operations.	**8**
Module – V **Sorting and searching**: Introduction, Radix sort, Shell Sort, Quick Sort, Heap Sort. Searching: Introduction, Binary Search, Transpose Sequential Search, Interpolation Search.	**5**

TEXT BOOKS:

1. Baluja G S, "Data Structure through C", Ganpat Rai Publication, New Delhi, 2015.
2. PaiG A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", 2nd Edn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2010.

REFERENCE BOOKS:

1. TremblayJ. P., Sorenson P. G, "An Introduction to Data Structures with Applications", 2nd Edn, McGraw-Hill, Inc. New York, NY, USA.
2. Lipschutz Seymour, "Data Structures", 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Drozdek Adam, "Data Structures and Algorithms in C++", Thomson Learning, New Delhi – 2007.
4. FellerJ., Fitzgerald B., "Understanding Open Source Software Development", Pearson Education Ltd. New Delhi

Gaps in the Syllabus (to meet Industry/Profession requirements)

- Introduced programming skills for real time applications.

POs met through Gaps in the Syllabus
3, 4, 12

Topics beyond syllabus/Advanced topics/Design

- Topics related to real world application/ problem should be introduced.

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

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1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA163
Course Title: DISCRETE MATHEMATICS
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Use appropriate set, function, or relation models to analyse practical examples, interpret the associated operations and terminology in context.
B.	Determine number of logical possibilities and probability of events.
C.	Learn logic and proof techniques to expand mathematical maturity.
D.	Formulate problems precisely and explain their reasoning clearly.
E.	Solve the problems, apply formal proof techniques

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

CO1	To formulate problems precisely
CO2	Solve the problems, apply formal proof techniques, and explain their reasoning clearly.
CO3	Illustrate by example, basic terminology and model problems in computer engineering using graphs and trees
CO4	Analyse problems precisely and explain their reasoning clearly.
CO5	Solve the problems, apply formal proof techniques

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Propositions and Sets :** Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, Universal and Existential Quantifiers, Normal forms, Mathematical Induction. Understanding sets and operations of sets through propositional calculus	**10**
Module – II **Relations and Functions:** Relations, Properties of Binary Relations, Closure of relations, Warshall's algorithm, Equivalence relations. Functions, Types of functions, Composition of functions, Invertible functions. Permutations and Combinations, Pigeonhole Principle, Recurrence Relation.	**10**
Module – III **Partially Ordered Sets:** Introduction, Elements of Partially Ordered Sets, Lattices.	**7**
Module – IV **Graph Theory and Trees:** Basic terminology, representation of a graph in computer memory, Relations and Digraphs, Paths in Relations and Digraphs, Shortest path in weighted graphs (Dijkstra's algorithm). Basic terminology and characterization of trees, Tree traversal, Spanning trees, Minimal Spanning trees (Introduction).	**8**
Module – V **Groups, Rings and Fields:** Groups, Semi Groups, Monoids, Subgroups, Isomorphism and Homomorphism and Normal Subgroups, Rings, Integral Domain, Rings Homomorphism, Polynomial Rings, Fields.	**5**

TEXT BOOKS:

1. Kolman B., Busby R. and Ross S., "Discrete Mathematical Structures", 6th Edition, Pearson Education, 2002, ISBN 81-7808-556-9.
2. Deo N., "Graph Theory with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
3. Johnsonbaugh R., "Discrete Mathematics", 5th Edition, Pearson Education, 2001 ISBN 81 – 7808 279 – 9.

REFERENCE BOOKS:

1. Biggs N., "Discrete Mathematics", 3rd Edition, Oxford University Press, ISBN 0 –19 – 850717 – 8.
2. Rosen Kenneth H., "Discrete Mathematics and its Applications", 6th edition, McGraw-Hill, 2007, ISBN 978-0-07-288008-3.
3. LipschutzSemyour& Lipson Marc, "Discrete Mathematics", McGraw-Hill, 3rd Special Indian Edition, ISBN-13: 978-0-07-060174-1.
4. LiuC. L. and MohapatraD. P., "Elements of Discrete Mathematics", SiE Edition, Tata McGraw- Hill, 2008, ISBN 10:0-07-066913-9.
5. LipschutzS. andLipsonM.,Schaum's Outline of Discrete Mathematics, Revised Third Edition, Tata McGraw Hill, 2010.
6. MottJ. L., KandelA. andBakerT. P., Discrete Mathematics for Computer Scientists and Mathematicians, 2nd Edition, Prentice Hall of India, 2001.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
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Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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Mapping Between COs and Course Delivery (CD) methods

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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA165
Course Title: FUNDAMENTALS OF OPERATING SYSTEM
Pre-requisite(s): Nil
Co- requisite(s): Fundamentals of Operating System Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Present the main components of OS and their working
B.	Introduce the concepts of process and thread and their scheduling policies
C.	Handling synchronization of concurrent processes and deadlocks
D.	Analyze the different techniques for managing memory, I/O, disk and files
E.	Design the components of operating system

Course Outcomes

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

CO 1	Understand the general architecture of computer system.
CO 2	Understand, contrast and compare differing structures for operating Systems
CO 3	Gain proficiency needed to analyse theory and implementation of: processes, scheduling, I/O and files systems.
CO 4	Be familiar with various types of operating systems including Unix /Linux
CO 5	Get in-depth knowledge of memory management for operating systems

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction & System Structures: What Operating Systems do, Computer System Organisation, Computer System Architecture: Single Processor Systems, Multiprocessor Systems, Clustered Systems, Operating System Structure, Operating System Operations, Distributed Systems, Special Purpose Systems, Computing Environments, Open-Source Operating Systems, Operating System Services, User Operating System Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation: Design Goals, Mechanisms and Policies, Implementation, Operating System Structure: Simple Structure, Layered Approach, System Boot.	**10**
Module – II Process Management: Process Concept, Operations on Processes, Process Scheduling-Basic Concepts, Scheduling Queues, Schedulers, Pre-emptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms.	**10**
Module – III Deadlock Handling: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	**7**
Module – IV Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation. File Management: File Concept, Access Methods, Directory & Disk Structure, File System Mounting, File Sharing, Protection, File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management.	**8**
Module – V Secondary Memory Management: Overview of Mass Storage Structures, Disk Structure, Disk Scheduling, Disk Management. Case Study- The Linux System: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling (except Symmetric Multiprocessing), Memory Management (except Virtual Memory), File Systems, Input & Output.	**5**

TEXT BOOKS:

1. Silberschatz A., Galvin P.B. & Gagne G., "Operating System Concepts", 8th Edition, Wiley India, 2012.

REFERENCE BOOKS:

1. Deitel H.M., "Operating Systems", 3rd Edition, Prentice-Hall of India, 2006.
2. Tanenbaum A.S., "Modern Operating Systems", 2nd Edition, Prentice-Hall of India, 2010.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Page Replacement Algorithms
2. Case Study of any OS.
3. Applications of advance memory management.

POs met through Gaps in the Syllabus

3, 4, 12, 13

Topics beyond syllabus/Advanced topics/Design

1. Distributed Operating Systems
2. Design of access matrix.
3. Design of kernel model of Linux OS.
4. Application design of Virtual Memory.

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CE101
Course Title: ENVIRONMENTAL SCIENCE
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:2 T:0 P:0
Class schedule per week: 02
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To develop basic knowledge of ecological principles and their applications in environment.
B.	To identify the structure and composition of the spheres of the earth, the only planet sustaining life.
C.	To analyse, how the environment is getting contaminated and probable control mechanisms for them.
D.	To generate awareness and become a sensitive citizen towards the changing environment.

Course Outcomes

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

CO1	Explain the structure and function of ecosystems and their importance in the holistic environment.
CO2	Identify the sources, causes, impacts and control of air pollution.
CO3	Distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.
CO4	Judge the importance of soil, causes of contamination and need of solid waste management.
CO5	Predict the sources of radiation hazards and pros and cons of noise pollution.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Ecosystem and Environment:** Concepts of Ecology and Environmental science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.	**10**
Module – II **Air Pollution:** Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.	**10**
Module – III **Water Pollution:** Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.	**7**
Module – IV **Soil Pollution and Solid Waste Management:** Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composing, pyrolysis.	**8**
Module – V **Noise pollution & Radioactive pollution:** Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods-safe guards from exposure to radiations, international regulation, Management of radioactive wastes.	**5**

TEXT BOOKS:

1. A, K. De., "Environmental Chemistry", New Age Publications India Ltd., 3rd Edition, 2008.**(T1)**
2. R. Rajagopalan, "Environmental Studies: From Crisis to Future", 3rd Edition, Oxford University Press, 2016.**(T2)**
3. Eugene P. Odum., "Fundamentals of Ecology", 3rd Edition, WB Sunders Company, Philadelphia, 1971.**(T3)**
4. C. N. Sawyer, P. L. McCarty and G. F. Parkin, "Chemistry for Environmental Engineering and Science", John Henry Press, 2002.**(T4)**
5. S.C. Santra,"Environmental Science", New Central Book Agency, 2011. **(T5)**

REFERENCE BOOKS:

1. D.W. Conell, "Basic Concepts of Environmental Chemistry", CRC Press.**(R1)**
2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G., "Environmental Engineering", Mc-Graw Hill International. **(R2)**
3. G.M. Masters & Wendell Ela, "Introduction to Environmental Engineering and Science", PHI Publishers, 1991.**(R3)**

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Explain the structure and function of ecosystems and their importance in the holistic environment.
2. Identify the sources, causes, impacts and control of air pollution
3. Distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms.

POs met through Gaps in the Syllabus

3, 4, 12, 13, 14

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	1	3	1	1	1				2			
CO2	3	3	3	1	3	1	1	1				2			
CO3	3	3	3	3	3	1	2	2		1	1	2			
CO4	3	3	3	1	3		1	1		1	1	2			
CO5	3	3	3	3	3	1	1	1	1	1	1	2			

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1, CD2
CD2	Tutorials/Assignments	CO2	CD1, CD2
CD3	Seminars	CO3	CD1, CD2
CD4	Mini projects/Projects	CO4	CD1, CD2
CD5	Laboratory experiments/teaching aids	CO5	CD1, CD2
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

Course Code: CA156
Course Title: DATA STRUCTURES LAB
Pre-requisite(s): C/C++; Knowledge of programming languages
Co- requisite(s): Data Structures
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: II/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To assess how the choice of data structures and algorithm design methods impact the performance of programs.
B.	To choose the appropriate data structure and algorithm design method for a specified application.
C.	To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
D.	Analyse and compare the different algorithms

Course Outcomes

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

CO1	Be able to design and analyze the time and space efficiency of the data Structure
CO2	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort
CO3	Have practical knowledge on the applications of data structures
CO4	Be capable to identity the appropriate data structure for given problem

SYLLABUS

1. Program to Find the Number of Elements in an Array
2. Develop and Implement a menu driven program in C for the following Array operations
3. Creating Array of N Integer elements.
4. Display of Array elements with suitable headings.
5. Inserting an element (ELEM) at a given valid position (POS).
6. Deleting an element at a given valid position (POS).
7. Programs for Stack, Queues and Circular Queues using Arrays
8. Program to convert an Infix Expression into Postfix and Postfix Evaluation
9. Program to implement stack using arrays
10. Program to implement stack using linked list

11. Program to implement multiple stack in a single array
12. Program to convert infix notation to postfix notation using stacks
13. Program to implement queue using arrays
14. Program to implement queue using pointers
15. Program to reverse elements in a queue
16. Program to implement circular queue using arrays
17. Program to create add remove & display element from single linked list
18. Program to create add remove & display element from double linked list
19. Program to count number of nodes in linear linked list
20. Program to create add remove & display element from circular linked list
21. Programs to implement stack & queues using linked representation
22. Program to concatenate two linear linked lists
23. Program to accept a singly linked list of integers & sort the list in ascending order.
24. Program to reverse linked list
25. Program to represent polynomial using linked list
26. Program to add two polynomials using linked list
27. Program for the creation of binary tree, provide insertion & deletion in c
28. Program for pre-order, post-order & in-order traversals of a binary tree using non recursive.
29. Program to count no, of leaves of binary tree
30. Program for implementation of B-tree (insertion & deletion)
31. Program for implementation of multi-way tree in c
32. Program for implementation of AVL tree
33. Program to implement bubble sort program using arrays
34. Program to implement merge sort using arrays
35. Program to implement selection sort program using arrays
36. Program to implement insertion sort program using arrays
37. Program to implement topological sort using arrays
38. Program to implement heap sort using arrays
39. Program to implement heap sort using pointers
40. Program to implement bubble sort program using pointers
41. Program to implement linear search using pointers
42. Program to implement binary search using pointers
43. Program to implement linear search using arrays
44. Program to implement binary search using arrays

TEXT BOOKS:

1. Baluja G S, "Data Structure through C", Ganpat Rai Publication, New Delhi, 2015.
2. Pai G A V, "Data Structures and Algorithms: Concepts, Techniques and Applications", 2nd Edn, Tata McGraw-Hill, 2008.
3. Horowitz E., Sahni S., Susan A., "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2010.

REFERENCE BOOKS:

1. Tremblay J. P., Sorenson P. G, "An Introduction to Data Structures with Applications", 2nd Edn, McGraw-Hill, Inc. New York, NY, USA.
2. Lipschutz Seymour, "Data Structures", 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.

3. Drozdek Adam, “Data Structures and Algorithms in C++”, Thomson Learning, New Delhi – 2007.
4. Feller J., Fitzgerald B., “Understanding Open Source Software Development”, Pearson Education Ltd.

Gaps in the Syllabus (to meet Industry/Profession requirements)

Introduction of advanced programming concept keeping in view industry requirement.

POs met through Gaps in the Syllabus
3, 4, 12

Topics beyond syllabus/Advanced topics/Design

Practical orientation programming should be given emphasis

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment
1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA166
Course Title: FUNDAMENTALS OF OPERATING SYSTEM LAB
Pre-requisite(s): Nil
Co- requisite(s): Fundamentals of Operating System
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Present the main components of OS and their working
B.	Introduce the concepts of process and thread and their scheduling policies
C.	Handling synchronization of concurrent processes and deadlocks
D.	Analyze the different techniques for managing memory, I/O, disk and files
E.	Design the components of operating system

Course Outcomes

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

CO1	Understand the general architecture of computer system.
CO2	Understand, contrast and compare differing structures for operating Systems
CO3	Gain proficiency needed to analyse theory and implementation of: processes, scheduling, I/O and files systems.
CO4	Be familiar with various types of operating systems including Unix /Linux
CO5	Get in-depth knowledge of memory management for operating systems

SYLLABUS

1. Implement in C the following UNIX commands using System calls : cat and mv
2. WAP in C to Determine the size of a file using the lseek command.
3. WAP to calculate the number of blocks assigned for the file.
4. Write a C program that deletes a directory with all its subfolders. The name of the directory should be read from the command line.
5. Write a program that deletes every 5th byte from a file, but without using a temporary file or allocating a buffer in the memory.
6. WAP in C to implement FCFS CPU scheduling Algorithm.
7. WAP in C to implement SJF CPU scheduling Algorithm.
8. WAP in C to implement Priority CPU scheduling Algorithm.
9. WAP in C to implement Round Robin (RR) CPU scheduling Algorithm.
10. WAP in c to read from the buffer & produce desired output.
11. WAP ii C to create User id & Password.
12. WAP in c to implement and find how many Users currently login in NetWork.
13. WAP in c to create your own system call just like a copy.
14. WAP in c to create your own system call just like a delete.
15. WAP in c to find the Disk Space.
16. WAP In C to find The number of pages in the process.
17. WAP In C to find The number of frames allocated to the process.
18. WAP in c to find the no. of blocks occupied by a file.
19. WAP in c to create your own system call just like a delete.
20. WAP in c to create your own system call just like a ls.
21. WAP in c to find a PID no. of any Process.

TEXT BOOK:

1. ManikantaPalakollu,"Practical System Programming with C: Pragmatic Example Applications in Linux and Unix-Based Operating Systems",2020, Apress.

REFERENCE BOOK:

1. YashwantKanetkar, "Unix shell programming", BPV Publications, Second Edition.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Shell Programming under Linux OS
2. Case Study of any OS.
3. Applications are of Linux OS.

POs met through Gaps in the Syllabus

3, 4, 12, 13

Topics beyond syllabus/Advanced topics/Design

1. Distributed Operating Systems
2. Design of access matrix.
3. Design of kernel model of Linux OS.
4. Application design of Virtual Memory.

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment
1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA168
Course Title: MATLAB PROGRAMMING LAB
Pre-requisite(s): Knowledge of Basic Mathematics
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Present the main components of MATLAB
B.	Introduce the different mathematical functions available in MATLAB
C.	Handling different mathematical applications using MATLAB
D.	Analyze the different techniques for handling real time applications
E.	Development of simulation using MATLAB

Course Outcomes

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

CO1	Understand the general idea about MATLAB software.
CO2	Understand the implementation of different mathematical formulas in MATLAB environment.
CO3	Gain proficiency needed to implement mathematical applications.
CO4	Be familiar with various types of scientific software
CO5	Get in-depth knowledge of implementations of real time simulation

SYLLABUS
1. Solve the following using command window

$$\frac{35.7 \,.\, 64\,7^3}{45 + 5^2}$$

2. Solve the following using command window

$$\frac{5}{4} \,.\, 7 \,.\, 6^2 + \cdots \frac{3^7}{(9^3 - 652)}$$

3. Invoke MATLAB interactively and perform the following steps.
a) Initialize a variable x to 2.
b) Add 3 to x. Print out the result.
c) Print out the result of x + 1*2 and (x+1)*2. (Observe how parentheses make a difference).

d) What variable *type* is x?

e) Write a program to Demonstrate by using several values of angle θ that:

$\sin^2(\theta) + \cos^2(\theta) = 1$.

4. Given a vector t, write down the MATLAB expressions that will correctly compute the following:
   a. $\ln(2 + t + t^2)$
   b. $e^t(1 + \cos(3t))$
   c. $\cos^2(t) + \sin^2(t)$
   d. $\tan^{-1}(t)$ (this is the *inverse* tangent function)
   e. cot(t)
   f. $\sec^2(t) + \cot(t) - 1$

5. Make a plot of x = [0:0.1:20]; y = sin(x);

6. Write a program to Draw the graph that joins the points (0,1), (4,3), (2,0) and (5,-2).

7. Write a program to. create a row of data under the variable name x

x=[0 1 2 3 4 5 6 7 8 9 10] add 7 to the data and multiply with 8.

8. Solve the following using command window

$$\frac{3^7 \log(76)}{7^3 - 546} + \sqrt[3]{910}$$

9. Solve the following using command window

$$\cos^2\left(\frac{5\pi}{6}\right) \quad \sin\left(\frac{7\pi}{8}\right)^2 + \frac{\tan\left(\frac{\pi}{6} In8\right)}{\sqrt{7}}$$

10. Consider the following matrix and write a program to find the transpose of A

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 4 & 5 \\ 2 & 5 & 2 \end{bmatrix}, B = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$$

11. Create the following three matrices

$$A = \begin{bmatrix} 5 & 2 & 4 \\ 1 & 7 & -3 \\ 6 & -10 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 11 & 5 & -3 \\ 0 & -12 & 4 \\ 2 & 6 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 7 & 14 & 1 \\ 10 & 3 & -2 \\ 8 & -5 & 9 \end{bmatrix}$$

$$A = \begin{bmatrix} 5 & 2 & 4 \\ 1 & 7 & -3 \\ 6 & -10 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 11 & 5 & -3 \\ 0 & -12 & 4 \\ 2 & 6 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 7 & 14 & 1 \\ 10 & 3 & -2 \\ 8 & -5 & 9 \end{bmatrix}$$

Calculate A + B and B + A to show that addition of matrices is commutative

12. Calculate A + (B+C) and (A+B) + C to show that addition of matrices is associative

13. Calculate 5(A + C) and 5A + 5C to show that, when matrices are multiplied by a scalar, the multiplication is distributive.

14. Write a MATLAB program to find the sum of numbers from 1 to 9.

15. Find and display all integers between 1 and 10000 which divide by 37.

16. Fibonacci numbers form a sequence starting with 0 followed by 1. Each subsequent number is the sum of the previous two. Hence the sequence starts as 0, 1, 1, 2, 3, 5, 8, 13, ... Calculate and display the first 10 even Fibonacci numbers.

17. Calculate A*(B+C) and A*B + A*C to show that matrix multiplication is distributive.

18. Calculate (by writing one command) the radius r of a sphere that has a volume of 350 in^3. Once r is determined, use it to calculate the surface area of the sphare.
19. Write a MATLAB code to Create a new function, that multiply 2 numbers, and use it.

20. Write a function called F to C to convert Fahrenheit temperatures into Celsius.

21. Write a script that generates an array of 6 random numbers between 0 and 10.
22. Plot the function $f(x) = \frac{x^2-x+1}{x^2+x+1}$ $for -10 \leq x \leq 10 f(x) = \frac{x^2-x+1}{x^2+x+1}$ $for -10 \leq x \leq 10$

TEXT BOOK:
1. Amos Gilat "MATLAB An Introduction with Applications", 1st Edition, John Willy & Sons, Inc., 2003

REFREANCE BOOK:
1. RudraPratap "Getting started with MATLAB", Oxford; Edition, 2010

Gaps in the Syllabus (to meet Industry/Profession requirements)
1. Idea of implementation of Simulation using MATLAB
2. Ideas of implementation of complex mathematical formula

POs met through Gaps in the Syllabus
1, 2

Topics beyond syllabus/Advanced topics/Design
3. Development of real time simulation
4. Implementation of relational and logical operators.
5. Design of Polynomial and curve fitting.
6. Implementation of Interpolation.

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment
1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA203
Course Title: DATABASE MANAGEMENT SYSTEMS
Pre-requisite(s): Nil
Co- requisite(s): DBMS Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand the structure of databases
B.	To learn Query processing and decomposition.
C.	To understand how to create a database
D.	To learn transaction processing in databases
E.	To understand how concurrency control is performed in a database.
F.	To understand fault tolerance and reliability of database.

Course Outcomes

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

CO1	Design a database for a given set of requirements.
CO2	Use SQL.
CO3	Apply normalization techniques on given database.
CO4	Have knowledge of 'indexing and hashing' mechanisms in a database management system.
CO5	Have idea of the backend activities involved in extracting data from a database. Have knowledge of transaction and concurrency control mechanisms in a database management system.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Purpose of Database Systems, View of Data, Data Models, Database Languages, Relational Database, Database Architecture, Database Users and Administrators, Transaction Management.	**10**
Module – II **Relational Data Models and Languages:** Basic Concepts, Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Reduction of an E-R Diagram to Tables, The Relational Algebra, The Tuple Relational Calculus and The Domain Relational Calculus.	**10**
Module – III **Relational-Database Design:** Pitfalls in Relational-Database Design, Functional Dependencies, Decomposition, Desirable Properties of Decomposition, First Normal Form, Second Normal Form, Third normal Form, Boyce-Codd Normal Form, Fourth Normal Form and More Normal Forms.	**7**
Module – IV **Query Processing and Optimization:** Overview, Measures of Query Cost, Selection Operation, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, and Choice of Evaluation Plans.	**8**
Module – V **Transactions and Concurrency Control:** Transaction Concept, Transaction State, Desirable Properties of Transactions, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols and Deadlock Handling.	**5**

TEXT BOOKS:

1. Silberschatz, Korth, &Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill, 2011.

REFERENCE BOOKS:

1. Elmasri, &Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2008.
2. Date C.J., "An Introduction to Database System", Pearson Education, New Delhi, 2005.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA205
Course Title: JAVA PROGRAMMING
Pre-requisite(s): Concepts of Programming Languages
Co- requisite(s): JAVA Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Learn about Object oriented programming concepts
B.	Learn how to use the JDK
C.	Improve their programming skills in core Java
D.	Use the Java packages, applets for software development
E.	Use the knowledge of object-oriented programming through Java

Course Outcomes

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

CO1.	Elaborate the use of JDK of various versions for programming
CO2.	Identify the latest know-how related to the new developments in the field of Java
CO3.	Apply the knowledge gained for their project work as well as to develop some GUI applications.
CO4.	Design solutions in JAVA
CO5.	Apply features of Advanced Java through programming

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Procedure-Oriented Programming, Object-Oriented programming, Benefits of OOP, Applications of OOP, Basics, Evolution of Java, Structure of JAVA Program, Simple Java Program, Tokens, Comments, Identifiers, Operators, Literals, Control Structures. Java Environment Setup, Compiling a Java Program, Java Virtual Machine, Philosophy of Java and Benefits.	**10**
Module – II Data types and program statements: Primitive and reference data types, variables and constants, enumerated constants, labelled statement, expression and null statements, compound statement, control statement – decision and loops, jump statement, declaration statement, try-throw-catch-finally statement, declaring and creating arrays, accessing array elements, assigning values to array elements, multidimensional arrays.	**10**
Module – III Functions, Data Abstraction and classes: Declaration, definition and call, main method arguments, reference variables, method overloading, parameter passing by value for primitive types, object references and arrays, scope of variables, return from methods. Class and object, class members and initialization, access rights of members – public, private and protected access modifiers, constructor and copy constructor, mutability, finalization, dynamic memory management, garbage collection, this keyword, static members, scope of variables, interface – declaration, implementation and extending, package and package visibility.	**7**
Module – IV Inheritance and Collection classes: multi-level and single inheritance, multiple inheritance of interfaces, Object class, access rights in subclasses and packages, constructor calling sequence, super keyword, dynamic binding of methods, abstract class, overriding, shadowing and hiding, finalize, association, aggregation and composition. String, StringBuffer, Date, Calendar, Math, Object, Class, Exception class	**8**
Module – V Input/Output and JAVA Applets: Stream classes – InputStream, OutputStream, Buffered Stream, file classes and handling, pushback streams, reader and writer classes, file reader and writer, serialization. Applet code example, HTML tags for applet, applet life cycle, color, font andbasic GUI handling, basic graphics, and animation.	**5**

TEXT BOOKS:

1. Balagurusamy E., "Programming in Java", 2nd Edition, Tata McGraw Hill Publication, New Delhi.

REFERENCE BOOKS:

1. Naghton Patrick &Schildt H., "The Complete Reference Java 2", Tata McGraw Hill Publication, New Delhi.
2. Dietel Harvey M &Dietel Paul J., "Java How to program", 7th edition, Pearson Education, New Delhi.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Multithreading process in Java.
2. Detailed applet programming.
3. Handling available Java applications as case studies for better understanding.

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Concepts of multithreading in Java
2. Detailed knowledge on GUI designs in Java
3. Database connectivity with front end

POs met through Topics beyond syllabus/Advanced topics/Design

3, 4, 5, 6

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA207
Course Title: INTRODUCTION TO COMPUTER ALGORITHMS
Pre-requisite(s): Data Structures
Co- requisite(s): Computer Algorithms Lab
Credits: 4 **L:** 3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand basic algorithm designing techniques such as recursion, greedy, backtracking and branch and bound.
B.	To analyze the asymptotic performance of an algorithm.
C.	To demonstrate a familiarity with algorithms and data structures..
D.	To apply important algorithmic design paradigms and methods of analysis in solving real life problems.
E.	To Synthesize efficient algorithms in common engineering design situations.

Course Outcomes

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

CO1	Students will be able to have a clear understanding on solving the problems systematically.
CO2	Students will be able to make use of linear and non-linear data structures, like, graphs and trees while designing algorithms.
CO3	Students will be having a clear understanding of different design paradigms..
CO4	Students will be able to analyze and measure the efficiency of an algorithm
CO5	Students will have basic knowledge of fundamentals of algorithms which would help them to take up an advanced course in the same field.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** What is an algorithm? Design and performance analysis of algorithms, space and time trade-offs. Analysis of selection sort and insertion sort. Asymptotic notations (O, è, ¿,ωo) to measure complexity of algorithms.	**8**
Module – II **Recursion:** Basic concept. Analysis of recursive algorithms, Master's theorem. Divide & Conquer: The general method. binary search, finding the maximum and minimum, merge sort, quick sort, Best and worst case analysis for the mentioned algorithms.	**8**
Module – III **The Greedy Method:** The general method. Applications to Knapsack problem, minimum weight spanning trees: Prim's &Kruskal's algorithms. Dijkstra's algorithm for finding single source shortest paths problem.	**8**
Module – IV **Algorithms on Graphs:** **Br**eadth First Search, Depth First Search, Biconnectivity, Depth First Search of a Directed Graph, Topological Sorting.	**8**
Module – V **Basic concepts of Backtracking:** 8-queen problem, Branch and Bound: 0/1 Knapsack problem, assignment problem**.**	**8**

TEXT BOOKS:

1. CormenThomas H., LeisersonCharles E., &Rivest.Ronald L., "Introduction to Algorithms PHI publication.
2. Horowitz Ellis, SahniSartaj and Rajasekaran S., "Fundamentals of Computer Algorithms" Galgotia publications.

REFERENCE BOOKS:

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., "The Design & Analysis of Computer Algorithms", Addison Wesley Publications.
2. Kleinberg Jon &Tardos Eva, "Algorithm Design", Pearson Education Publications.
3. Brassard Gilles & Bratley Paul, "Fundamentals of Algorithms", PHI Publications.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Dynamic Programming design paradigm.

POs met through Gaps in the Syllabus

3, 4, 5

Topics beyond syllabus/Advanced topics/Design

NIL

POs met through Topics beyond syllabus/Advanced topics/Design

N.A.

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	2	1	2	3	3	3	3
CO2	3	1	1	1	1	3	1	1	2	1	2	3	3	3	3
CO3	2	3	3	1	2	1	2	2	2	1	2	3	3	3	3
CO4	1	1	3	3	1	1	1	1	2	1	2	3	3	3	3
CO5	3	3	3	1	2	1	1	2	2		1	3	3	3	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD 8
CD2	Tutorials/Assignments	CO2	CD1, CD2, CD8
CD3	Seminars	CO3	CD1, CD2, CD3, CD5, CD8
CD4	Mini Projects/Projects	CO4	CD1, CD3, CD8
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2, CD3, CD8
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA204
Course Title: DBMS LAB
Pre-requisite(s): Nil
Co- requisite(s): Database Management Systems
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand the structure of databases
B.	To learn Query processing and decomposition.
C.	To understand how to create a database
D.	To learn transaction processing in databases
E.	To understand how concurrency control is performed in a database.
F.	To understand fault tolerance and reliability of database.

Course Outcomes

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

CO1	Design a database for a given set of requirements.
CO2	Use SQL.
CO3	Apply normalization techniques on given database.
CO4	Have knowledge of 'indexing and hashing' mechanisms in a database management system.
CO5	Have idea of the backend activities involved in extracting data from a database. Have knowledge of transaction and concurrency control mechanisms in a database management system.

SYLLABUS

List of Programs as Assignments:

Consider the following tables: **emp**(empno, ename, job, mgr, hiredate, sal, comm, deptno, gr), **dept**(deptno, dname, loc)

Write the following queries:

1. List all information about all department from emp table.
2. List all employee names along with their salaries from emp table.
3. List all department numbers, employee numbers and their managers numbers in descending order of deptno from emp table.
4. List department names and locations from the dept table.
5. List the employees belonging to the department 20.
6. List the name and salary of the employees whose salary is more than 1000.
7. List the names of the clerks working in the department 20.
8. List the names of analysts and salesmen.
9. List the details of the employees who have joined before the end of September 81.
10. List the names of employees who are not managers.
11. List the names of employees whose employee number are 7369, 7521, 7839, 7934, 7788.
12. List the employee details not belonging to the department 10, 30, and 40.
13. List the employee name and salary, whose salary is between 1000 and 2000.
14. List the employee names, who are not eligible for commission.(salary having >15,000 eligible for commission)
15. List the employees who are eligible for commission.
16. List the details of employees, whose salary is greater than 2000 and commission is NULL.
17. List the employees whose names start with an "S" (not"s").
18. List the name, salary and PF amount of all the employees(PF is calculated as 10% of salary).
19. List the empno, ename, sal in ascending order of salary.
20. List the employee name, salary, job and Department no descending order of Department No and salary.
21. List the employee details in ascending order of salary.
22. List the employee details in descending order of salary
23. Display name, and sal and commission of all employees whose monthly salary is greater than their commission.
24. Select SMITH HAS WORKED IN THE POSITION OF CLERK IN DEPT 20.Display result in this format.
25. Generate a statement which prompts the user at runtime. The intention is to display employees hired between 2 given dates.
26. Define a variable representing an expression used to calculate total annual remuneration. Use the variable in a statement which finds all employees who earn $30000 a year or more.
27. List all the employees name and salaries increased by 15% and expressed as a whole number of dollars.
28. Produce the following output

EMPLOYEE AND JOB

SMITH CLERK
ALLEN SALESMAN

29. Produce the following output:

SMITH (Clerk)

ALLEN (Salesman)

30. Do a case sensitive search for a list of employees with a job that the user enters.
31. It has been discovered that the sales people in dept. 30 are not all male. Please produce the Following output.

ENAME	DEPTNO	JOB
ALLEN	30	Sales Person

32. Display each employees name and hiredate of dept 20.
33. Display each employees name, hiredate and salary review date. Assume salary review date is one year from hiredate. Output should be in ascending review date.
34. Print list of employees displaying just salary, if more than 1500. If exactly 1500 display " On Target". If less than 1500 display " Below 1500".
35. Write a query which returns DAY of the week (i.e. MONDAY) for any date entered in the format DD/MM/YY.
36. Write a query to calculate length of service of each employee.
37. Find the minimum salary of all employees.
38. Find the maximum, minimum, and average salaries of all employees.
39. List the maximum and minimum salary of each job type.
40. Find how many managers are in each dept.
41. Find the average salary and average total remuneration of each job type. Remembers sales man earn commission.
42. Find out the difference between highest and lowest salary.
43. Find all department s which have more than three employees.
44. Check whether all employee nos are unique. (No Duplicate)
45. List lowest paid employee working for each Manager. Exclude any groups where the minimum salary is less than 1000. Sort the output by salary.
46. Produce a list showing employees 'salary grade'.(> 10000 A, >10000 &<20000 B, >20000 C)
47. Show only employee on Grade C.
48. Show all employee in Dallas.
49. List the employees name, job, salary, grade and department for everyone in the company except clerks. Sort on salary, displaying the highest first.
50. List the following details of employees who earn $36000 a year or who are clerks.

Ename	Job	Annual Sal	Dept no	Dname	Grade

51. Display all employees who earn less than their managers.
52. Display all employees by name and eno along with their managers name and number.
53. Modify above spoliation to display KING who has no MANAGER.
54. Find the job that was files in the first half of 1983 and the name job that was filled in the same period in 1984.
55. Find all employees who have joined before their manager.
56. Find the employees who earn the highest salary in each job, type, sort in descending order of salary.
57. Find the employees who earn the minimum salary for their job, Display the result in descending order of salary
58. Find the most recently hired employees in the department. Order by hiredate.
59. Show the details of any employee who earns a salary greater than the average for their department. Sort in department number order.
60. List all department where there are no employees.

TEXT BOOK

1. SQL, PL/SQL the programming Language of Oracle, Ivan Bayross, 4th edition

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA206
Course Title: JAVA PROGRAMMING LAB
Pre-requisite(s): Nil
Co- requisite(s): Java Programming
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Learn about Object oriented programming concepts
B.	Learn how to use the JDK
C.	Improve their programming skills in core Java
D.	Use the Java packages, applets for software development
E.	Use the knowledge of object-oriented programming through Java

Course Outcomes

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

CO1	Elaborate the use of JDK of various versions for programming
CO2	Identify the latest know-how related to the new developments in the field of Java
CO3	Apply the knowledge gained for their project work as well as to develop some GUI applications.
CO4	Design solutions in JAVA
CO5	Apply features of Advanced Java through programming

SYLLABUS

1. WAJP to show the characteristic of a number. {E.g. 24 it has two coefficients 2 in tens position and 4 in units position. It is composed of 2 and 3. It is a positive number. Also show whether it is odd or even.
2. WAJP to take input through command line argument and do the following:
    a) Check whether the number is prime.
    b) Generate the reverse a number.
3. Write a menu driven program using switch in Java to perform following:
    a) For input of 1, check whether the number is prime
    b) For input of 3, find the factors of the number
    c) For input of 5, check the number is odd or even.
4. Write a program in Java to generate hexadecimal equivalent of a number without using array.
5. WAJP to take two number inputs through command line argument and do the following:

a) Check whether two numbers are prime to each other or not.
b) Find LCM of two numbers.

6. WAJP to create a class and exhibit the role of static functions (other than main) by declaring, defining and calling them.
7. WAJP to compute and display the count of occurrence of 4 in a number. E.g. 4564 will compute 2.
8. WAJP to take an angle value in degrees and then compute the equivalent radians and then prove $\sin^2\theta + \cos^2\theta = 1$, Note $180^o = \pi^c$.
9. WAJP to sort a list of numbers in ascending order.
10. WAJP to generate Pascal's Triangle using a square matrix.
11. Write a program in Java to take input of two 3×3 matrices through command line argument and then:
    a) Add them up and display the result
    b) Subtract them and display the result
    c) Multiply them and display product
12. WAJP to count the number of words, characters in a sentence.
13. Write a program in Java to take input of a sentence through command line argument and then count the number of words and vowels.
14. WAJP to handle the Exception using try and multiple catch block; the exceptions that you will handle are, number format error, array bound error and divide by zero.
15. WAJP to create a class called **Room** with two data member length and width and then implement constructor overloading in it.
16. Write a program in Java to explain the role of the following:
    a) Non-parameterized constructor
    b) Parameterized constructor
    c) Copy constructor (take input and display the output.)
17. WAJP to create a class called **Fraction** with data member numerator and denominator; take input (through command line argument) of two fractions and then add, subtract, multiply and divide, finally display the result in reduced term.
18. Write a program in Java to create a class for **Employee** having 2 data member code and name. Then create 3 classes **Officer**, **AdminStaff**and**MStaff**. The **Officer** class has data members designation and pay-scale; the **AdminStaff**has data members grade and pay-band; the **MStaff**has data member department and two sub-classes **Regular** and **Casual**. The **Regular** staff has data members level and consolidated-pay and **Casual** has data member daily-wage. Take all inputs through constructors and write appropriate methods for displaying one data for each type of class.
19. WAJP to design a class called **Account** using the inheritance and static that show all function of bank (withdrawal, deposit) and generate account number dynamically.
20. WAJP to design an application *Password.java* that produces and prints a random password depending upon name of an individual. If the input is Abdul Kalam then the password would be *33421LAM*. Note: take the first name A=1, B=2, D=4, U=21 where 2+1=3, and L=12, where 1+2=3; so the number comes to be *12433*, so u can find out.
21. WAJP to draw a format like

```
*
* * *

* * * * *

* * * * * * *
```

* * * * *

* * *

*

22. WAJP to take a string count all vowels and then delete the same from the string.
23. Write a **Patient** class which inherits from the **Person** class. Patient can again be of two types, indoor and outdoor. The Patient class requires the following:
    a) a variable to store the patient ID for the patient
    b) a variable to store the department of hospital
    c) a variable to store the ward of hospital
    d) a variable to store the patient 's date of joining the hospital
    e) a variable to store the patient 's address
    f) a variable to store the medical fees that the patient pays
    g) constructor methods, which initialize the variables
    h) a method to calculate the medical fees (for both indoor and outdoor patient)
24. WAJP to take a string as password and check whether it contains at least two numbers, 3 alphabets and no space in it. If any contrary throw message.
25. Write a program in Java to create a class called Rational having two data members for numerator and denominator. Take two inputs of rational numbers and perform multiplication and division. Display the result in reduced form.
26. Write a program in Java to print a format like, * * * * * * *

    * * * * *

    * * *

    *
27. Write a class called **Shape** which contains a user-defined interface for **Computation**, which contains methods for calculation of area, perimeter and volume. Write four classes for **circle, rectangle, sphere** and **rectangular parallelepiped**, and all these classes inherit from Shape. Now take input for the following:
    a) radius of circle and compute its area and perimeter
    b) Length and breadth of rectangle and compute its area and perimeter
    c) Length, breadth and height for **rectangular parallelepiped** and compute its area and volume
    d) Radius of sphere and compute its area and volume
    ** Area of circle= πr^2 , perimeter of circle= $2\pi r$, area of sphere= $4\pi r^2$, volume of sphere= $\frac{4}{3}\pi r^3$; volume of rectangular parallelepiped = $l * b * h$: area of rectangular parallelepiped= $2(l*b + b*h + h*l)$
28. Write a class called Employee, which requires the following:
    a) a variable to store the employee ID
    employee ID should be of format EMP**M**1234, EMP**S**1234, EMP**A**1234, EMP**C**1234, where M=manager, S=supervisor, A=analyst, C=clerk; number can be any no. but first three characters should be EMP
    b) a variable to store the employee name
    c) a variable to store department
    d) a variable to store city

e) a variable to store basic salary
f) a method to calculate the salary of employee
if the city is metro then the HRA would be 30% else 20%
if the employee ID contain M then DA would be 120%, if S then DA would be 110%, if A then DA would be 100%, and if C then DA would be 90%
g) constructor methods, which initialize the variables

29. WAJP to create 4 threads and show exhibit their execution after the call of the "start ( )" method.Write a program in Java to create 3 threads and exhibit their behaviour by changing their priorities in the "main" thread. Display the possible output.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Multithreading process in Java.
2. Detailed applet programming.
3. Handling available Java applications as case studies for better understanding.

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Concepts of multithreading in Java
2. Detailed knowledge on GUI designs in Java
3. Database connectivity with front end

POs met through Topics beyond syllabus/Advanced topics/Design

3, 4, 5, 6

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA208
Course Title: COMPUTER ALGORITHMS LAB
Pre-requisite(s): Data Structures
Co- requisite(s): Introduction to Computer Algorithms
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand basic algorithm designing techniques such as recursion, greedy, backtracking and branch and bound.
B.	To analyze the asymptotic performance of an algorithm.
C.	To demonstrate a familiarity with algorithms and data structures..
D.	To apply important algorithmic design paradigms and methods of analysis in solving real life problems.
E.	To Synthesize efficient algorithms in common engineering design situations.

Course Outcomes

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

CO1	Students will be able to have a clear understanding on solving the problems systematically.
CO2	Students will be able to make use of linear and non-linear data structures, like, graphs and trees while designing algorithms.
CO3	Students will be having a clear understanding of different design paradigms..
CO4	Students will be able to analyze and measure the efficiency of an algorithm
CO5	Students will have basic knowledge of fundamentals of algorithms which would help them to take up an advanced course in the same field.

SYLLABUS

1. Implement 'Binary' search and 'Linear' search and determine the time taken to search an element.
2. Implement the sorting of a given set of elements using the Heap sort method and determine the time taken to sort the elements.
3. Implement the sorting of a given set of elements using Merge sort method and determine the time taken to sort the elements.
4. Implement the sorting of a given set of elements using Selection sort and determine the time taken to sort the elements.
5. Implement the N-Queen problem using back tracking.
6. Implement All Pair Shortest paths problem using Floyd's Algorithm.
7. Implement the finding of shortest paths to other vertices using Dijkstra's algorithm for a weighted connected graph.
8. Implement the Kruskal's algorithm to find the Minimum Cost Spanning Tree.
9. Implement the Prim's algorithm to find the Minimum Cost Spanning Tree.
10. Implement the BFS and DFS tree traversal algorithms for a given tree.
11. Implement 0/1 knapsack problem.
12. Implement any scheme to find the optimal solution for the Traveling Sales Person problem.

Course Code: CA251
Course Title: WEB PROGRAMMING CONCEPTS
Pre-requisite(s): HTML, XML
Co- requisite(s): Web Programming Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn about basics of web programming
B.	Learn HTML, Java Script, XML for scripting
C.	Learn web based programming using ASP.NET
D.	Learn PHP based programming
E.	Learn Making static and dynamic websites

Course Outcomes

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

CO1	Know the fundamentals of web programming
CO2	Identify .NET technology and framework
CO3	Elaborate on the web based programming
CO4	Perform web based programming.
CO5	Design static and dynamic websites

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction to Internet and HTML**: Introduction to Internet, Internet Services, Web Server, Web Client, Domain Registration, Internet Security. HTML Tags, HTML Documents, Header Section, Body Section, Headings, Link Documents using Anchor Tag, Formatting Characters, Font tag, Images and Pictures, Listing, Tables in HTML, HTML iframes, HTML Forms.	**8**
Module – II **JavaScript:**Use of JavaScript in Web Pages, Advantages of JavaScript, Data Types, Variables, Operators and Expressions , Conditional Statements, Array Objects, Date Objects, String Objects**,** Type Casting,, Functions , DOM. Introduction to Javascript Frameworks, Library and Runtime Environment : React, Angular, Node.js, Express.js.	**8**
Module – III **Understanding XML:** Overview of XML, XML Families of Technology, Creating XML Documents, Rules for Well-Formed XML, Discerning Structure, Working with Mixed content, Adding Comments, CDATA Sections, Creating a DTD-The Concept of a Valid XML Document, Creating a DTD for an existing XML File.	**8**
Module – IV **ASP .NET:** Building Web Forms Using ASP .NET, Exploring ASP .NET Server Controls, Using ASP.NET Server Controls to Create Web Forms, Understanding the Code behind the Page. Using Validation Controls to Improve Web Forms.	**8**
Module – V **PHP:** Preparing the Use PHP, Exploring PHP for the First Time, Understanding PHP Basics, Displaying PHP Output, Managing PHP Program Flow. Planning a PHP Web Application, Creating and Using a Logon Window, Managing System Data, Updating a PHP Web Application.	**8**

TEXT BOOKS

1. Xavier C., "Web Technology & Design", New Age International Publishers, 1st Edn, New Delhi, 2004.
2. BaiXue, Ekedahl Michael, FarrellJoyce, GosselinDon, ZakDiane, KaparthiShashi, MacintyrePeter, Morrissey Bill, "The Web Warrior Guide to Web Programming", India Edition, Thomson Education.

REFERENCE BOOK

1. Ross Ivan Bay, "Web Enable Commercial Application Using HTML, DHTML", BPB Publication.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Detailed learning of HTML and XHTML
2. Detailed learning of JavaScript
3. Detailed learning of XML

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Concepts of XSLT
2. Knowledge about Active Server Pages
3. Designing interactive server pages

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 1

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA253
Course Title: PRINCIPLES OF SOFTWARE ENGINEERING
Pre-requisite(s):
Co- requisite(s): Principles of Software Engineering Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students :

A.	To understand the importance, limitations and challenges of processes involved in software development
B.	To gain knowledge of various software models.
C.	To learn about software requirements analysis and specification
D.	To gain knowledge of various software design activities
E.	To learn cost estimation, software testing, maintenance and debugging.

Course Outcomes

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

CO1	Identify the difference of software engineering discipline with the other engineering disciplines
CO2	Elaborate knowledge of various software models
CO3	Analyse about software requirements analysis and specification
CO4	Infer from knowledge of various software design activities.
CO5	Implement cost estimation, software testing, maintenance and debugging.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** The Software Engineering Discipline – Evolution and Impact, Programs vs. Software Products, Why Study Software Engineering? Emergence of Software Engineering, Notable Changes in Software Development Practices and Computer Systems Engineering. **Software Life Cycles Models:** Classical Waterfall Model, Iterative Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model and Comparison of Different Life Cycle Models	**8**
Module – II **Software Project Management:** Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO – A Heuristic Estimation Technique, Scheduling and Risk Management. **Requirement Analysis and Specifications:** Requirements Gathering and Analysis and Software Requirements Specification.	**8**
Module – III **Software Design:** What is a Good Software Design? Cohesion and Coupling, Neat Arrangement, **Software Design Approaches**, Object-Oriented vs. Function-Oriented Design, Overview of SA/SD Methodology, Structured Analysis, Data Flow Diagrams, Structured Design, **Object Modelling Using UML**: Overview, UML, UML Diagrams, Use Case Model, Class Diagrams Design Patterns, Object-Oriented analysis and Design Process	**8**
Module – IV **Coding and Testing:** Coding, Code Review, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Integration Testing and System Testing. **Software Reliability and Quality Management**: S/W Reliability, Statistical Testing, S/W Quality, S/W Quality Management System, ISO 9000, SEI CMM, Personal Software Process, Six Sigma	**8**
Module –V **Software Maintenance**: Characteristics, S/W Reverse Engineering, S/W Maintenance Process Models, Estimation of Maintenance Cost.	**8**

Text Books:

1. Rajib Mall, Fundamentals of Software Engineering, 4th Edition, PHI, 2014.

Reference Books:

1. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa, 2005.
2. Ian Sommerville, Software Enginnering, 9th Edition, Pearson Education, 2011.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. It is not possible to teach students all the methods and practices employed by practitioners.

2. Software engineering is dynamic disciplines that have continuous growth in research in identifying new methods, tools and methodologies that have cause vast improvement in software development and maintenance to be more reliable and efficient.

3. To improve the quality of software are increasing due to the competition in software industry and the complexity of software development

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. **Model-driven software development**
2. **Aspect-oriented software development**
3. **Software engineering for security**
4. **Metamodeling**
5. **UML profiles**

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2				2	2	3	3
CO2	3	1	1	1	1	3	1	1				2	2	3	2
CO3	2	3	3	1	2	1	2	2		1	1	2	3	2	3
CO4	1	1	3	3	1	1	1	1		1	1	2	3	2	2
CO5	3	3	3	1	2	1	1	2	1	1	1	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CDCode	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA252
Course Title: WEB PROGRAMMING CONCEPTS LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn about basics of web programming
B.	Learn HTML, Java Script, XML for scripting
C.	Learn web based programming using ASP.NET
D.	Learn PHP based programming
E.	Learn Making static and dynamic websites

Course Outcomes

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

CO1	Know the fundamentals of web programming
CO2	Identify .NET technology and framework
CO3	Elaborate on the web based programming
CO4	Perform web based programming.
CO5	Design static and dynamic websites

SYLLABUS

1. India is a large country. Different regions observe variations in climate. The spoken language of one state is quite different from that of another. They wear different types of garments. They celebrate different festivals and perform varied religious rites. People belonging to diverse cultures belong to different religious faiths. In spite of these diversities, Indians feel a sense of unity and oneness among them. Thus, we conclude that India is a land of Unity in Diversity.

a) All the headings should be H2 and green color.
b) Main heading should be H1 and center aligned.
c) The background should be yellow color.
d) There are 10 paragraphs so each of them should be made using P tag.
e) The Introduction and Conclusion paragraphs should have "Times New Roman" font, the size should be 12 and color should be blue.
f) All the remaining paragraphs text should be pink and magenta colored in an alternate way.
g) There should be one meaningful picture in the web page with specific dimension.

2. Create a webpage having a list as shown below:

Food
- **Fruit**
  - Apple
  - Mango
  - Pear
- **Vegetable**
  - Potato
  - Tomato
  - Carrot
- **Dress**
  - Ethnic wear
  - Kurta
  - Sherwani
  - Western wear
  - suit
  - jeans
- **Sports**

Indoor sports
- Carom
- Table tennis

Outdoor sports
- Cricket
- Hockey

3. Create a webpage with the following:

a) A superscript and subscript tag
b) Pre tag
c) Paragraph tag
d) Anchor tag
e) Image tag
f) Definition list tag

g) Marquee tag
h) Horizontal line tag
i) Break tag
j) Heading tag

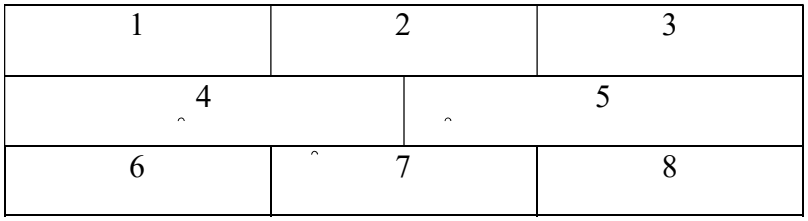
4. Create a webpage having 10 divisions each having separate background color and text color using <DIV> tag. At the top right corner there should be an image hyperlink opening in a new webpage.
5. Create a webpage with a form loaded into it and take input of three strings through three textboxes and then concatenate them without using any built-in function.

6. Create a webpage with two tables. First one should have 1 row and 5 columns and the second one with 3 rows and 4 columns. The contents of the first table should be center aligned and contents of the second table should be right aligned. Each column of the first table should have separate colors and each row of the second table should have separate colors.

7. Write a JavaScript program to calculate and display the aggregate and percentage of three subjects' (Physics, Chemistry and Mathematics) marks along with the name of a student. The name and individual marks input shall be taken by textbox in the webpage.

8. Write a JavaScript program to search the element 4 in the array [2, 6, 4, 10, 4, 0, -2] using any method.

9. Create a framed webpage with different frames as below:



Contents of 1st, 3rd, 5th, 7th frame should be same again 2nd, 4th, 6th and 8th should be same.
10. Create a webpage to take input of a string and check whether it is a palindrome or not.
11. Write a program using JavaScript to display a structure as given below:

*
* *
* * *
* * * *
* * * * *
12. Write a program using JavaScript to take input of an array of numbers like [-4, 5, 6, -1, 10] and then sort it in descending order.
13. Create a webpage to take input of a string and reverse that without using any user defined function.
14. Write a JavaScript program to search 10 in the array [2, 6, -5, 10, 11, 0, -2] using a binary search method.
15. Write a JavaScript program to take two arrays like [3, 7, 1, 6, 2, 3] and [5, 6, 0, -3] and merge them into third array along with that remove the repetitive elements.
16. Write a JavaScript program to calculate the percentage of three subjects' (English, Mathematics, and

Science) marks along with the name of a student. The name and individual marks input shall be taken by form in the webpage.

17. Create a webpage to take input of a string and count the number of vowels in it.
18. Create a webpage to take input of two strings and concatenate them without using any built-in function.
19. Create a webpage to take input of a string and then slice it into three separate strings and display that.
20. Write a JavaScript program to take two arrays like [1, 3, 8, 1, 6, 2, 3] and [2, 1, 5, 6, 0, -3] and merge them into third array along with that remove the repetitive elements.
21. Write a JavaScript program to calculate and display the aggregate and percentage of three subjects' (Physics, Chemistry and Mathematics) marks along with the name of a student. The name and individual marks input shall be taken by textbox in the webpage.
22. Create a webpage to take input of a string and check whether it is a palindrome or not.

TEXT BOOK:

1. C. Xavier, Web Technology & Design, New Age International Publishers, 1st Edn, New Delhi, 2004.

REFERENCE BOOK:

1. Ivan Bay Ross, Web Enable Commercial Application Using HTML, DHTML, BPB Publication.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

a) Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA254
Course Title: PRINCIPLES OF SOFTWARE ENGINEERING LAB
Pre-requisite(s):
Co- requisite(s): Principles of Software Engineering
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand the concept of UML
B.	To gain knowledge of various diagrams.
C.	Learn about software requirement specification.
D.	To gain knowledge about software design specification
E.	To learn about the relationships among different UML diagrams.

Course Outcomes

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

CO1	Identify the software requirement capturing process.
CO2	Elaborate knowledge about dynamic view of system.
CO3	Analyse about static view of software system.
CO4	Analysis about the relationship among static and dynamic view of system.
CO5	Identify the process of deployment of software system

SYLLABUS

List of Programs as Assignments

1. Draw use case diagram for online banking system.
2. Draw use case diagram for online library system
3. Draw use case diagram for online railway reservation system
4. Draw use case diagram for employee information system.
5. Draw use case diagram for inventory control system
6. Draw use case diagram for student information system.
7. Draw use case diagram for online hotel management system.
7. Draw use case diagram for online bus reservation system.
8. Draw use case diagram for online course registration system

Draw use case diagram for online teacher information system.

9. Draw sequence diagram for online banking system.
10. Draw sequence diagram for online library system.
11. Draw sequence diagram for online railway reservation system.

12. Draw sequence diagram for employee information system.
13. Draw sequence diagram for inventory control system.
14. Draw sequence diagram for student information system.
15. Draw sequence diagram for online hotel management system.
16. Draw sequence diagram for online bus reservation system.
17. Draw sequence diagram for online course registration system.
18. Draw sequence diagram for online teacher information system.
19. Draw activity diagram for online banking system.
20. Draw activity diagram for online library system.
21. Draw activity diagram for online railway reservation system.
22. Draw activity diagram for employee information system.
23. Draw activity diagram for inventory control system.
24. Draw activity diagram for student information system.
25. Draw activity diagram for online hotel management system.
26. Draw activity diagram for online bus reservation system.
27. Draw activity diagram for online course registration system
28. Draw activity diagram for online teacher information system.
29. Draw class diagram for online banking system.
30. Draw class diagram for online library system
31. Draw class diagram for online railway reservation system
32. Draw class diagram for employee information system.
33. Draw class diagram for inventory control system
34. Draw class diagram for student information system.
35. Draw class diagram for online hotel management system.
36. Draw class diagram for online bus reservation system.
37. Draw class diagram for online course registration system .
38. Draw class diagram for online teacher information system

TEXT BOOKS:

1. MallRajib, "Fundamentals of Software Engineering", PHI, 2005.

REFERENCE BOOKS:

1. Pressman, "Software engineering A Practitioner's Approach", MGH**.**

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Estimation of software scope feasibility and resources.
2. Develop architectural diagram, and implement by following coding principles.
3. Apply testing strategies and handle software product maintenance issues.

POs met through Gaps in the Syllabus

3, 4, 2

Topics beyond syllabus/Advanced topics/Design

1. Gather and analyze system requirements

2. Develop process models and process system models
3. Translating design into coding.
4. Applying different testing stategies

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment
1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	3
CO2	3	3	3	1	3	1	1	1				2	3	2	3
CO3	3	3	3	3	3	1	2	2		1	1	2	3	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials		

	and Internets		
CD9	Simulation		

Course Code: CA305
Course Title: COMPUTER GRAPHICS
Pre-requisite(s):
Co- requisite(s): Computer Graphics Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Acquire fundamental knowledge of role of graphics in computer science.
B.	Learn various object modelling algorithms and computations related to it.
C.	Learn to model and colour 2D and 3D objects
D.	Learn to develop simple Graphical User Interface
E.	Learn about graphics system and corresponding display methodologies.

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

CO1	Can perform visual computations for geometrical drawings.
CO2.	Can model 2D objects.
CO3.	Apply geometrical transformation of the modelled objects.
CO4.	Can develop simple Graphical User Interface.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction to Graphics Systems**: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard Copy Devices, Graphics Software. Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality Systems	**8**
Module – II **Output Primitives**: Points and Lines, Line Drawing Algorithms (DDA and Bresenham's Algorithms), Loading the Frame Buffer, Circle Generating Algorithm, Filled Area Primitives – Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Color Tables.	**8**
Module – III **2D Transformation and Viewing**: Basic Transformations, Matrix Representations and Homogeneous Coordinates, Composite Transformations (Translations, Rotations, Scalings), Other Transformations (Reflection and Shear), The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to- Viewport Coordinate Transformation, Clipping- Point, Cohen-Sutherland Line Clipping and Sutherland- Hodgeman Polygon Clipping.	**8**
Module – IV **Three-Dimensional object representation:** ● Polygon Surfaces, Polygon Tables, Plane Equations, PolygonMeshes, ● Curved Lines and Surfaces,Quadric Surfaces, Sphere, Ellipsoid **Three-Dimensional Geometric and Modeling Transformations:** ● Translation, Rotation, Scaling, Other Transformations --Reflections, Shears	**8**
Module – V **Three-Dimensional Viewing:** Viewing Pipeline, Projections-Parallel Projections, Perspective projections. Three-Dimension clippings. **Visible-Surface Detection Methods:** Classification of Visible-Surface Detection Algorithms -- Back-Face Detection, Depth-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method.	**8**

TEXT BOOKS

1. HearnD. andBakerM. P., "Computer Graphics: C Version", 2nd Edition, Pearson Education, 2007.
2. BufordJ. F. K., "Multimedia Systems", 1st Edition, Pearson Education,2005.

REFERENCE BOOKS

1. FoleyJ. D., DamA. Van, Feiner S. K. and HughesJ. F., "Computer Graphics: Principles and Practice in C", 2nd Edition, Pearson Education,2000.

ParekhR., "Principles of Multimedia", 2nd Edition, Tata McGraw Hill,2012.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CDCode	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA307
Course Title: INTRODUCTION TO COMPUTER NETWORKS
Pre-requisite(s):
Co- requisite(s): Computer Networks Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To build an understanding of the fundamental concepts of the data communication model and communications architecture.
B.	To study characteristics of communication mediums and the characteristics of signals propagated through different transmission media, including concepts of transmission impairments.
C.	To understand the basic principles of signal encoding techniques, error- detection, and error-correction techniques.
D.	To understand techniques for flow control and multiplexing for maximum utilization of bandwidths in the data communications process.
E.	To understand the various switching techniques and routing techniques for efficient transmission.

Course Outcomes

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

CO1	Understand and be able to explain the principles of a layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.
CO2	Understand, explain and calculate digital transmission over different types of communication media.
CO3	Understand, explain and solve mathematical problems for data-link and network protocols.
CO4	Describe the principles of access control to shared media and perform performance calculations.
CO5	Understand and explain the principles and protocols for route calculations and be able to perform such calculations.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Network**: Needs and **Adv**antages, Network Hardware, Network software, Classification of Networks: LAN, MAN, WAN, Network Topology: Bus, Star, Ring, Star bus, Star ring, Mesh – Features, Advantages and disadvantages of each type.	**8**
Module – II **Transmission Media**: Wired & Wireless transmission, properties &speciality of various media, **Connectivity Devices**: Modem, Repeater, NIC, Network adapters, Connectors, Transceiver, Hub, Bridge, Switches, Routers and Gateways, **Network Architecture**: Layering and Design, OSI Reference Model, TCP/IP Model, SNA	**8**
Module – III **Physical Layer**: Functions and Services, Interface: EIA 232 D Interface, DTE/DCE Interface, Null Modem, Physical Layer Standard. Multiplexing: FDM & TDM	**8**
Module – IV **Data Link Layer**: Functions, Error control: Error Detection and Correction Techniques), Flow Control: Stop and Wait & Sliding Window Flow controls. Protocols: HDLC. **Network Layer**: Need and Services, Internetworking Principles, Internet Protocol(IPv4), Routing, Congestion Control.	**8**
Module – V **Local Area Network**: Ethernet, Fast Ethernet, Token Rings, FDDI, ATM, IEEE 802 standards: 802.3, 802.4, 802.5 **Network Security:** Network security issues, approaches to network security, hacking. Firewalls: types of firewall technology- network level and application level, limitations of firewalls. Encryption and Decryption (Basic concepts)	**8**

TEXT BOOK

1. Tanenbaum Andrew S, “Computer Networks”, Pearson Education, New Delhi.

REFERENCE BOOKS

1. ComerD E, “Computer Networks and Internet”, 2nd Edition, Pearson Education, NewDelhi.
2. GuptaPrakash C, “Data Communication & Computer Networks”, PHI, New Delhi.
3. Forouzan B., “Data Communications and Networking”, 3rd edition, Tata McGraw-Hill Publications.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher’s Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA306
Course Title: COMPUTER GRAPHICS LAB
Pre-requisite(s):
Co- requisite(s): Computer Graphics
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A	To learn computer graphics by practical
B	To Learn coding for various graphics tools.
C	To learn the various theory by implementation using programming
D	To identify the limitations of C Language for graphics related problem.
E	To know the practical application of computer graphics.

Course Outcomes

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

CO1	To code programs efficiently.
CO2	To translate the graphics algorithm to programs.
CO3	To test and execute the graphical syntax and logical errors.
CO4	To apply programming to solve simple graphical problems using functions.
CO5	To write the C program efficiently for transformation problems.

SYLLABUS

Write programs using ***C language***

1. To get the background color.
2. To set the background color.
3. To plot a point of co-ordinate (100,100).
4. To draw a line using the line function.
5. To draw a line using the line function. Take the end co-ordinates from the user.
6. To draw a triangle using the polygon function.
7. To draw a polygon of ‘n’ edges using polygon function.
8. To draw a polygon of ‘n’ edges taken from the user using the polygon function.
9. To draw a circle using the circle function.
10. To draw a circle of radius ‘r’ taken from the user using the circle function.

11. To draw a line using dda algorithm.
12. To draw a line using bresenham's line algorithm.
13. To draw a circle using midpoint circle algorithm.
14. To draw a line using bresenham's line algo, where end points are taken from the user.
15. To draw a line using ddaalgo, where end points are taken from the user.
16. To draw 'n' concentric circles taken from user using midpoint algorithm.
17. To create a line and translate it.
18. To create a line and increase its size with a value taken from user.
19. To create an equilateral triangle.
20. To draw a line and rotate it with angle of 45.
21. To create a circle and translate it.
22. To create a circle and translate it with a value taken from user.
23. To create an equilateral triangle and rotate it with angle of 45.
24. To create an equilateral triangle and create reflection.
25. To scale a rectangle.
26. To shear a rectangle. take the shear factor from the user.
27. To create an equilateral triangle and translate, rotate and scale it.
28. To draw a line with shear and translation.
29. Draw bar chart.
30. Draw pie chart.

TEXT BOOK

1. Roger T. Stevens, Advanced Graphics Programming in C and C++, BPB Publication
2. Donald Hearn, M. Pauline Baker, Computer Graphics, C Version, Prentice Hall Publication
3. https://www.programmingsimplified.com/c/graphics.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA308
Course Title: COMPUTER NETWORKS LAB
Pre-requisite(s):
Co- requisite(s): Computer Networks
Credits: 2 **L:** 0 **T:** 0 **P:**4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A	To familiarize the student in introducing and exploring various Network topologies and networking protocols.
B	To understand the use of client/server architecture in application
C	To enable the student on how to approach for networking problems using networking simulation tools.
D	To Design reliable servers using both TCP and UDP sockets
E	Familiar with network tools and network programming.

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

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple client-server architecture-based solutions that meet a specific set of criteria.
CO4	Identify the elements of a communication network
CO5	Simulate various OSI layer protocols using C/C++/ Java

SYLLABUS
1. To familiarize with the Lab Network Topology, locating different interfaces, routers and switches.
2. Study different pools of IP addresses.
3. To learn and observe the usage of different networking commands e.g. hostname, ipconfig, arp, nbstat, netdiag, netstate, nslookup, ping, tracert, pathping, route, etc. Learning remote login using telnet session. Measuring typical average delays between different locations of the network.
4. Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.
5. "Ping" is a command used to determine if a server is responding and to estimate the roundtrip time of a message sent to that server. Use the ping command for the following URLs and record the success or failure statistics along with the average round trip time.

a. google.com
b. msn.com
c. bitmesra.ac.in

6. Trace the route that is taken when you try to access:

a) google.com b) msn.com c) bitmesra.ac.in

7. Learn basic networkingcommands on Linux / Unix and other operating systems.
8. Write a program to determine if the IP address is in Class A, B, C, D, or E.
9. Write a program to translate dotted decimal IP address into 32 bit address.
10. Write a program to perform bit stuffing and de-stuffing
11. Write a program to get the ip address and host name for a given URL.
12. To implement socket programming, write a program to display date and time fromserver to client using TCP Sockets.
13. Write a program to send a message from server to client using UDP Sockets.
14. Write a program to send and receive a message from Server to Client and vice a versa using TCP socket.
15. Write a program to implement an echo server.
16. Write a program to simulate address resolution protocol (ARP).
17. Write a program to simulate reverse address resolution protocol (RARP).
18. Write a program to execute a command on remote server, issued by a client.
19. Write a program to generate the digital waveform for a given bit string using following digital encoding schemes:
    a. NRZ – L
    b. NRZ – I
    c. Bipolar AMI
    d. Pseudo ternary
    e. Manchester
    f. Differential Manchester
20. Write a program to generate the VRC-LRC code for a given message. Introduce an error (Single bit/ Multiple bit) at random location in the message and detect the error.
21. Write a program to generate the Checksum code for a given message. Introduce an error at random location in the message and verify that you can detect the error.
22. Write a program to generate the CRC code for a given message and CRC polynomial. Introduce a single bit error at random location in the message and verify that you can detect the error.
23. Write a program to implement the Hamming Code method for error detection and error correction.
24. Write a program to compute the least cost path from a user specified source node to all other nodes for a given network using Dijakstra's algorithm. Display the path and path cost for each node.
25. Write a program to compute the least cost path from a user specified source node to all other nodes for a given network using Bellman-Ford's algorithm. Display the path and path cost for each node.
26. Write a program to simulate the Stop & Wait automatic repeat request (ARQ) protocol for a randomly generated sequence of frames and acknowledgments with error.
27. Write a program to simulate the Sliding Window automatic repeat request (ARQ) protocol for a randomly generated sequence of frames and acknowledgments with error.
28. Create a socket program for HTTP web page upload and download
29. Take a 64 bit plain text and encrypt the same using DES algorithm.
30. Write a program to break the above DES coding.
31. Using RSA algorithm encrypts a text data and Decrypt the same.

Books recommended:

1. William Stallings, Data and Computer Communication, Prentice Hall of India.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill.
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Applications of various protocols e.g., FTP, MIME, SNMP
2. Routing in switched networks
3. Simulations of LAN
4. Secure communication

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Cellular wireless networks
2. Internet applications
3. High Speed LANs

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	%Contribution during CO Assessment
Day to day performance &Lab files	30
First Quiz	10
Viva	20
Examination Experiment Performance	30
Second Quiz	10

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA351
Course Title: INTRODUCTION TO DISTRIBUTED COMPUTING
Pre-requisite(s): Computer Network, Operating System
Co- requisite(s): Distributed Computing Lab
Credits: 3 L:3 T:0 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	Know about Different forms of Computing.
B.	Understand Interprocess Communications.
C.	Learn and understand Distributed Computing Paradigms.
D.	Know about The Client Server Paradigm.
E.	Implement Distributed Objects.

Course Outcomes

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

CO1.	Justify the presence of concurrency within the framework of distributed system.
CO2	Explain the range of requirements that modern distributed systems have to address.
CO3	Describe how the resources in a parallel and distributed system are managed by software
CO4	Understand the memory hierarchy and cost-performance trade-offs.
CO5	Explain what virtualization is and how it is realized in hardware and software.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Distributed Computing Concept:** Definitions, The history of distributed computing, Different forms of computing, The strengths & weaknesses of distributed computing, Basics of operating systems, Network basics, Software engineering basics. Event synchronization, Timeouts and threading, Deadlocks, Data representation, Data marshalling, Event diagram and sequence diagram.	**8**
Module – II **Distributed Computing Paradigms:** Paradigms and Abstraction, Message Passing, The Client-Server Paradigm, the Message System Paradigm, Remote Procedure Call Model, RMI, The Distributed Objects Paradigm, The Object space, The Mobile Agent Paradigm.	**8**
Module – III **The Socket API:** The Socket metaphor in IPC, The Datagram Socket API, The Stream-Mode Socket API, Sockets with nonblocking I/O Operations, Secure Socket API. The client server paradigm issues, connection-oriented and connectionless servers, Iterative server and concurrent server, stateful server and stateless server.	**8**
Module – IV **Distributed Objects:** Remote Procedure Calls, Distributed Objected Systems, Remote Method Invocation, The Java RMI Architecture, The API for the Java RMI, RMI Security Manager, Comparison of RMI and Socket APIs.	**8**
Module – V **Group Communication:** Unicasting versus Multicasting, Multicast API, Connectionless versus Connection-oriented Multicast, Reliable Multicasting versus Unreliable Multicasting, The Java Basic Multicast API.	**8**

TEXT BOOK

1. Liu M. L., "Distributed Computing: Principles and Application", Pearson Education, 2008.

REFERENCE BOOK

1. AltiyaH.,WelchJ., "Distributed Computing Fundamentals, Simulations and Advanced Topics", 2nd edition, Wiley – India Edition, 2006.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Load balancing has not been addressed.
2. RMI technology has not be discussed in detail.

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA353
Course Title: DATA MINING AND WAREHOUSING
Pre-requisite(s):
Co- requisite(s): Data Mining Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the need of data mining activities.
B.	Identify the methods of pre-processing data and performing activates related to ETL.
C.	Know the various applications of data mining.
D.	To familiarize the concepts of Data mining
E.	To decide what data mining activities are required to obtain the desired objectives.

Course Outcomes

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

CO1	Identify data mining related applications and activities
CO2	Assess the problem and decide what data mining activities are required to obtainthedesired objectives.
CO3	Mathematically perform pre-processing operations on datasets to ensure the validity of the data is improved.
CO4	Analyse and evaluate algorithms for performing common data mining
CO5	Apply Data mining methods for performance and optimization issues

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** What is data mining? Motivating challenges. The origins of data mining. Data mining tasks. Data: Types of Data. Attributes and Measurement. Types of Data Sets. Data Quality Measurement and Data Collection Issues. Basics. Similarity and Dissimilarity between Simple Attributes. Dissimilarities between Data Objects. Similarities between Data Objects. Examples of Proximity Measures. Issues in Proximity Calculation. Selecting the Right Proximity Measure.	**10**
Module – II **Association Analysis:** Basic Concepts and Algorithms Preliminaries. Frequent Itemset Generation. The Apriori Principle. Frequent Itemset Generation in the Apriori Algorithm.	**5**
Module – III **Cluster Analysis:** Basic Concepts and Algorithms. What is Cluster Analysis? Different Types of Clustering. Different Types of Clusters. K-means. Basic K-means Algorithm. Basic Agglomerative Hierarchical Clustering Algorithm. Key Issues in Hierarchical Clustering.	**8**
Module – IV **Classification:** Basic Concepts and Techniques. General Framework for Classification. Decision Tree Classifier. A Basic Algorithm to Build a Decision Tree. Methods for Expressing Attribute Test Conditions. Algorithm for Decision Tree Induction. Characteristics of Decision Tree Classifiers.	**10**
Module – V **The Data Warehouse**: The Structure of the Data Warehouse, Subject Orientation, Day 1-Day n Phenomenon, Granularity, Exploration and Data Mining, Living Sample Database, Partitioning as a Design Approach, Structuring Data in the Data Warehouse, Auditing and the Data Warehouse, Cost Justification, Data Homogeneity/Heterogeneity, Purging Warehouse Data. What is Granularity? Discuss levels of Granularity.	**7**

TEXT BOOK

1. Tan Pang-Ning, Steinbach Michael, and Kumar Vipin , "Introduction to Data Mining", Pearson Education, New Delhi.
2. W. H. Inmon, Building the Data warehouse, 3rdEdn, Wiley Dreamtech India (P) Ltd., 2003.

REFERENCE BOOKS

1. Han Jiawei &Kamber Micheline, "Data Mining Concepts & Techniques", Publisher Harcourt India.
2. Private Limited, Second Edition
3. Dunham H.M. & Sridhar S., "Data Mining", Pearson Education, New Delhi, 2006.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Use of massive data to implement all the data mining concepts.
2. Interaction with domain knowledge concepts with the actual algorithmic implementation.
3. Handling various data using same data mining algorithms.

POs met through Gaps in the Syllabus

1, 3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1.Text Mining
2.Outlier Mining
3. Advanced clustering algorithms

POs met through Topics beyond syllabus/Advanced topics/Design

1, 2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA 352
Course title: DISTRIBUTED COMPUTING LAB
Pre-requisite(s):
Co- requisite(s): Distributed Computing
Credits: 2 L 0 T:0 P: 4
Class schedule per week: 04
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

1	To familiarize the student in introducing and exploring variousnetworking protocols
2	To understand the use of client/server architecture in applications using networking simulation tools.
3	To Design reliable servers using both TCP and UDP sockets
4	To Design Object-oriented Paradigm
5	Familiar with network tools and network programming in Object-oriented environment.

Course Outcomes

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

CO1	Express programming & simulation for networking problems.
CO2	Get a thorough understanding of various aspects of networking devices
CO3	Design and implement simulation of a simple LAN and a WAN that meet a specific set of criteria.
CO4	Identify the elements of distributed environment
CO5	Simulate various OSI layer protocols using C/C++/ Java

SYLLABUS

List of Programs as Assignments:
Lab Assignment No: 1

1. Implement concurrent echoclient-server application.
2. Implement concurrent day-time client-server application.

Lab Assignment No: 2

3. Implementation of Sub-netting and Super-netting.
4. Write a C/C++ program to determine if the IP address is in Class A, B, C, D, or E.

Lab Assignment No: 3

5. Write a program to send message from client to server and server to client using TCP client/server communication.
6. Write a program to send message from client to server and server to client using UDP client/server communication.

Lab Assignment No: 4

7. Write a program to send message from server to multiple clients using Socket Programming.

Lab Assignment No: 5

8. Configure following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY
9. Incrementing a counter in shared memory.
10. Trace the route that is taken when you try to access:
    a) google.com b) msn.com c) bitmesra.ac.in

Lab Assignment No: 6

11. Write a program to implement RPC (Remote procedure call)
12. The socket server will return your full name (e.g., Yih-Feng Hwang) to a client when the socket server receives any request from the client.

Lab Assignment No: 7

13. Write a program to implement EchoClient and Echoserver program using TCP and UDP sockets.

Lab Assignment No: 8

14. Create a socket program for HTTP web page upload and download
15. Write a program to translate dotted decimal IP address into 32 bit address.

Lab Assignment No: 9

16. Create CORBA based server-client application.
17. Write a program to implement Daytime Server and Client using RMI

Lab Assignment No: 10

18. Write a program to implement reliable multicast API.
19. Take a 64 bit plain text and encrypt the same using DES algorithm.

Books recommended:

1. M. L. Liu, Distributed Computing :Principles and applications, Pearson Publications
2. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.
3. William Stallings, Data and Computer Communication, Prentice Hall of India.

Gaps in the Syllabus (to meet Industry/Profession requirements)

5. Applications of various protocols e.g., FTP, MIME, SNMP

6. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, and distributed file systems
7. To analyze the current popular distributed systems such as peer-to-peer (P2P) systems.
8. Secure communication

POs met through Gaps in the Syllabus
7, 13, 18

Topics beyond syllabus/Advanced topics/Design
4. Cellular wireless networks
5. Internet applications
6. High Speed LANs

POs met through Topics beyond syllabus/Advanced topics/Design
3, 8, 9, 19

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	%Contribution during CO Assessment
Day to day performance &Lab files	30
First Quiz	10
Viva	20
Examination Experiment Performance	30
Second Quiz	10

Indirect Assessment
1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
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CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	**CO1**	CD1, CD8
CD2	Tutorials/Assignments	**CO2**	CD1, CD8 and CD9
CD3	Seminars	**CO3**	CD1, CD2 and CD5
CD4	Mini Projects/Projects	**CO4**	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	**CO5**	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code : CA 354
Course Title: DATA MINING LAB
Prerequisite(s): Basic Programming
Co- requisite(s): Data Mining
Credits: 2 **L:**0 **T:**0 **P:**4
Class Schedule per week: 04
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives
This course envisions to impart to students

A.	To know about the data wrangling and ETL process
B.	Different categories of datasets, datatypes, and attribute-types
C.	Understand the techniques of different data mining functionalities
D.	Real life applications of data mining functionalities
E.	Learn contemporary tools to implement the related processes and algorithms

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

CO1	Basics of suitable tool to implement the data wrangling and ETL process
CO2	Methods and metrics of descriptive and visual data analysis
CO3	Implement the techniques of different data mining functionalities using suitable packages/ libraries/ tools
CO4	Conduct projects to solve real life problems using the data mining methods and tools

Modules

Module1.Descriptive Statistics, Visualization and ETL Process:
Descriptive statistics measures: measures of central tendency- mean, median, mode, quartiles, range; measures of dispersion- standard .deviation; skewness; kurtosis; Bivariate statistical measures- correlation Data visualization: histogram, frequency polygon, boxplot, bar plots, pie chart (2D and 3D), ogive plot, scatterplot, Time-series plot (histogram)

Module 2. ETL Process and data wrangling:
Data Cleaning- missing values and noise handling; Combining information from multiple files; Splitting data into relevant portions

Module 3. Supervised Techniques:
Classification and Prediction using K-Nearest-Neighbor; Classifying with Probability Theory; Naïve Bayes; Building Decision Trees; Classification using neural network; Regression models

Module 4. Unsupervised Learning:
Clustering using K-Means, K-medians; Hierarchical Clustering and dendrogram plot; Principal Component Analysis and Dimensionality Reduction

Module 5: Association Mining:
Apriori Algorithm of association mining, Association rule-based classification
Assignments -Possible Applications (covered throughout the course)
- Collaborative Recommender Systems
- Text Categorization
- Predictive User Modeling
- Concept Discovery from Documents
- Finding groups using social or behavioral data
- Building predictive models for target marketing
- Customer or user segmentation

Sample Exercises
It is expected that student should implement concept of Data Mining and Warehousing. The open source ETL Tools like RapidMiner/ Weka and data mining packages available in Python/ R etc. can be used to implement the concept of Data Mining and Warehousing. Some examples are as follows (Subject Teacher may add more):
1. Demonstration of any ETL tool.
2. Write a program of Apriori algorithm using any programming language.
3. Create suitable data-set and demonstrate preprocessing using suitable tool.
4. Demonstration of Association rule process on suitable data-set using Apriori algorithm.
5. Demonstration of classification rule process using decision tree algorithm.
6. Demonstration of classification rule process using Naive Bayes algorithm.
7. To classify the data with Neural Network Algorithm using Multilayer Perceptron.
8. Demonstration of prediction using regression algorithm.
9. Demonstration of clustering rule process on data-set iris.using simple k-means.
10. Demonstration of clustering rule process on data-set iris. usingK-medoids Clustering .
11. To Demonstrate Clustering features in Large Databases with noise

Reference Books
1. Learning Data Mining with Python, second edition, Robert Layton, OReilly
2. Data Mining for Business Analytics,GalitShmueli, Peter C. Bruce, Peter Gedeck, Nitin R. Patel, OReilly, Wiley Publication

Gaps in the Syllabus (to meet industry / Profession requirements)
1.Use of massive data to implement all the data mining concepts
2. Handling various data using same data mining algorithms
3. Exposure to domain knowledge with the actual algorithmic implementation

Tools beyond syllabus
1. Implementation of Big data using given tool
2. Implementation of advanced graphical tools

POs met through Topics beyond syllabus

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	%Contribution during CO Assessment
Day to day performance &Lab files	30
First Quiz	10
Viva	20
Examination Experiment Performance	30
Second Quiz	10

Indirect Assessment

1. Students' feedback on course outcome

Mapping between COs and Course Delivery (CD) methods

Course Outcome	Program Outcome												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulations		

PROGRAM ELECTIVES
(LIST OF SKILL ENHANCEMENT COURSES)

Course Code: CA212
Course Title: OFFICE AUTOMATION TOOLS LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn automation tools
B.	To understand the basic of basic technology
C.	To learn the problem-solving process through computer.
D.	To know the limitations of automation
E.	To know the practical application of various automation tools

Course Outcomes

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

CO1	To solve real time problems using automation tools
CO2	To translate the real time problem into automation problem
CO3	To analyse the basic application of automation tools.
CO4	To apply different tools for different automation problems
CO5	To decompose a real-time problem into a small automation problems.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **COMPUTER SCIENCE & OPERATING SYSTEMS (WINDOWS/LINUX)** 1. **Types of Computer:** Analog, Digital, and Hybrid type, Hardware, Software, System software, Application software, Stored Program Concept and Von Newman Architecture, Firm ware, Human ware, Stored Program Concept, Evolution of computers, Generation of computer. 2. **Data Processing:** Data collection, Classifications, Sorting and Merging, Processing, Summarizing Storing. 3. **Data Organisation:** Organization Data, Character, Field, Record, File, Database, Sequential Access, Random Access, Indexed Sequential Access. 4. **Data Communication:** Local Area Network, Wide Area Network, Satellite Communication, Internet. 5. **Operating System:** Introduction, Different Operating Systems, Loading and Quitting the Operating Systems Important DOS/Windows/Linux Commands.	**10**
Module – II **WINDOWS/Linux** 1. Windows Introduction, 2. Concepts different Operating System GUI/CUI. 3. Desktop Icons. (Windows / Desktop Linux) 4. My Computer, Recycle Bin, Internet Explorer, Network Neighbourhood, My Documents 5. Working with windows: How to create a Folder, Copying and cutting files, Renaming 6. Programs, Favourites, Documents, Settings, Find, Run, Shut down 7. APPLICATION ICONS 8. Introduction to Output Devices	**10**
Module – III **PERSONAL COMPUTER SOFTWARE TOOLS (MS WORD, EXCEL AND POWERPOINT)** 1. Open Office Word Processing using MS WORD: An introduction to MS-Word / ON INTRODUCTION TO WORD/Writer. 2. The Word work space, Starting and quitting word, Creating and Manipulating Various documents, Editing of proofing files, Merging documents and macros. 3. How to use Mouse and Menu, Working with dialog box 4. Primary Command in File Menu: The Open Commands, The File name	**7**

commands, The New commands, The Save, Save As, and Save all commands, The Close command, The Page setup, The Print commands, The Exit commands 5. Edit Menu commands: The Cut, Copy, and Paste commands, The Undo and Repeat commands 6. Format commands: Font commands, Paragraphcommands 7. Other Menu: The view menu, The Insert menu, The tool menu, The table menu, The Window menu	
Module – IV **EXCEL** 1. BUILDING A SIMPLE WORKSHEET 2. Entering Text, Entering Values, Entering Dates and Times, Moving Around, Selecting Ranges, Using Menu, Using 3. Tool Bar, Using Shortcut Menus, Changing Entries, Copying Entries, Moving Entries, Inserting and Deleting cells 4. FORMATTING BASICS 5. Changing Character Style, Changing Alignment, Changing Column Width 6. WORKING WITH MULTIPLE WORKSHEET 7. Copying entries between work books, Moving sheets between work books, Deleting sheets, Quitting Excel 8. OPENING EXISTING WORKBOOKS 9. Simple calculations, Doing Arithmetic, Totaling column of values, Naming cells and Ranges 10. FORMATTING TEXT 11. Displaying dollars and cents, Formatting decimal places, dates Format, Copying style and formats 12. FORMULAS THAT MAKE DECISIONS 13. Using the IF function, Using the nested IF function, Copying formulas 14. Checking Spelling, Printing Worksheets, Preview Worksheets, Setting up the pages, 15. Sorting data, Keeping Leading in View, Finding records, Adding and deleting Records, Filtering Records 16. Plotting charts, Sizing and moving charts, Updating charts, changing the chart type, Using chart auto format 17. Creating Macros, Recording Macros, Running Macros	**8**
Module – V **POWER POINT** 1. Main Features of Power Point 2. MAKING THE PRESENTATION 3. Creating Template with the Auto Content Wizard. Creating a Presentation with a Template. Creating a presentation from Scratch 4. DIFFERENT VIEWS 5. Normal Slide, Outline, Slide Sorter, Slide Show, Notes, Slide Master 6. ANIMATION, ART AND SOUND 7. Controlling Transitions between slides. Animating Different Parts of a slide. Inserting a Motion Clip. Including	**5**

8. Sounds in slides. 9. INCLUDING GRAPHS, CHARTS, TABLES AND COLUMNS 10. Organization Chart Slide, Creating a table Slide. Creating two column Slide, Module 1: Showing A Presentation, 11. Rehearsing/ Timing a Presentation, Designation some slides as "Hidden", Viewing Slides Anywhere in a Slide Show. 12. Techniques for Making a Show Livelier 13. OFFICE CONNECTIONS 14. Presenting with the help of other Office Programs Importing the text from a World Document. 15. Printing a Presentation	

TEXT BOOKS:

1. Kumar Bittu, **"**Mastering MS Office , V & S Publishers, Ist Edition, 2017.

REFERENCE BOOKS:

1. Rajaraman V and AdabalaN . "Fundamentals of Computers" **,**PHI, sixth Edition

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Introduction to graphics and animation tool.
2. Multimedia Introduction.

POs met through Gaps in the Syllabus

1, 2, 3, 4

Topics beyond syllabus/Advanced topics/Design

1. Animation.
2. App development.

POs met through Topics beyond syllabus/Advanced topics/Design

3, 5, 7, 8,

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

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CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA214
Course Title: DESKTOP PUBLISHING LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Able to create a new document using Desktop Publishing software.
B.	Learn the advantages of Desktop Publishing software.
C.	To understand the idea of Desktop Publishing software.
D.	To know the applications of Desktop Publishing software.
E.	To understand the basic concepts of Desktop Publishing software.

Course Outcomes

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

CO1	Identify the application of Desktop Publishing software
CO2	Apply the basic idea of Desktop Publishing software
CO3	To analyse a photo using Desktop Publishing software
CO4	Apply Desktop Publishing software to manage a page in better way
CO5	Create a template to solve a real time problem

SYLLABUS:

INTRODUCTION

Introduction to Desk Top Publishing packages, Components of Desk Top Publishing packages.

CREATING A NEW DOCUMENT

Setting the Margins, Setting the Page Size, Changing the page Orientation, Setting Page Numbers, Changing the Page Size view, Creating New Document Windows: Displaying the Rulers, Changing the Rulers, Using Rulers, Using Guidelines, Positioning Guidelines., Adding Guidelines to Master Pages. Aligning to Guidelines, Displaying Guidelines, Locking Guidelines. Formatting Types: Changing Font Families, Changing Fond Sizes, Changing Typeface Style, Changing Character Specifications: Changing Type leading, Changing Character Widths, Changing Tracking, Changing Type Options. Saving Your Document: Saving a new Document, Saving an existing Document, Saving a Document as another document, Reverting to a Previously Saved Version. Developing Paragraphs: Typing Text, Adding special Characters to Text, Aligning Text. Formatting paragraphs: Changing Indents, Changing the space around Paragraphs, Changing paragraph Alignment, controlling How Paragraphs Break Between Pages and Columns, Adding lines Above or Below Your Paragraphs.

1. INTRODUCTION TO CREATING FRAMES

Converting Other Objects to Frames, Threading and Unthreading Text. Threading additional Text, Threading Text to Different Page, Unthreading Text Blocks, Rethreading Text Blocks, Making Text Blocks Disappear Without Deleting them, Selecting and Dragging Text, Editing Deleting Text, Cut, Copying, Pasting Text, Viewing the Contents of Clipboard, Using Undo and Revert. Inserting and Removing Pages: Inserting and Removing Pages, Adjusting Spacing of Characters, Words, Lines Adjusting, Spacing and Leading, Setting and changing Tabs.

Introduction to Auto Flow, page maker Plug-Ins, Drop Cap, Change Case, Bullets and Numbering.

2. ADDING DESIGN ELEMENTS- INTRODUCTION

Adding Graphics to your Document, Adding Lines, Changing Lines Specifications, Adding Shapes, changing Shape specifications, Changing Line and fill, Specifications together (Fill and Stroke), Changing Round Corners, Creating Drop-Shadow, Boxes, Text wrap, Changing page maker Options: Adjusting Margins, Setting and Adjusting Columns, Setting Unequal Width Columns, Creating headers and Footers, Creating Graphics in page maker, Rotating Text, Skewing and Mirroring objects with Control Palette. Importing Graphics into page maker: Placing, Sizing, aligning Graphics, Cropping Graphics.

3. SETTING UP TEMPLATES

Setting Up Master Page Templates, Creating Custom Page Sizes, Creating Custom Boarders, Creating a News Paper Template, Creating New master Pages, Saving an existing Page As a Master Page. Setting UP Custom Styles: Defining Styles, Creating, Editing, Removing Styles and Copying Styles.

Lab Section [each Day 50 mints x 2 = 100 mints]

1. Installation of Operating Systems
2. Working with Windows Operating system.
3. Get familiar with Linux Operating.
4. Lab ion open office.
5. Document formatting in word/Mail Merge
6. Printing in Word.
7. Lab on spreadsheet.
8. Formatting data on spreadsheet
9. Working with Multiple worksheet/Formulas/Sorting /Filtering
10. Configuration of Samba Server.
11. File configuration.
12. Introduction to Desk Top Publishing.
13. Creating documents using photo editing packages.
14. Lab on photo editing packages

TEXT BOOK

1. "Computer Basics with office Automation" by KumarArchana, IK International Publishing,2010, ISBN 9789380578620.

REFERENCE BOOK

1. "BPB's Office 2010 Course Complete Book For Learning Better And Faster" by Prof.JainSatish, Kratika, GeethaM., BPB publisher.
2. Desktop publishing by B Kumar, BPB Publisher.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA216
Course Title: HTML PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: II/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Able to understand the basic concepts of HTML
B.	Learn the advantages of HTML
C.	To understand the structure of HTML page
D.	To know the applications of HTML
E.	To understand the difference between HTML with other language

Course Outcomes

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

CO1	Able to create a HTML page
CO2	Able to analyse a HTML page
CO3	Able to modify a HTML page
CO4	Able to create a HTML page using table, background and picture.
CO5	Able to use CSS for a HTML page.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction (1L): HTML Document structure The Basics (2L): Head, Body, Lists: ordered & unordered	**8**
Module – II Links (3L): Introduction, Absolute links & Relative links, using the ID attribute to link within a document	**8**
Module – III Images (2L): Putting an image on a page, using images as links, putting an image in the background	**8**
Module – IV Tables (3L): Creating a table, Table headers, spanning multiple columns, styling table Forms (3L): Basic input and attributes, other kinds of inputs, styling forms with CSS	**8**
Module – V PHP Programming Introduction to PHP: PHP introduction, important tools & s/w requirement, Scope of PHP, Basic syntax, variable & constants, data type, expressions, scope of variables, operators. Handling HTML form with PHP: Capturing form data, GET and POST methods, Dealing with multi value fields, Redirecting a form after submission PHP conditional events & loops: PHP conditional statements, switch case, while, for and do … while loops PHP functions: Need of function, Default argument, Functions call by value and call by reference String Manipulation & regular expression: Creating and accessing string, Searching & replacing string, formatting, joining and splitting String, String related library functions Array: Creating index based and Associative array S/w Lab based on PHP: Create a PHP login page having user name and password. On clicking submit button, a Welcome message should be displayed if the user is already registered otherwise error message should be displayed. Create a “birthday countdown” script which will count the number of days between current day and birthday.	**8**

TEXT BOOKS:

1. "Introduction to HTML and CSS", O'Reilly, 2010.
2. DuckettJon, "HTML and CSS", John Wiley, 2012.

S/w Lab based on HTML:

1. Create an HTML document with the following formatting options:
a) Text formatting
b) Heading styles
c) Font (Type, size and color)
d) Background (colored background and image in background)
e) Paragraph/ Division

2. Create a HTML document which consists of
a) Ordered List
b) Unordered List
c) Nested List
d) Image
3. Create a HTML document which implements internal/ external linking
4. Create a table with the view
5. Create a form using HTML tags which has the following type of controls:
a) Text Box
b) Option/ radio buttons/ Check box
c) Reset and Submit buttons

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA260
Course Title: VISUAL BASIC LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A	Able to understand the basic concepts of Visual Basic
B	Learn the advantages of Visual Basic
C	To understand the structure of Visual Basic
D	To know the applications of Visual Basic L
E	To understand the difference between Visual Basic with other language

Course Outcomes

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

CO1	Able to create a Visual Basic project
CO2	Able to solve real-time problem using Visual Basic
CO3	Able to analyse any logical and numerical problems using Visual Basic
CO4	Able to create a form using Visual Basic
CO5	Able to create an application using frontend and backend

SYLLABUS

List of Programs as Assignments:

1. Print a table of numbers from 5 to 15 and their squares and Cubes.
2. Print the largest of three numbers.
3. Find the factional of a number n.

4. Enter a list of positive numbers terminated by zero. Find the sum and average of these numbers.
5. A person deposits Rs. 1000 in a fixed account yielding 5% interest. Complete the amount in the account at the end of each year for n years.
6. Write a VB application to choose your hobbies from a list.
7. Read n numbers. Count the number of negative numbers, positive numbers and zeroes in the list. Use arrays.
8. Read a single dimension array. Find the sum and average of these numbers.
9. Read a two dimension array. Find the sum of two 2D Array.
10. Create a database Employee and Make a form in VB 6.0 to allow data entry to Employee Form with the following command buttons:

Employee Form			
Employee Id			**Previous**
Employee Name			**Next**
Date of Joining			**First**
Designation			**Last**
Department			**Add**
Address			**Delete**
Basic Pay			**Modify**
			Save

TEXT BOOK:

1. Beginner's Guide to Gambas by John Rittinghouse, Kindle Edition

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		
CD9	Simulation		

Course Code: CA262
Course Title: COMPUTERIZED ACCOUNTING LAB
Pre-requisite(s): Basic knowledge of Accountancy
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A	Able to understand the basic concepts of Financial Packages
B	Learn the advantages of Financial Packages
C	To understand the structure of Financial Packages
D	To know the applications of Financial Packages
E	To understand the pros and cons of Financial Packages

Course Outcomes

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

CO1	Able to write program
CO2	Able to solve real-time problem using Financial Packages
CO3	Able to analyze any logical and numerical problems using Financial Packages
CO4	Able to create a function using Financial Packages
CO5	Able to create an accounting software.

SYLLABUS
1 How would you configure Financial Data for a specific financial year?
2 How would you create a Ledger, Group?
3 How would you display, alter & delete Ledger ?
4. Describe the process of entering Vouchers
5 Describe the process of Payment, Receipt, Journal, Sales and Purchase order.
6 How would you display, alter and delete the Vouchers?
7 Describe the various options of reports.
8 Day Books Cash and Bank & Ledgers Books
9 How would you display Trail Balance, Profit & Loss Statement?
10 How would you create Balance Sheet in columns and rows?

11 How would you cost categories with cost centers in Financial Packages.
12 Various options of shortcut or Function Key.
13 Various options printing reports in Financial Packages.
14 Understanding "by cash flow" and "fund flow" in Financial Packages.
15 Describe the Accounts with Inventory company in Financial Packages.
16 Create a Stock, Stock Unit & Alternate units, Stock Group & Stock Item
17 Describe the sales voucher, Sales invoice and purchase invoice.
18 How would you display stock group and stock item ?
19 How would you sales & purchase with tax Auto calculation?
20 Sales bill with auto discount using Financial Packages.
21 Creation of Employee payroll using Financial Packages.
22 How would you delete a company, Modify company using Financial Packages.

TEXT BOOKS:

1. RealAccounting Software by A.K. Nadhani, BPB Publisher, 2003

REFERENCE BOOKS:

1. Computerized Accounting System by Manoj and Ajay, Sahitya Bhutan Publisher

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA264
Course Title: GRAPHIC DESIGN AND PHOTO EDITING LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	Able to understand the basic concepts of Graphic Design and Photo Editing Packages.
B.	Learn the advantages of Graphic Design and Photo Editing Packages.
C.	To understand the structure of Graphic Design and Photo Editing Packages.
D.	To know the applications of Graphic Design and Photo Editing Packages.
E.	To understand the difference between different Graphic Design and Photo Editing Packages

Course Outcomes

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

CO1	Able to analyze any photo using Graphic Design and Photo Editing Packages.
CO2	Able to apply use layer masks, filters and blending modes
CO3	Able to create, edit and work with text
CO4	Able to Design layouts for web pages, Paper Adverts, Brouchers, CD Covers, Package Designing
CO5	Able to create new layers and perform other basic layer functions

SYLLABUS

1. Interface Graphic Design and Photo Editing Packages and workspace, Document setup width height & resolution.
2. What are the kinds of Tools in the toolbox? (Tool Palette and Interface - The Tool Palette - Painting and Editing - Custom Brushes)
3. Using selection tools, transform, marquee, crop, lesso, magic wand, eraser etc.(Basic Photo Corrections - Rotating, Scaling, and Distorting with Transformations - Feathering and Info Palette - Understand Resolution - Touch up Tools)
4. What are foreground and background colors?
5. How do you change the size of a picture?

TEXT BOOK:

1. GIMP Pocket Reference: Image Creation and Manipulation, by Sven Neumann, O'Reilly Publisher, 2000.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3

CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
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CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

ANNEXURE - I

Course Code: CA105
Course Title: BASICS OF MATHEMATICS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Get an understanding about set and relations.
B.	Demonstrate a depth of understanding of functions and binary operations.
C.	Gain an understanding of Abstract Algebra and Matrices.
D.	Get a brief idea about the principles of Differential Calculus and Differential Equations.
E.	Be able to solve differential equations and differential calculus problems.

Course Outcomes

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

CO1	Decide the behavior of set and relations in the field of computer science.
CO2	Apply the concepts of functions and binary operations in various computer programs.
CO3	By using the properties of Algebra and Matrices to decide the behavior different problems
CO4	Apply the principles of Differential Calculus and Differential Equations to solve a variety of scientific problems in engineering and sciences.
CO5	Enhance and develop the ability of using the language of mathematics in engineering.

SYLLABUS

Module –I **Sets and Relations:** Sets and their representations, The empty set, Finite and Infinite set, Equal and equivalent set, Subset; power set; Universal set; Venn diagrams; Operations on sets; Complement of a set; Cartesian product, Relation, Inverse Relation, Composition of relation, Equivalence of relations and Classes.	**8**
Module – II **Functions and Binary Operations:** Functions as a set, Representation of function, Types of Functions, Functions applicable in Computer Science: Integer function, Factorial function, Absolute, Characteristic, Floor, Ceiling, Remainder, Boolean, Exponential, Logarithmic, Hashing functions and Binary operation on a set.	**8**
Module – III **Abstract Algebra**: Group, Subgroup, Abelian group, Order of group, cyclic group and Simple theorems, Definition of Ring, Subring Integral domain and Field.	**8**
Module – IV **Matrices Algebra**: Definition of matrix, Operations on matrices, Square matrix and its inverse, Inverse of a matrix by Row operation, Rank of matrix by Echelon form, Solution of a System of Linear Simultaneous equation by matrix method, Eigen value and Eigen vector **Linear Algebra:** Vector spaces, Subspaces, Span of a set, Linear Dependence, Independence.	**8**
Module – V **Differential equation**: Definition of Differential equation, Order and degree of a differential equation, Linear differential equation and Equation of Higher Order Linear differential equation with constant coefficients	**8**

TEXT BOOKS:

1. Vasishtha A.R., "Modern Algebra", Krishna Prakashan Media (P) Ltd, Meerut, 2006.(T1)
2. Vasishtha A.R, "Matrices", Krishna Prakashan Media (P) Ltd, Meerut, 2006. (T2)
3. Das H.K., "Advanced Engineering Mathematics", S. Chand, 2009.(T3)

REFERENCE BOOKS:

1. KolmanB., BusbyR. C., and RossS. C., "Discrete Mathematical Structures", 6th Edition, Prentice Hall of India, 2008.(R1)
2. ShethH., "Abstract Algebra", PHI, 2009.(R2)
3. GrewalB. S., "Higher Engineering Mathematics", Khanna Publishers, 2000.(R3)

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	2
CO2	3	3	3	1	3	1	1	1				2	2	3	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	3
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

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1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA115
Course Title: INTRODUCTION TO COMPUTER SCIENCE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the Truth Table.
B.	Identify the number of variables and their simplification importance.
C.	Understand different computer program languages.
D.	Understand different Computer Software and operating system.
E.	Describe performance evaluation of computers, computer architecture and Memory and CPU.

Course Outcomes

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

CO1	Minimize the circuit diagrams by use of logic gates and Boolean Algebra.
CO2	Analyze the outcome of the circuit designed.
CO3	Create complex circuit with use of modular block interconnection.
CO4	Analyze I/O devices and interconnection structures of computer.
CO5	Develop independent learning skills and be able to learn more about different computer architectures and hardware.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module –I **Introduction to Computers:** Definition, Characteristics of Computers, Classification of Computers, Applications of Computers. **Number Systems and Logic Gates:** Number Systems, Conversion between Number bases, Arithmetic System. Signed and Unsigned Numbers, Concept of Overflow, Binary Coding, Logic Gates, Boolean Algebra and Combination of Logic Gates.	8
Module – II **Computer Architecture:** Central Processing Unit (CPU), Memory, Communication between various units of a Computer System, The Instruction Format, Instruction Set, **Computer Memory:** Primary Memory Hierarchy, Random Access Memory, Types of RAM, Read only memory (ROM), Types of ROM., Classification of Secondary Storage Devices, Magnetic Tape, Magnetic Disk, Optical Disk.	8
Module – III **Input Devices & Output Devices:** Keyboard, Pointing Devices, Speech Recognition, Digital Camera, Scanners, Optical **S**canners, output devices: Printers, Plotters, Computer Output Microfilm (COM), Monitors, Audio output, Projectors, Terminals. **Computer Program & Languages:** Introduction, Developing a program, Algorithm, Flowchart, Pseudo Code (P-Code). Classification of Programming Languages, Generations of Programming Languages.	8
Module – IV **Computer Software:** Software: Definition, Relationship between Software and Hardware, Software Categories, System Software, Application Software. **Operating system:** Definition of Operating system, Evolution of operating system, Types of Operating System, Functions of an Operating System, Modern Operating Systems.	8
Module – V **Data Communication and Computer Network:** Introduction of Data Communication, Transmission Media, Multiplexing, Switching, Computer Network's Topologies, Communication Protocols, Network Devices. **Internet Basics:** Basic Internet Terms, InternetApplications, Electronic Mail: An Introduction how E-mail Works, Searching the Web (SearchEngines), Languages of Internet, Internet and Viruses.	8

TEXT BOOKS:

1. ITL Education Solution Limited, R & D Wing, Introduction to Computer Science, Pearson Education, 2004.
2. Mano M., "Computer System Architecture", Prentice Hall of India, New Delhi, 1995.**(T1)**

REFERENCE BOOKS:

1. Raja Raman V, Fundamentals of Computers, Second Edition, PHI, New Delhi, 1996.

Gaps in the Syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	2
CO2	3	3	3	1	3	1	1	1				2	2	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	2	3	2
CO4	3	3	3	1	3		1	1		1	1	2	2	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA169
Course Title: MATHEMATICS FOR COMPUTING
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: I/1
Branch: Bachelor of Computer Applications
Name of Teacher:

Course Objectives

This course envisions to impart to students :

1.	To gain knowledge on formal methods and languages
2.	Distinguish different computing models and classify their respective types
3.	Show a competent understanding of the basic concepts of complexity theory

Course Outcomes

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

CO1	Demonstrate the knowledge of mathematical models of computation and describe how the relate to formal languages
CO2	Derive an appropriate model of computation for a given language and vice versa.
CO3	Infer the equivalence of languages described using different automata

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module –I **Propositional Logic:** Introduction, Construction of truth table, Connectives, Compound Statements, Tautology, Contradiction, Contingency, Inference Rules, Conjunctive and disjunctive normal forms, semantics, Truth Tables, tautology, Adequate Set of Connectives.	**8**
Module – II **Predicate logic:** Introduction, semantics, connectives, quantifiers, resolution. First order language, symbolizing ordinary sentences into first order formulae, formal theory for predicate calculus, theorems and derivations	**8**
Module – III **Number Theory:** Division algorithm, Greatest common divisor, least common multiple, Linear Diophantine equations, Fundamental Theorem of Arithmetic, definition of congruence, Residue System, Test of Divisibility, linear congruence	**8**
Module – IV **Graph Theory:** Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Degree of a graph, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walks, Paths, Circuits, Hamiltonian and Euler Graph, Adjacency and incidence matrices of a graph, Spanning tree of a graph.	**8**
Module – V **Automata Theory** Alphabet, languages and grammars, productions and derivation, Hierarchy of languages. Regular languages and finite automata , deterministic finite automata (DFA), nondeterministic finite automata (NFA), regular grammars and properties of regular languages	**8**

TEXT BOOKS:

1. Elliott Mendelson; Introduction to Mathematical Logic; Chapman & Hall; London(1997)
2. J.H.Gallier; Logic for Computer Science; John.Wiley& Sons (1987).
3. N. Deo; Graph Theory with Application to Engineering and Computer Science; Prentice Hall of India, New Delhi, 1990.
4. Mishra K.L.P,Theory of Computer Science: Automata, Languages and Computation, Third Edition January 2006.
5. S B Malik, Basic Number Theory, Vikash Publishing House Pvt. Ltd., 2nd Revised Edition 2013

REFERENCE BOOKS:

1. Discrete Structure & Graph Theory, Rathore, EPH

Course Code: CA171
Course Title: CONCEPTS OF PROGRAMMING LANGUAGES
Pre-requisite(s): Introduction to Computer Science
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: II/1
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students:

A.	To Describe and classify various programming languages and data types.
B.	To summarize the sequence control.
C.	To Generalize various object oriented programming paradigms.
D.	To Discuss about Logical and functional programming.
E.	To summarize the concept of concurrent programming.

Course Outcomes

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

CO1	To understand various programming concepts and data types.
CO2	Apply various sequence control techniques of programming languages.
CO3	To understand the object oriented programming.
CO4	To analyze logical and functional programming
CO5	To understand about concurrent programming.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
MODULE I INTRODUCTION Introduction: Role of programming languages – Need to study programming languages – Characteristics of a good programming languages – Introduction to various programming paradigms: Procedural – Object-oriented – Logic and functional – Concurrent programming. Data Types: Properties of structured and non-structured data types and Objects – Variables – Constants – Derived and abstract data types – Declaration – Type checking. Binding and binding times – Type conversion – Scalar data type – Composite data types – Implementation and Storage representation of data types and control flow statement.	**8**
Module – II SEQUENCE CONTROL Sequence Control: Implicit and explicit sequence control – Sequencing with arithmetic and non-arithmetic expressions – Sequence control between statements. Subprograms control: Subprogram sequence control – Attributes of data control – Shared data in.	**8**
Module – III OBJECT ORIENTED PROGRAMMING Object Oriented Programming: The class declarations – Constructors – Information hiding and data abstraction using classes – Access specification – Inheritance – Polymorphism – Parameterized types – Exception handling.	**8**
Module – IVLOGICAL AND FUNCTIONAL PROGRAMMING Logic Programming: Logic programming language model – Logical statements – Resolution – unification – search structures: backward and forward – Applications of logic programming – PROLOG. Functional Programming: Features of functional languages – LISP – Applications of functional and logic programming languages.	**8**
Module –V CONCURRENT PROGRAMMING Basic concepts of Concurrent Programming: processes – Synchronization primitives – Safety and liveness properties – Parallelism in Hardware – Streams – Concurrency as interleaving – Safe access to shared data.	**8**

Text Book & Reference Book:

1. Ghezzi C, Milano P., Jazayeri M., "Programming Languages Concepts", Pearson, 11th Edition, 2016

2. Scbesta R., "Concepts of Programming Languages", Pearson Education, 10th Edition, 2013.
3. Sethi R., "Programming Languages concepts & constructs", 2 nd Edition, Pearson Education, 2006

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2				2	2	3	3
CO2	3	1	1	1	1	3	1	1				2	2	3	2
CO3	2	3	3	1	2	1	2	2		1	1	2	3	2	3
CO4	1	1	3	3	1	1	1	1		1	1	2	3	2	2
CO5	3	3	3	1	2	1	1	2	1	1	1	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CDCode	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA209
Course Title: COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS
Pre-requisite(s): Programming knowledge and Mathematics
Co- requisite(s): Computer Oriented Numerical and Statistical Methods Lab
Credits: 4 L:4 T:0 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Able to map a problem in the computer domain so that with the help of computer it can be Solved.
B.	To develop skill to represent and solve a problem in Computer
C.	Able to understand the basic of computing methodologies that done with computers.
D.	To develop understanding of basic of computation methodologies
E.	Understating the functionality of Abstract machines with their limitations

Course Outcomes

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

CO1	Identify problems in the computer domain.
CO2	Explain the basic of computing methodologies that done with computers
CO3	Evaluate basic computation methodologies
CO4	Analyse functionality of Abstract machines with their limitations
CO5	Apply computing methodologies that are done with computers.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Errors in Numerical Methods:** Concept of Exact and Approximate Numbers, Significant Figures, Rounding off rules, Absolute, Relative and Percentage Errors, General Error Formula. **Solution of Algebraic and Transcendental Equations:** Basic Concepts, Geometrical Interpretation (if any), Condition for Convergence, Rate of Convergence, Bisection Method, Method of False Position or Regula-Falsi Method, Method of Iteration, Newton Raphson Method.	**10**
Module – II **Interpolation :** Finite Differences, Forward Difference Operator, Backward Difference Operator, Central Difference Operator, Shift Operator – Properties of the Operators, Relation among the Operators, Differences of a Polynomial, Newton's Forward and Backward Difference Interpolation Formulae, Gauss' Central Difference Interpolation Formulae, Lagrange's Interpolation, Divided Differences and their properties, Newton's general interpolation formula with divided difference, Inverse interpolation using Lagrange's interpolation formula.	**10**
Module – III **System of Linear Algebraic Equations:** Matrix Inversion Method, Gauss Elimination Method, Gauss Jordan Method, LU Decomposition Method, Gauss-Jacobi Method, Gauss – Seidel Method. **Numerical Differentiation and Integration:** Numerical Differentiation, Numerical Integration, Derivation of General Quadrature Formula., Trapizoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8- Rule. **Numerical Solution of Ordinary Differential Equations:** Solution by Taylor's Series, Euler's Method, Modified Euler's Method, Runge-Kutta Methods (2^{nd} order)	**7**
Module – IV **Concepts of Probability:** Experiment and Sample Space, Events and Operations with Events, Probability of an Event, Basic Probability Rules, Applications of Probability Rules, Conditional Probability. **Random Variables:** How Random Variable Arise, Probability Distribution of a Random Variable, Mean or Expected Value of a Random Variable, Probability Histogram Value of a Random Variable, Variance and Standard Deviation of a Random Variable. **Binomial Experiments:** Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table. **Normal Curve and Normal Distribution:** Motivation behind a Normal Curve, Properties of a Normal Curve, Normal Probability Distribution, Areas Under a Normal Curve.	**8**
Module – V	**5**

Estimation of Population Parameters: Parameter and Statistic, Point and Interval Estimation, Interval Estimation of Three Common Parameters. **Bivariate Quantitative Data- Correlation and Regression:** Concepts of a Bivariate Data Set, Correlation Coefficient, Inferences on a Population Correlation Coefficient, The Regression line, Inferences on the Population Regression Line.	

TEXT BOOKS:

1. Sastry S.S., "Introductory Methods of Numerical Analysis", PHI, Private Ltd., New Delhi.
2. PalN. & Sarkar S., "Statistics: Concepts and Applications", PHI, New Delhi, 2005.

REFERENCE BOOKS:

1. Hogg R.V. et.al, "Probability and Statistical Inpane", 7thEdn, Pearson Education, New Delhi, 2006.
2. Burden R.L. &Faires J.D., "Numerical Analysis", Thomson Learning-Brooks/Cole, Indian Reprint, 2005.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CDCode	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA210
Course Title: COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS LAB
Pre-requisite(s): C/C++; Knowledge of programming languages
Co- requisite(s): Computer Oriented Numerical and Statistical Methods
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: III/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Be able to map a problem in the computer domain so that with the help of computer it can be Solved.
B.	Learn the problem-solving process through computer.
C.	To solve problems of larger size which helps the students to understand the challenges caused by problem size.
D.	To know the rate of convergence of different methodologies.
E.	To compare among different methodologies used to solve a particular problem.
F.	To know the practical application of various programming techniques.

Course Outcomes

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

CO1	Identify and suitably model a problems in the computer domain.
CO2	Clearly understand different numerical methods that are used to solve problems in the domain.
CO3	Understand the difficulties associated with the problems of large size.
CO4	To select the most efficient (fastest) methodology to solve problems of large sizes.
CO5	Identify the most suitable one among all known methodologies.
CO6	Understand not only the numerical methods but also various programming techniques.
CO7	Identify and suitably model a problems in the computer domain.

SYLLABUS

Assignment 1
Write a program in C to solve the equation $x^4 + x^2 - 1 = 0$, correct to eight decimal places using bisection method.
Assignment 2

Write a program in C to find the root (which lies between 2 and 3) of the following equation correct to six significant figures using bisection method:

$$x^2 - 5\log_{10}(5x^2+2x+3) = 0$$

Assignment 3

Write a program in C to find the root of the equation $x^3 - 4x^2 + 10x - 10 = 0$ correct to six significant figures using Regula-Falsi Method.

Assignment 4

Write a program in C to find the root (which lies between 1 and 2) of the following equation correct to six decimal places using Regula-Falsi Method and the method of Bisection. Compare the number of iterations required in both the cases:

$$2x - 3\cos x = 1.85$$

Assignment 5

Write a program in C to find root of the equation $x^3 - 8x - 4$ using Newton-Raphson method correct to seven significant figures.

Assignment 6

Write a program in C to solve the equation $3x - \cos x - 1 = 0$, by the method of Iteration, for the root lying between 0 and 1, correct to 6 decimal places.

Assignment 7

Write a program in C to compare the rate of convergence of the Newton-Raphson method, Regula-Falsi method and the method of Bisection to find the root of the equation $2x \sin x = \cos x$ lying between 0 and 1.

Assignment 8

Write a program in C to compute a difference table for the following data and hence find the value of $\Delta^p y_q$ and $\nabla^p y_q$; p and q are to be taken from the users.

X	0.30	0.32	0.34	0.36	0.38	0.40
Y	1.7596	1.7698	1.7804	1.7912	1.8024	1.8139

Assignment 9

Write a program in C to find f(2.02) having given the following table, using Newton's forward Interpolation formula correct to five significant figures.

X	2.0	2.2	2.4	2.6	2.8	3.0
f(x)	0.30103	0.34242	0.38021	0.41497	0.44716	0.47721

Assignment 10

Write a program in C to find f(2.91) having given the following table, using Newton's Interpolation formula, correct to five significant figures.

X	2.0	2.2	2.4	2.6	2.8	3.0
f(x)	0.30103	0.34242	0.38021	0.41497	0.44716	0.47721

Assignment 11

Write a program in C to find the missing element in the following table:

X	22	25	28	31	34	37
f(X)	14	27	35	?	50	65

Assignment 12

Write a program in C to find the value of X when it is given that f(X) = 55 in the table given in Assignment 11 after finding the value of f(31).

Assignment 13

Solve by Gauss elimination method with partial pivoting, the following system of equations correct up to four significant figures.

$x + 3y = 2z = 5$

$2x - y + z = -1$

$x + 2y + 3z = 2$

Assignment 14

Find the inverse of the following matrix by Gauss-Jordan method.

$$\begin{matrix} 5 & 3 & 7 \\ 1 & 5 & 2 \\ 7 & 2 & 10 \end{matrix}$$

Hence find the root of the following system of equations correct up to five decimal places:

$5x + 3y + 7z = 5$

$x + 5y + 2z = -1$

$7x + 2y + 10z = 5$

Assignment 15

Solve, by Gauss-Jacobi iterative method, the following system of equations correct up to four significant figures.

$4.50x + 0.15y + 0.30z = 1.57$

$0.15x - 10.50y + 0.45z = -3.86$

$0.45x + 0.30y - 15.00z = 14.28$

Assignment 16

Solve, by Gauss-Seidel iteration method, the following system of equations, correct up to four significant figures.

$6.32x - 0.73y - 0.65z + 1.06t = 2.95$

$0.89x + 4.32y - 0.47z + 0.95t = 3.36$

$0.74x + 1.01y + 5.28z - 0.88t = 1.97$

$1.13x - 0.89y + 0.61z + 5.63t = 4.27$

Assignment 17

Write a program in C to calculate the approximate value of the following definite integrals using Trapizoidal rule, taking 20 subintervals, correct up to 6 significant figures. Calculate the percentage of error present in the result for (i).

(i) $\int_1^3 (11 + 4x + 5x^2)dx$ $\int_1^3 (11 + 4x + 5x^2)dx$

(ii) (ii) $\int_0^{0.5} \sqrt{\frac{1 - 0.75x^2}{1 - x^2}}\,dx$ $\int_0^{0.5} \sqrt{\frac{1 - 0.75x^2}{1 - x^2}}\,dx$

Assignment 18

Write a program in C to calculate the approximate value of $\int_0^{0.5} \frac{dx}{\sqrt{(1-x^2)(1-0.75x^2)}}$ correct up to 7 significant figures, using Simpson's 1/3 rule, taking 30 subintervals.

Assignment 19

Write a program in C to calculate the approximate value of $\int_0^1 \frac{dx}{x^2-2x+3}$ correct up to 4 significant figures, using Simpson's 1/3 rule and Trapizoidal rule, taking 18 subintervals. Compare the results by calculating percentage error. (Assume the result correct upto 7 significant digits as the exact value.)

Assignment 20

Write a program in C to calculate the approximate value of $\int_2^3 \frac{dx}{(x-1)\sqrt{x^2-2x}}$ correct up to 6 significant figures, using Simpson's 3/8 rule.

Assignment 21

Write a program in C to compute y(1.0), correct up to 7 significant figures, by Euler's method $\frac{dy}{dx} = -\frac{y}{1+x}$; y(0.2) = 2, taking step length h = 0.01.

Assignment 22

Write a program in C to compute y(1.0), correct up to 5 significant figures, by Euler's method and Modified Euler's method from the following differential equation:

$\frac{dy}{dx} = 1 + x + x^2$; y(0) = 1,

taking step length h = 0.25. Compare the results (approximate values) obtained in both the cases with the exact value.

Assignment 23

Write a program in C to compute y(0.6), correct up to 7 significant figures by the method of Runge-Kutta of second order from the following differential equation:

dy/dx = $(0.5 - x + y^2) / (x^2 + y + 1)$; y(0) = 0, taking step length h = 0.1.

Assignment 24

Write a program in C to compute y(0.5), correct up to 7 significant figures, by the Modified Euler's method and Runge-Kutta method of second order from the following differential equation:

dy/dx = $0.25\ y^2 + x^2$; y(0) = -1,

taking step length h = 0.1 . Hence, compare the results.

Assignment 25

Write a program in C to represent a set of 100 bivariate data of the form (x, y) into a two way frequency table and then calculate xx and yy from the marginal distributions. Generate the (x, y) tuples using random numbers so that $0 \leq x \leq 51$ and $150 \leq y \leq 250$.

Assignment 26

Write a program in C to compute the correlation coefficient between X and Y.

X	**2.52**	**2.49**	**2.49**	**2.45**	**2.43**	**2.42**	**2.41**	**2.40**
Y	**740**	**720**	**780**	**900**	**960**	**1020**	**980**	**1040**

Assignment 27

Ten students obtained the following marks in Mathematics and Statistics. Calculate the rank correlation coefficient between these two sets of data using a C program.

Student	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Marks in Mathematics	**78**	**36**	**98**	**25**	**75**	**82**	**90**	**62**	**65**	**39**
Marks in Statistics	**84**	**51**	**91**	**60**	**68**	**62**	**86**	**58**	**53**	**47**

Assignment 28

Write a program in C to predict the value of x when the value of y is given and vice versa from a given bivariate data set.

TEXT BOOK:

1. T Veerarajan, T Ramachandran, "Numerical Methods With Programs in C", First Edition, The McGraw Hill Companies

REFERENCE BOOKS:

1. Mollah S. A., "Numerical Analysis and Computational Procedures," Books and Allied (P) Ltd., Kolkata, 2017.
2. Sastry S.S., "Introductory Methods of Numerical Analysis," PHI, Private Ltd., New Delhi.
3. Pal N. & Sarkar S., "Statistics: Concepts and Applications," PHI, New Delhi, 2005.
4. Das N. G., "Statistical Methods," Tata McGraw Hill Edu. P. Ltd., New Delhi, 2010.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA265
Course Title: FUNDAMENTALS OF OPTIMIZATION TECHNIQUES
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students :

A.	To learn basic aspects of operations Research.
B.	To learn various methods and methodology in Operations Research
C.	To develop variety of models for making appropriate decisions
D.	To help them in optimising prevailing in a given situations
E.	Develop mathematical skills to analyze and solve network models arising from a wide range of applications.

Course Outcomes

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

CO1	Formulate Operations Research models.
CO2	Apply suitable Operations research tools for obtaining solution values of models
CO3	Demonstrate a working knowledge of various Operations Research Models.
CO4	Appraise the need for Operations Research in PERT, CPM.
CO5	To apply OR models in solving different problems.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction, Models and Modeling in OR, Methods of Solving the OR Models, Phases of an OR study, Applications, Opportunities and Shortcomings of O.R	**4**
Module – II Linear Programming models, mathematical formulation of general linear programming models, application of LPP models, Solution of Linear Programming Problem by Graphical Method, Special Cases in Graphical Method	**10**
Module – III Solution of linear Programming Problem by Simplex method – Maximization and Minimization, Artificial starting solution, Special cases in the Simplex Method	**10**
Module – IV Transportation Algorithm , Basic Feasible Solution of a Transportation Problem ,Modified Distribution Method , Unbalanced Transportation Problem ,Degenerate Transportation Problem, Transhipment Problem	**8**
Module –V Network Analysis: Basic components of Network, Rules for drawing Network diagram Time calculation in Networks. Critical Path Method and PROJECT Evaluation and Review Techniques. Algorithm and flow chart for CPM and PERT	**8**

Text Book & Reference Book:

1. Hamdy A. Taha, Operations Research; Pearson, 10th Ed.
2. Operations Research Theory & Application, J.K. Sharma, Macmillan, 3rd Ed.
3. KantiSwarup, Gupta, P.K. and Manmohan, Operations Research, Sultan Chand: New Delhi, 12th thoroughly revisedEd

Gaps in the Syllabus (to meet Industry/Profession requirements)

Revised Simplex Method, Integer Programming, Queuing Models, Decision Theory, Goal Programming,Dynamic Programming, Non-Linear Progamming Problems to be covered in Advance

Topic
POs met through Gaps in the Syllabus
3, 4, 12

Topics beyond syllabus/Advanced topics/Design

Advanced Optimization Theory

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2				2	2	3	3
CO2	3	1	1	1	1	3	1	1				2	2	3	2
CO3	2	3	3	1	2	1	2	2		1	1	2	3	2	3
CO4	1	1	3	3	1	1	1	1		1	1	2	3	2	2
CO5	3	3	3	1	2	1	1	2	1	1	1	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA267
Course Title: BUSINESS INTELLIGENCE
Pre-requisite(s):
Co- requisite(s):
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students :

MODULE	(NO. OF LECTURE HOURS)
Module – I Business Intelligence: Introduction, meaning, purpose and structure of Business Intelligence Systems. Characteristics and components of BI, understanding Business Analytics concepts- attributes, hierarchies and dimensions in data analysis, understanding the competitive landscape of BI platforms	**8**
Module – III Business performance management: conceptual framework and phases of BPM, performance evaluation and improvement tools, impact analysis on performance, enterprise risk management based on KPIs, role of business analytics (BA) in BI.	**8**
Module – IV Data visualization: balanced scorecards, characteristics of dashboards vs. scorecards, list attributes of metrics in dashboards, basic and composite charts, best practices for designing data visualizations, common pitfalls of dashboard design	**8**
Module –V Knowledge discovery and Data mining: purpose of data profiling and data enhancement, data mining model creation, understanding data mining tools, directed vs. undirected knowledge discovery, selecting data mining algorithm, data mining queries and reports	**8**

Course Code: CA269
Course Title: HUMAN VALUES AND PROFESSIONAL ETHICS
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L:2 T:0 P:0
Class schedule per week:
Class: BCA
Semester / Level: IV/2
Branch: Bachelor of Computer Applications
Name of Teacher:

Course Objectives

This course envisions to impart to students:

1.	Development of a holistic perspective based on self-exploration about themselves, family, society and nature/existence
2.	Understanding of the harmony in the human being, family, society, nature/existence
3.	Strengthening of self-reflection
4.	Development a commitment and courage to act.

Course Outcomes

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

CO1	Knowledge of Value Education
CO2	Able to distinguish the need of Self and Body
CO3	Importance of harmony in the family, nature/existence
CO4	Ability to learn about Professional Ethics

SYLLABUS

Syllabus	(NO. OF LECTURE HOURS)
Module I: Course Introduction Purpose and motivation for the course, Understating Value Education, Self-exploration as the process for Value Education, Right Understanding, Relationship and Physical facility, Method to fulfill the basic Human Aspirations	**06**
Module II: Harmony in the Human Being Understanding Human being as the Co-existence of self and body, distinguishing the needs of the self and body, The Body as an Instrument of the self, harmony of the Self with the Body, Program to ensure self-regulation and Health	**06**
Module II: Harmony in the family and Society Harmony in the family, the basic Unit of Human Interaction, Trust, respect, Understanding the Harmony in the Society, Vision for the Universal Human Order	**06**
Module IV: Harmony in the nature (Existence) Understanding Harmony in the Nature, Realizing Existence as Co-existence at all levels, The Holistic Perception of harmony in Existence	**06**
Module –VImplications of the Holistic Understanding-Professional Ethics Basis for Universal Human Values, Ethical Human Conduct, Ethics in the light of Right Understanding, Strategies for Transition towards Value-based Life and Profession	**06**

Text Book & Reference Book:

1. Human Values and professional ethics by R R Gaur, R Asthana, G P Bagaria, Excel Books, Second Edition, New Delhi, 2019

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2				2	2	3	3
CO2	3	1	1	1	1	3	1	1				2	2	3	2
CO3	2	3	3	1	2	1	2	2		1	1	2	3	2	3
CO4	1	1	3	3	1	1	1	1		1	1	2	3	2	2
CO5	3	3	3	1	2	1	1	2	1	1	1	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA309
Course title: INTRODUCTION TO PYTHON PROGRAMMING
Pre-requisite(s): Nil
Co- requisite(s): Introduction to Python Programming Lab
Credits: 4 **L: 3 T: 1 P: 0**
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand computer programming concept using python language
B.	Explore basic data types, control structures and standard library functions.
C.	Explore the basic data structures: List, Tuple, Sets, Dictionaries available in python
D	Learning Object oriented concept of programming and its implementation in python.
E.	Handle disk data file for input output operations.

Course Outcomes

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

CO1	Solve the basic mathematical problem using python programming
CO2	Use basic data types control structures and utility functions from standard library for faster programming.
CO3	Use the basic and user defined data structures as per the need of problem.
CO4	Design and implement the problem using OOP concept of python.
CO5	Store, retrieve and manipulate data with disk file.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction to Computers, Programs, and Python:** Introduction, Programming Languages, Operating Systems, The History of Python, Features of python language, Getting Started with Python, Programming Style and Documentation, Programming Errors. **Elementary Programming:** Introduction, Writing a Simple Program, Reading Input from the Console, Identifiers, Variables, Assignment Statements, and Expressions, Simultaneous Assignments, Named Constants, Numeric Data Types and Operators, Evaluating Expressions and Operator Precedence, Augmented Assignment Operators, Type Conversions and Rounding.	**8**
Module – II **Mathematical Functions, Strings and Objects**: Introduction, Common Python Functions, Strings and Characters, Introduction to Objects and Methods, Formatting Numbers and Strings. **Control Structures: Selections:** Introduction, Boolean Types, Values, and Expressions, **if** Statements, Two-Way **if-else** Statements, Nested **if** and Multi-Way **if-elif-else** Statements**,** Logical Operators, Conditional Expressions, **Loops**: Introduction, The **while** Loop, The **for** Loop, Nested Loops, Keywords **break** and **continue**	**8**
Module – III **Functions:** Introduction, Defining a Function, Calling a Function, Functions with/without Return Values, Positional and Keyword Arguments, Passing Arguments by Reference Values, Modularizing code, The Scope of Variables, Default Arguments, Returning Multiple Values. **Lists:** Introduction, List Basics, Copying Lists, Passing Lists to Functions, Returning a List from a Function, Searching Lists, Sorting, Processing Two-Dimensional Lists, Passing Two-Dimensional Lists to Functions, Multidimensional Lists.	**8**
Module – IV **Tuples, Sets, and Dictionaries:** Introduction, Tuples: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Tuple methods, Sets: Creating Sets, Manipulating and Accessing Sets, Subset and Superset, Set Operations, Comparing the Performance of Sets and Lists, Dictionaries: Creating a Dictionary, Adding, Modifying, and Retrieving Values, Deleting Items, Looping Items, The Dictionary Methods.	**8**
Module – V **Objects and Classes:** Introduction, Defining Classes for Objects, Immutable Objects vs. Mutable Objects, Hiding Data Fields, Class Abstraction and Encapsulation, Object-Oriented Thinking. Inheritance and Polymorphism: Introduction, Superclasses and Subclasses, Overriding Methods, The **object** Class, Polymorphism and Dynamic Binding, The **isinstance**Function. Class Relationships: Association, Aggregation, composition. **Files and Exception Handling:** Introduction, text input and ouput: opening a file, Writing Data, Testing a File's Existence, Reading All Data from a File, Writing and Reading Numeric Data, Binary IO Using Pickling, Exception Handling, Raising Exceptions.	**8**

TEXT BOOK

1. Y. Daniel Liang, "Introduction to programming using python", Pearson Education; First edition (2017).

REFERENCE BOOK

1. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education; Forth edition (2018)
2. Mark Lutz, "Learning Python" O′Reilly Fifth edition (2013)
3. Mark Summerfield, "Programming in Python 3: A Complete Introduction to the Python Language" Pearson Education; Second edition (2018)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA310
Course title: INTRODUCTION TO PYTHON PROGRAMMING LAB.
Pre-requisite(s): Nil
Co- requisite(s): Introduction to Python Programming
Credits: 2 **L: 0 T: 0 P:** 4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	Understand computer programming concept using python language
B.	Explore basic data types, control structures and standrard library functions.
C.	Explore the basic data structures: List, Tuple, Sets, Dictionaries available in python
D.	Learning Object oriented concept of programming and its implementation in python.
E.	Handle disk data file for input output operations.

Course Outcomes

After the completion of this course, students will be able:

CO1	Solve the basic mathematical problem using python programming
CO2	Use basic data types control structures and utility functions from standard library for faster programming.
CO3	Use the basic and user defined data structures as per the need of problem.
CO4	Design and implement the problem using OOP concept of python.
CO5	Store, retrieve and manipulate data with disk file.

SYLLABUS

List of Programs as Assignments:

1. Write a program that displays “Hello to Python programming”.
2. Write a program to read two integers and perform arithmetic operations on them
3. (addition, subtraction, multiplication and division).
4. Write a program to read the marks of three subjects and find the average of them.
5. Surface area of a prism can be calculated if the lengths of the three sides are known. Write a program that takes the sides as input (read it as integer) and prints the surface area of the prism (Surface Area = 2ab + 2bc + 2ca)
6. A plane travels 395,000 meters in 9000 seconds. Write a program to find the speed of the plane (Speed = Distance / Time).
7. You need to empty out the rectangular swimming pool which is 12 meters long, 7 meters wide and 2 meter depth. You have a pump which can move 17 cubic meters of water in an hour. Write

a program to find how long it will take to empty your pool? (Volume = l * w * h, and flow = volume/time).

8. Write a program to convert temperature from centigrade (read it as float value) to Fahrenheit.
9. A car starts from a stoplight and is traveling with a velocity of 10 m/sec east in 20 seconds. Write a program to find the acceleration of the car. [acc = $(V_{final} - V_{initial})$/
10. Time].
11. Write a Program to Prompt for a Score between 0.0 and 1.0. If the Score Is Out of Range, Print an Error. If the Score Is between 0.0 and 1.0, Print a Grade Using the Following Table

i.

Score	Grade
>= 0.9	A
>= 0.8	B
>= 0.7	C
>= 0.6	D
< 0.6	F

12. Write a Program to find the maximum of three numbers.
13. Suppose you want to develop a program to play a lottery. The program randomly generates a two-digit number, prompts the user to enter a two-digit number, and determines whether the user wins according to the following rules:
    If the user's input matches the lottery in the exact order, the award is $10,000.
    If all the digits in the user's input match all the digits in the lottery number, the award is $3,000.
    If one digit in the user's input matches a digit in the lottery number, the award is $1,000.
14. Write a Program to Check If a Given Year Is a Leap Year.
15. Program to Find the GCD of Two Positive Numbers.
16. Write a program that prompts the user to enter a four-digit integer and displays the number in reverse order.
17. Write Python Program to Find the Sum of Digits in a Number
18. Write a program to print the sum of the following series.
    $1 + 1/2 + 1/3 +. \ldots + 1/n$
    $1/1 + 2^2/2 + 3^3/3 + \ldots\ldots + n^n/n$
19. Write a Program to Display the Fibonacci Sequences up to nth Term Where n is Provided by the User.
20. Write a Program to Find the Sum of All Odd and Even Numbers up to a Number Specified by the User.
21. Write a Program to Check Whether a Number Is Prime or Not.
22. Write a Program to Find the Factorial of a Number.
23. Write a Program to Demonstrate the Return of Multiple Values from a Function Definition.
24. Program to Demonstrate the Use of Default Parameters
25. Write Program to Demonstrate the Scope of Variables.
26. Program to Print the Characters Which Are Common in Two Strings.
27. Write a program to check whether a given String is palindrome or not.
28. Write Python Program to Count the Number of Times an Item appears in the List.
29. Write a program to create a list of integer numbers. Sort the elements using any sorting method.
30. Write a program to create a lists of integer numbers and perform the linear and binary search.

31. Write a program to create a lists of cities names and perform the sort the cities name in alphabetical order.
32. Find Mean, Variance and Standard Deviation of List Numbers
33. Write a Program to Find the Transpose of a Matrix.
34. Write a program to perform the matrices multiplication.
35. Write a program to create a dictionary for countries name as key and currency as value. Traverse the dictionary with key: value Pairs in using for Loop.
36. Write a program to create tuples, and perform the following operations: Merging of tuples, Splitting of a tuple, comparison of two tuples.
37. Write a program to create an intersection, union, set difference, and symmetric difference of sets.
38. Write a program with "MyRectangle" class having the dimensions as data members and area() as a method member. Calculate the area of each rectangle object created by user.
39. Design a class with name "MyComplex" to represent the complex number including the constructor overloading, methods to perform the arithmetic operation over the two complex numbers. Write the complete python program for the above design.
40. Design a class with name "Distance" to represent the distance in feet and inch. Include the method to calculate the addition of two distances. Write the complete python program for the above design.
41. Write a complete program to implement the Employee and its subclasses (Salarayed Employee, DailyWaged Employee, Commission based employee) given in Hierarchical and multilevel manner. The program should exhibit the use of super key word to invoke the super class constructor.
42. Write a program to open a file and perform the reading and writing operation with the file.
43. Write a program to count the number of line in a file.
44. Write a program to count the frequencies of each word from a file.
45. Write a program to copy the text of a file to another file.
46. Write a program to append a file with the content of another file.
47. Write a program to compare two file.
48. Write a program to delete and insert a sentence at specified position in a file.
49. Write a program to delete a sentence from a file if the file contains a specific word.
50. Write program to delete comment lines from a file.
51. Write a program to capitalize each word of the file.
52. Write a program to handle an exception using exception handling mechanism of the python.
53. Write a program to raise an exception explicitly using raise keyword.

TEXT BOOKS:

1. Y. Daniel Liang, "Introduction to programming using python", Pearson Education; First edition (2017).

REFERENCE BOOKS:

1. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education; Forth edition (2018)
2. Mark Lutz, "Learning Python" O′Reilly Fifth edition (2013)
3. Mark Summerfield, "Programming in Python 3: A Complete Introduction to the Python Language" Pearson Education; Second edition (2018)

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and

			CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA311
Course Title: INTRODUCTION TO ANDROID PROGRAMMING
Pre-requisite(s): Concepts of Programming Languages
Co- requisite(s): Introduction to Android Programming Lab
Credits: 4 **L:**3 **T:**1 **P:**0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives
This course envisions to impart to students to:

A.	Develop app for digital devices.
B.	Learn real time app.
C.	Apply skill on real time applications.
D.	Understand the logic and challenges of Android programming
E.	. Integrate Java and android to develop game and applications for different industries

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

CO1	Define app requirements for digital devices.
CO2	Classify the constraints in developing real time app.
CO3	Apply skill on real time applications.
CO4	Evaluate the logic and challenges of Android programming.
CO5	Develop and Integrate Java and android to develop game and applications for different industries

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I What is Android? Android EcoSystem, Features of Android, Architecture of Android, Android Verson,Android SDK, Android Development tools, Anatomy of an Android Application.	**8**
Module – II Android User Interface: Linear Layout, Absolute Layout, Frame Layout, Relative Layout, Table Layout.	**8**
Module – III Designing User Interface with View: Text View, Push Button, Image Button, Edit Text, Checkbox, ToggleButton, Radio Button, ProgressBar, Spinner, List View, Gridview, Time and Date Picker.	**8**
Module – IV Displaying Pictures and Menus with Views: Gallery Views,ImageSwitcher, GridView, Options Menu, Context Menu, DigitalClock View, Webview. SMS Messaging: Sending SMS Messages Programmatically.	**8**
Module – V SQLITE Database in Android: SQLite Database, Creation and connection of the database, extracting values from a curser.	**8**

TEXT BOOK

1. Dixit Prashant Kumar, "Android", Vikas Publishing House Pvt. Ltd, 1stEdition, 2014.

REFERENCE BOOK

1. LeeWei-Meng, "Beginning Android for Application Development", Wiley, Indian Edition.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Not interfacing with remote cloud storage
2. Not interfacing with computing Fog layer

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment
1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA312
Course title: INTRODUCTION TO ANDROID PROGRAMMING LAB
Pre-requisite(s):
Co- requisite(s): Introduction to Android Programming
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: BCA Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	Develop app for digital devices.
B.	Learn real time app.
C.	Apply skill on real time applications.
D.	Understand the logic and challenges of Android programming
E.	Integrate Java and android to develop game and applications for different industries

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

CO1	Define app requirements for digital devices.
CO2	Classify the constraints in developing real time app.
CO3	Apply skill on real time applications.
CO4	Evaluate the logic and challenges of Android programming.
CO5	Develop and Integrate Java and android to develop game and applications for different industries

SYLLABUS
List of Programs as Assignments:
1. Write a program using Android Developer Studio/Eclipse to generate Frame Layout.
2. Write a program using Android Developer Studio/Eclipse to generate button with content "My Button".
3. Write a program using Android Developer Studio/Eclipse to generate three buttons with content "First", "Second", "Third" and then orient them along row wise.
4. Write a program using Android Developer Studio/Eclipse to generate three buttons with content "First", "Second", "Third" and then orient them along column wise.
5. Write a program using Android Developer Studio/Eclipse to create Text-View to accept user name.
6. Write a program using Android Developer Studio/Eclipse to generate the following Table Layout

Roll Number

Name

7. Write a program using Android Developer Studio/Eclipse to generate the following Table Layout

Login Id

Password

Submit

8. Write a program using Android Developer Studio/Eclipse to implement Check box.
9. Write a program using Android Developer Studio/Eclipse to implement Radio button.
10. Write a program using Android Developer Studio/Eclipse to import image to Frame Layout.
11. Write a program using Android Developer Studio/Eclipse to display an option Menu.
12. Write a program using Android Developer Studio/Eclipse to generate Analog Clock.
13. Write a program using Android Developer Studio/Eclipse to generate Digital Clock
14. Write a program using Android Developer Studio/Eclipse to load URL "google.com".
15. Write a program using Android Developer Studio/Eclipse to load URL "bitmesra.ac.in"
16. Write a program using Android Developer Studio/Eclipse to accept a mobile number and then send SMS "Welcome".
17. Write a program using Android Developer Studio/Eclipse to implement Context Menu.
18. Write a program using Android Developer Studio/Eclipse to display current date.

19. Create a SQLITE database Employee and Make a form in Android Studio/Eclipse to allow data entry to

Employee Form with the following command buttons:

Employee Id

Employee Name

Address

Date of Joining

SAVE

CANCEL

20. Create a SQLITE database Student and Make a form in Android Studio/Eclipse to allow data entry to
Student Form with the following command buttons:

Roll No

Name

SUBMIT

CANCEL

TEXT BOOKS:
1. Dixit Prashant Kumar, "Android", Vikas Publishing House Pvt. Ltd, 1 st Edition,2014.

REFERENCE BOOKS:
1. Programming Android, 2nd Edition, ZigurdMednieks, Blake Meike, Laird Dornin, Masumi Nakamura,

O'Reilly Media, October 2012

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure
Direct Assessment

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
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CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA313
Course Title: MOBILE APPLICATION
Pre-requisite(s): COMPUTER NETWORK, OPERATING SYSTEMS
Co- requisite(s): Mobile Application Lab
Credits: 4 L: 3 T: 1 P: 0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To know about the mobile architecture with its different tires
B.	To know the mobile infrastructure and its components
C.	To adopt existing application and mobilizing and upgrading them for further use.
D.	To learn to compare mobile and native applications
E.	To gain knowledge of different architecture.

Course Outcomes

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

CO1	Be competent with the characterization and architecture of mobile applications.
CO2	Be competent with understanding enterprise scale requirements of mobile applications
CO3	Be competent with designing and developing mobile applications.
CO4	Be competent with comparatively evaluating the capabilities
CO5	Be exposed to technology and business trends impacting mobile applications

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction, Developing Mobile Applications, Going Mobile, People Perspective, Mobilizing the Enterprise**.**	**8**
Module – II Mobile Application Architectures, Client-Server layers and Tires, Client thin and fat & web page Hosting, Server one, two and three tire architecture, Connection type with always, partially and never connect, Good Architectural Design Tenets	**8**
Module – III Mobile Infrastructure, Mobile Device Types, Mobile Device Components, Connection Methods	**8**
Module – IV Mobile Client Applications, Thin Client, Fat Client, Web Page Hosting, Best Practices	**8**
Module – V Mobilizing existing application architectures. Evolution of Enterprise Architectures, Anatomy of Enterprise Web Architecture, Considerations When Mobilizing Existing Applications, Types of Mobile Applications, Mobile Web Apps Versus Native Applications, Mobile Web Apps Versus Native Applications, Mobile 2.0	**8**

TEXT BOOKS:

1. SchellRobbie, SchneiderHeather, LeeValentino, “Mobile Applications: Architecture, Design, and Development”, Prentice Hall 2004.
2. FlingBrian, “Mobile Design and Development”, O'Reilly Media, 2009.

REFERENCE BOOKS:

1. McWherterJeff, GowellScott, “Professional Mobile Application Development”, John Wiley & Sons 2012.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. On-demand development apps
2. Motion and Location sensing
3. Application performance management

POs met through Gaps in the Syllabus
3, 4, 12

Topics beyond syllabus/Advanced topics/Design
1. to promote efficiency through artificial intelligence
2. Surge of On-demand Apps
3. Integration of Wearable Apps
4. Real –time interaction between the service provider and customers.

POs met through Topics beyond syllabus/Advanced topics/Design
2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	3	2	3
CO2	3	3	3	1	3	1	1	1				2	2	3	3
CO3	3	3	3	3	3	1	2	2		1	1	2	3	2	3
CO4	3	3	3	1	3		1	1		1	1	2	2	3	3
CO5	3	3	3	3	3	1	1	1	1	1	1	2	3	2	3

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA314
Course Title: MOBILE APPLICATION LAB
Pre-requisite(s): Nil
Co- requisite(s): Mobile Application
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

1.	To know about the components and structure of mobile application development frameworks for Android and window OS based mobiles
2.	Understand how to work with various mobile application development frameworks
3.	Learn the basic and important design concepts and issues of development of mobile application
4.	Understand the capabilities of mobile devices
5.	Understand the limitations of mobile devices

Course Outcomes

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

CO1	Be competent with the characterization and architecture of mobile applications.
CO2	Be competent with understanding enterprise scale requirements of mobile applications
CO3	Be competent with designing and developing mobile applications.
CO4	Be competent with comparatively evaluating the capabilities
CO5	Be exposed to technology and business trends impacting mobile applications

SYLLABUS
List of Programs as Assignments
1. Compare various operating systems with Android OS.
2. Install and Configure java development kit (JDK), android studio and android SDK.
3. Configure android development tools (ADT) plug-in and create android virtual device.
4. Develop a program to display Hello World on screen.
5. Develop a program to implement linear layout and absolute layout.
6. Develop a program to implement frame layout, table layout and relative layout.
7. Develop a program to implement Text View and Edit Text.
8. Develop a program to implement AutoComplete Text View.
9. Develop a program to implement Button, Image Button and Toggle Button.

10. Develop a program to implement content provider.
11. Develop a program to implement service.
12. Develop a program to implement broadcast receiver.
13. Develop a program to implement sensors.
14. Develop a program to build Camera.
15. Develop a program for providing Bluetooth connectivity.
16. Create sample application with login module. (Check username and password) On successful login, Change Text View "Login Successful" and on login fail, alert user using Toast "Login fail".
17. Create login application where you will have to validate username and password till the username and password is not validated, login button should remain disabled.
18. Develop a program to

a. Send SMS
b. Receive SMS

19. Develop a program to send and receive e-mail.
20. Write a mobile application that creates alarm clock.
21. Write a mobile application that creates an alert upon receiving a message.
22. Develop a mobile application that uses GPS location information.

TEXT BOOK:

1. Android for Programmers: An App-Driven Approach, Deitel Developers, Pearson Education India, first edition 2011
2. Mobile Design and Development: Brian Fling, O'Reilly Media, Inc., 2009

REFERENCE BOOK:

1. Programming Android, ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, O'Reilly Media, Inc., 2011
2. Professional Mobile Application Development, Jeff McWherter, Scott Gowell, John Wiley & sons, 2012

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Implement an application that uses multithreading
2. Develop an application that makes use of Database.

Topics beyond syllabus/Advanced topics/Design

1. Real –time interaction between the service provider and customers.

POs met through Gaps in the Syllabus

3, 4

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA315
Course Title: SOFT COMPUTING
Pre-requisite(s):
Co- requisite(s): Soft Computing Lab
Credits: 4 **L: 3 T: 1 P: 0**
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand the concept of fuzzy logic and controllers.
B.	To understand the various architectures of ANN and its learning methods.
C.	To learn about basic concepts of genetic algorithm and its operators.
D.	To understand the Artificial Neural Networks.
E.	To understand the Genetic Algorithms.

Course Outcomes

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

CO1	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
CO3	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Fuzzy Set Theory:** Basic Definition and Terminology, Set Theoretic Operations, Fuzzy types and levels, MF Formulation and Parameterization, Fuzzy Union, Intersection and Complement, Fuzzy Number, Fuzzy measure.	**8**
Module – II **Fuzzy Logic: Fuzzy Rules and Fuzzy Reasoning:** Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Defuzzification, Fuzzy Reasoning. Fuzzy Inference System: Introduction, Mamdani Fuzzy Models, Other Variants, Takagi-Sugeno Fuzzy Models,.	**8**
Module – III **Fundamentals of Genetic Algorithms:** Basic Concepts, Creation of Offsprings, Encoding, Fitness Functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.	**8**
Module – IV **Introduction to Artificial Neural Networks**: What is a Neural Network? Human Brain, Models of Neuron, Neural Network viewed as Directed Graphs, Feedback, Network Architecture, Learning processes:(Hebbian, Competitive, Boltzman, Supervised, Unsupervised),Perceptrons, Adaline,Madaline.	**8**
Module – V Back Propagation Algorithm, Effect Of Tuning Parameters Of The Back Propagation Neural Network, Selection Of Various Parameters In BPN, Associative Memory and Adaptive Resonance Theory, Autocorrelators, Hetro correlators.	**8**

TEXT BOOKS:

1. Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi, 2004.
2. ajasekaran S. &Vijayalakshmi, G.A. Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, New Delhi, 2003.
3. Ross T. J., "Fuzzy Logic with Engineering Applications", TMH, New York, 1997.
4. Haykins Simon, "Neural Networks:A Comprehensive Foundation", Pearson Education,2002.

REFERENCE BOOKS:

1. Ray K.S., "Soft Computing and Its application", Vol 1, Apple Academic Press.2015.
2. Lee K.H., "First Course on Fuzzy Theory and App.", Adv in Soft Computing Spinger.2005.
   Zimmermann H.Z., "Fuzzy Set Theory and its App", 4thEdition, Spinger Science,2001.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Application of soft computing to develop and design the adaptive controllers.
2. Application of fuzzy inference system for prediction and modelling to complex problems.

POs met through Gaps in the Syllabus

3, 5

Topics beyond syllabus/Advanced topics/Design

1. Concepts and features of hard computing and soft computing.
2. NN- controller for an intelligent and autonomous robot.
3. Merits and Demerits of soft computing tools.

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA316
Course Title: SOFT COMPUTING LAB
Pre-requisite(s): Nil
Co- requisite(s): Soft Computing
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand the concept of fuzzy logic and controllers.
B.	To understand the various architectures of ANN and its learning methods.
C.	To learn about basic concepts of genetic algorithm and its operators.
D.	To understand the Artificial Neural Networks.
E.	To understand the Genetic Algorithms.

Course Outcomes

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

CO1	Solve numerical on Fuzzy sets and Fuzzy Reasoning.
CO2	Develop Fuzzy Inference System (FIS).
CO3	Solve problems on Genetic Algorithms
CO4	Explain concepts of neural networks
CO5	Develop neural networks models for various applications.

SYLLABUS

	QUESTIONS
1.	Implementation of Fuzzy Operations.
2.	Implementation of Fuzzy Relations (Max-min Composition).
3.	To implement De-Morgan's Law.
4.	To plot various membership functions.
5.	To implement FIS Editor.
6.	Implementation of Fuzzy Controller (Washing Machine).
7.	Implementation of Perceptron Learning Algorithm.
8.	Implementation of Unsupervised Learning Algorithm.
9.	Implementation of Simple Genetic Application.

TEXT BOOKS:

1. Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi, 2004.
2. Rajasekaran S. &Vijayalakshmi, G.A. Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, New Delhi, 2003.
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Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Application of soft computing to develop and design the adaptive controllers.
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POs met through Gaps in the Syllabus

3, 5

Topics beyond syllabus/Advanced topics/Design

1. Concepts and features of hard computing and soft computing.
2. NN- controller for an intelligent and autonomous robot.
3. Merits and Demerits of soft computing tools.

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 5

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure
Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
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Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
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CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA317
Course Title: INTRODUCTION TO INTERNET TECHNOLOGIES
Pre-requisite(s): Computer Network
Co- requisite(s): Internet Technologies Lab
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn about basics of Internet Technologies.
B.	Learn XML
C.	Learn Server Side Programming.
D.	Learn Java Servlet.
E.	Apply Internet based Programming and web applications.

Course Outcomes

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

CO1	Evaluate and analyse requirements of Internet technologies
CO2	Compare among the existing web based programming concepts
CO3	Create web based application.
CO4	Interactive server side application.
CO5	Implement dynamic web applications.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Internet Basics: Introduction to Internet, Client Server model, Internet IP Address, Domain Name, Domain Registration, Internet Services, A Brief Overview of TCP/IP and its Services, Hyper Text Transfer Protocol: Introduction, Web Servers and Clients, IP Address, Cyber Laws, URL and its Anatomy, Message format, Testing HTTP Using Telnet, Persistent and Non persistent Connections, Internet Security, Web Caching, Proxy.	**10**
Module – II History of HTML and W3C, HTML and its Flavours, HTML Basics, Elements, Attributes and Tags, Basic Tags, Advanced Tags, Frames, Images, Meta Tag, Planning of Web Page, Model and Structure for a Website, Designing Web Pages, Multimedia Content Frames, Cascading Style Sheet:Introduction,Advantages, Adding CSS, Browser Compatibility, CSS and Page Layout, Selectors	**10**
Module – III XML Technologies: Common Usage, Role of XML,Prolog,Body, Elements, Attributes, Validation, Displaying XML, Namespace. XML DTD: XML Schema Languages, validation, Introduction to DTD, Purpose of DTD, Using a DTD in an XML Document, Element Type Declaration, Attribute Declaration, Entity Declaration. Parsing XML: XML DOM, DOM Nodes, The Node Interface, Document Node, Element Node, Text Node, Attr Node, Java and DOM	**7**
Module – IV Server Side Programming: Servlet : Server –Side JAVA, Advantages Over Applets , Servlet Alternatives , Servlets Strengths , Servlet Architecture, Servlet life Cycle , Generic Servlet and Http Servlet, First Servlet , Passing Parameters to Servlets , Retrieving Parameters , Server side Include , Cookies, Filters, Problems with Servlet, Security Issues , Java Server Pages : Introduction and Marketplace , JSP and HTTP, JSP Engines, How JSP Works , JSP and Servlet, Anatomy of JSP page , JSP Syntax , JSP Components.	**8**
Module – V Session Tracking: User Passing Control and Data between Pages, Sharing Session and Application Data, Data Base Connectivity, JDBC Drivers, Basic Steps, Loading a Driver, Making a connection, Execute an SQLStatement, SQl Statements, Retrieving Result, GettingDatabase Information, Scrollable and Updatable Result Set, Result Set Metadata.	**5**

TEXT BOOKS:

1. RoyUttam K., "Web Technology", Oxford University Press.

REFERENCE BOOKS:

1. EtalXue Bai, "The Web Warrior Guide to Web Programming", Thomson Learning, 2003.
2. XavierC., "Web Technology & Design", New Age International Publishers, 1st Edn, New Delhi, 2004.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA318
Course Title: I**NTERNET TECHNOLOGIES LAB**
Pre-requisite(s):
Co- requisite(s): Introduction to Internet Technologies
Credits: 2 L:0 T:0 P:4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To learn client side web programming
B.	To Learn GUI design at client side
C.	To learn the concept of web server
D.	To know the server side web programming
E.	To know the practical application of various server side programming techniques.

Course Outcomes

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

CO1	To formulate client side HTML programming
CO2	To formulate XML web based applications
CO3	To configure web server
CO4	To apply programming concept to develop server side applications
CO5	To formulate server side applications to bind data bases.

SYLLABUS
List of Programs as Assignments:
1. Create a simple html file to demonstrate the use of different heading tags.
2. Create a simple html file to demonstrate different types of list.
3. Create a simple html file to create a table containing marks of 5 subjects of 10 students.
4. Design a html form for reserving a room in a hotel.
5. Create a html page with different types of frames such as floating frame, navigation frame & mixed frame.
6. Create a html form to find the railway fare from one place to another.
7. Create an XML structure with elements and attributes for Library information system.
8. Create an XML structure with elements and attributes for railway reservation system.
9. Create an XML document for student information system. Create a DTD and link the DTD to the XML document.
10. Create an XML document for employee information system. Create a DTD and link the DTD to the XML document

11. Create an XML schema for an XML file, which contains information about books that are available in the library.
12. Write a Servlet Program that displays server information (server name, port etc.).
13. Create a servlet program to retrieve the values entered in the html file.
14. Create a servlet program that takes your name and address from a HTML Form and displays it.
15. Write a program to show inter servlet communication between two servlets.
16. Create a simple servlet program to display the date and time.
17. Write a JSP program to output, "Welcome to JSP world." 18.Write a JSP page to display current time.
18. Write a JSP page that display a randomly generated number in first visit to this page and repeat displaying this same number in subsequent visits.
19. Write a JSP page to display current date.
20. Write a JSP page using <jsp:forward> to go to a servlet program which displays your name, date of birth and address.
21. Create a HTML form to take customer information (Name, Address, Mobile No.). Write a JSP program to validate this information of customers.
22. Write a jsp program to display student records stored in the database.
23. Create a form to record student details and store it into the database using jsp.
24. Write a program, using servlet and JDBC which takes students roll number and provides student information, which includes the name of the student, address, email-id, program of study, and year of admission. You have to use a database to store student's information.
25. Write program of Q25. with login and password protection. Display a message if login and password are not correctly given.
26. Create a database of students. Write a program using jsp to display the name, course, semester for those students who have more than 3 backlogs.

27. Create a database of students who are in the 5th Semester of the BCA. Write a program using JSP and JDBC to display the name and address of those students who are born after 1995.
28. Write a program using servlet and JDBC for developing an online application for the shopping of computer science books. You have to create a database for book title, author(s) of book, publisher, year of publication, price. Make necessary assumptions for book shopping.
29. Develop an application that collects/maintains the product information of an electronics goods production company in a database. Write a JSP page to retrieve information from the database on demand. Make necessary assumptions to develop this application.

Books recommended:

TEXT BOOK

1. Deitel,. P.J. Deitel, H.M. "Internet & World Wide Web How to Program", Pearson International Edition, 4th Edition.

REFERENCE BOOKS

1. Xavier C., "Web Technology & Design", New Age International Publishers, 1stEdn, New Delhi, 2004.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Second Quiz	10
Viva voce	20
Day to day performance	30
Exam Evaluation performance	30

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA329
Course Title: DATA ANALYTICS
Pre-requisite(s): Concepts of Programming Languages
Co- requisite(s): Data Analytics Lab
Credits: 4 L: 3 T: 1 P: 0
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand business intelligence and data analytics.
B.	To understand the methods of pre-processing data and performing activates related to data analytics.
C.	Know the various applications of data analysis.
D.	Know the business data analysis through the powerful tools of data analytics.
E.	To decide what data analysis techniques are required to obtain the desired objectives.

Course Outcomes

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

CO1	Illustrate about business intelligence and data analytics.
CO2	Explore different aspects of data analysis technologies.
CO3	Elaborate the methods of data mining and creation of decision tree.
CO4	Implement data analysis through the powerful tools of data application.
CO5	Apply R to implement various data analytics.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Analysis using Descriptive and Pictorial Statistics: mean, median, mode, harmonic mean, geometric mean, variance and standard deviation, quantiles, skewness, moments and kurtosis. Data Visualization: Summery table, Contingency table, Bar plot, Pie chart, Frequency distribution, Relative frequency distribution, Cumulative frequency distribution, Histogram, Frequency polygon, Cumulative frequency graphs, Box plot, Time series plot, Scatter diagram.	**10**
Module – II Data Relationships, Transformation, and Data Cleaning: Relationships between different types of data: Relationship between two categorical data, Relationship between categorical and quantitative data, Relationship between two quantitative data Transformation: The logarithm transformation, Root and square root transformation Standardization (Z-transformation), Min-max normalization. Data cleaning: missing values, noisy data.	**10**
Module – III Analysis using Inferential Statistics: Sampling, Sampling Distribution, and Estimation of Parameters, Sampling distribution of: means, proportions, difference of means, difference of proportions. Hypothesis testing about: population mean, the difference between two means, about a population proportion, difference between two proportions.	**10**
Module – IV Social Network and Text Data Analysis: What is a social network? Characteristics of social network. Link mining: Tasks and challenges. Mining on social networks. Text data analysis and informational retrieval. Dimensional reduction for text.	**5**
Module – V Outlier Analysis: Outlier detection based on: statistical distribution, distance based, deviation based.	**5**

TEXT BOOKS:

1. Gupta and Gupta, “Business Statistics”, Sultan Chand and Sons, 2014.
2. Bishnu and Bhattacherjee, Data Analysis: Using Statistics and Probability with R Language, PHI Learning, 2019.
3. Han J and Kamber M, “Data Mining: Concepts and techniques”, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Maheshwari Anil, "Data Analytics", Mc Graw hill publication, 2017.
2. TanPang-Ning, SteinbachMichael, and KumarVipin, "Introduction to Data Mining, Pearson Education", New Delhi.Dunham
3. H.M. & Sridhar S., "Data Mining", Pearson Education, New Delhi, 2006.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Use of various data to implement all the data analysis concepts.
2. Interaction with domain knowledge concepts with the actual algorithmic implementation.
3. Handling real data using data analytics algorithms.

POs met through Gaps in the Syllabus

1, 3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Data analysis using clustering
2. Panel data analysis, conjoint data analysis, logistic regression
3. Data analysis on domain specific data.

POs met through Topics beyond syllabus/Advanced topics/Design

1, 2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CO1	1	3	3	1	3	1	1	1				2	2	2	3
CO2	3	2	3	1	3	3	1	1				2	3	2	2
CO3	1	3	3	3	3	1	2	2		1	1	2	2	2	2
CO4	3	2	2	1	3		1	1		1	1	2	2	3	2
CO5	1	3	3	3	3	1	1	1	1	1	1	2	2	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD 4
CD2	Tutorials/Assignments	CO2	CD1 and CD4
CD3	Seminars	CO3	CD1, and CD8
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA330
Course Title: DATA ANALYTICS LAB
Pre-requisite(s): Concepts of Programming Languages
Co- requisite(s): Data Analytics
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 04
Class: BCA
Semester / Level: V/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To know details about the R Language.
B.	Understand Applications, advantages and limitations of various data types.
C.	Real life use of data analytics using R Language.
D.	Doing projects on data analytics using R Language.
E.	Use R as a tool to develop latest know-how related to the subject.

Course Outcomes

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

CO1	Basic concepts of R programming.
CO2	Classify features of R programming and skills for various data analytic tool.
CO3	Apply the knowledge gained for their project work as well as to develop some statistical applications.
CO4	Implement R for various data analytics applications.
CO5	Devised R based projects on data analytics.

SYLLABUS

Matrix

1. Write a R program to extract the submatrix whose rows have column value > 7 from a given matrix.
2. Write a R program to rotate a given matrix 90-degree clockwise rotation.
3. Write a R program to concatenate two given matrices of same column but different rows.

Factors

1. Write a R program to create an ordered factor from data consisting of the names of months.
2. Write a R program to concatenate two given factors in a single factor.
3. Write a R program to find the levels of factor of a given vector.

4. Write a R program to change the first level of a factor with another level of a given factor.

Arrays

1. Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from two given two vectors.
2. Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from two given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
3. Write a R program to create a two-dimensional 5x3 array of sequence of even integers greater than 50

Data Frame

1. Write a R program to extract specific column from a data frame using column name.
2. Write a R program to extract 3rd and 5th rows with 1st and 3rd columns from a given data frame.
3. Write a R program to create inner, outer, left, right join(merge) from given two data frames.
4. Write a R program to compare two data frames to find the row(s) in first data frame that are not present in second data frame.

TEXT BOOKS:

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Professional, 2017.
2. Bishnu, ParthaSarathi, Bhattacherjee, Vandana, Data Analysis : Using Statistics and Probability with R Language, PHI Learning, 2019.

REFERENCE BOOKS:

1. Mark Gardener, Beginning R: The Statistical Programming Language, O'Reilly.
2. Hadley Wickham and ,R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Use of massive data to implement all the data analytics concepts using R.
2. Interaction with domain knowledge with the actual algorithmic implementation using R language
3. Handling various data using same data analytics algorithms.

POs met through Gaps in the Syllabus

1, 3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Implementation of Big data using R
2. Implementation of data mining using R
3. Implementation advanced graphical tools.

POs met through Topics beyond syllabus/Advanced topics/Design
1, 2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Day to day performance & Lab files	30
First Quiz	10
Viva	20
Examination Experiment Performance	30
Second Quiz	10

Indirect Assessment
1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	2	3
CO2	3	1	3	1	3	3	1	1				2	2	3	3
CO3	3	3	3	3	3	1	2	2		1	1	2	3	3	2
CO4	3	2	2	1	3		1	1		1	1	2	2	2	2
CO5	1	3	3	3	3	1	1	1	1	1	1	2	3	3	2

Correlation Levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD2, CD 4
CD2	Tutorials/Assignments	CO2	CD1 and CD4
CD3	Seminars	CO3	CD1, and CD8
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA357
Course Title: INTRODUCTION TO CLOUD COMPUTING
Pre-requisite(s): Computer Network, Operating System
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To understand software, and other shared resources to be provisioned over the network as services in an on-demand manner.
B.	To understand the cloud computing models.
C.	To understand the different types of cloud computing services namely, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).
D.	To understand virtualization, security and privacy issues.
E.	To understand Cloud OS, federated clouds.

Course Outcomes

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

CO1	Identify the current practices in cloud computing.
CO2	Analyse the challenges in implementing clouds, data centers, hypervisor CPU and memory management
CO3	Elaborate cloud hosted applications, and other advanced and research topics in cloud computing
CO4	Evaluate the performance and systems issues, capacity planning, disaster recovery.
CO5	Summarize the cloud computing facilities and current technologies.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Cloud Computing at a glance, Distributed Systems, Virtualization, Web 2.0,	**8**
Module – II Eras of Computing, Elements of Distributed Computing, Concepts of Virtualization and its characteristics, Virtualization and cloud computing, cloud reference model, types of clouds, economics of the cloud.	**8**
Module – III **Cloud Interoperability and standards:** **Amazon Web Services:** Compute Services, Storage Services, Communication Services. Google AppEngine: Architectural and Core Concepts, Application Life-Cycle, Cost Model. Microsoft Azure: Azure Core Concepts, SQL Azure.	**8**
Module – IV Energy-Efficiency in clouds, Energy-Efficient and Green Cloud Computing Architecture, Market- Oriented Cloud Computing, Federated clouds: characterization and definition, cloud federation stack. Cloud Security and Trust Management: Cloud Security Defense Strategies.	**8**
Module – V Application of clouds in: Health care, Biology, CRM, ERP, Social Networking, Productivity and Geoscience. Cloudlets for Mobile Cloud Computing.	**8**

TEXT BOOK

1. BuyyaRajkumar, Charles, VecchiolaChristianamdSelviS. Thamarai "Mastering Cloud Computing", McGraw Hill Education(India) Private Limited, 2013.

REFERENCE BOOK

1. HwangKai, FoxGeoffrey C., DongarraJack J., "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann - India Edition, 2012.

Gaps in the Syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
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CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA359
Course Title: INTERNET OF THINGS
Pre-requisite(s): Internet Technologies, Networking
Co- requisite(s): Nil
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students:

A.	Learn about the basic concepts of IoT
B.	Learn the present state of technology of IoT architecture
C.	Get to know various types of IoT Protocols
D.	Learn about Data Analytics in the field of IoT
E.	Learn and Evaluate different applications of IoT is Smart City concept

Course Outcomes

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

CO1	Identify different parts of IoT and their uses
CO2	Explain the IoT architectures and their functions
CO3	Demonstrate the role of Wireless sensor network and Smart objects and in the field of IoT
CO4	Identify the emerging research challenges in the field of IoT
CO5	Design basic IoT application

SYLLABUS

MODULE	NO. OF LECTURE HOURS
MODULE I What Is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures, Convergence of IT and OT, IoT Challenges IoT Network Architecture and Design: Drivers behind New Network Architectures, Comparing IoT architectures, A Simplified IoT Architecture	**9**
MODULE II Smart Objects, The Things of IoT: Sensors, Actuators and Smart objects, Wireless Sensor Networks, Connecting Smart Objects: Communications criteria, IoT Access Technologies	**8**
MODULE III IP as the IoT Network Layer: Business Case of IP, Need for Optimization, Optimizing IP for IoT, Profiles and Compliances	**9**
MODULE IV Application Protocols for IoT: The Transport Layer, IoT Applications Transport methods, SCADA, Generic web based protocols, COAP, MQTT, Introduction to Data Analytics for IoT, Structured and Unstructured Data, Data in Motion and rest, IoT Data Analytics Overview and Challenges	**8**
MODULE V Case Studies/Industrial Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments	**6**

TEXT BOOK:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Student Feedback on Faculty

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	1	1	1	2	2
CO2	3	1	1	1	1	3	1	1	2	1	1	2	3	2	3
CO3	2	3	3	1	2	1	2	2	1	1	1	2	2	2	3
CO4	1	1	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	3	3	1	2	1	1	2	1	1	2	1	1	2	3

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1, CD5, CD8and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course Code: CA361
Course Title: SYSTEM PROGRAMMING
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 **L:** 3 **T: 0** **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Describe the utility of different system programs & system tools.
B.	Familiarize with the trade-offs between run-time and compile-time processing (Linking & Loading techniques).
C.	To learn the concepts and techniques behind the designing of various system software.
D.	To organize the functionalities & components of system software & tools into different layers for efficient code generation.
E.	Understand the designing of text editors, debuggers etc.

Course Outcomes

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

CO1	Elaborate the evolution of various system software.
CO2	Define various data structures that helps in the proper functioning of the system programs.
CO3	Analyse basic design of various system software.
CO4	Apply functionalities & components of system software & tools into different layers for efficient code generation.
CO5	Development and designing of text editors, debuggers etc.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Evolution of the Components of a Programming System, Assemblers, Loaders, Macros, Compilers, Linkers, Overview of Machine Language.	**8**
Module – II **Instruction Addressing and Execution:** Evolution of Operating Systems, Features of an Operating System, The BIOS Boot Process, The System Program Loader, Stack, Instruction Execution and Addressing, Instruction operands, protected Mode.	**8**
Module – III **Assemblers:** Overview of Assembly Language, Assembly Language Features, Conventional Segment Directives, Assembly Process, Single Pass Assembler, Design of a 2-Pass assembler for 8088.	**8**
Module – IV **Macros & Macro Processors:** Macros, Different forms of Macros, Macros using AIF, AGO, REPT. Etc., Design of a Macro Processor, Macro Assembler. Loaders: Basic Loader Functions, Absolute Loader, Compile & go Loader, Relocating Loader, Direct Linking Loader.	**8**
Module – V **Linkage Editors:** Linking and Relocation, Program Relocatability, Linkage Editor and its Application in IBP-PC, Linking for Program Overlays. Software Tools: Spectrum of Software Tools, Text Editors, Interpreter and Program Generators, Debug Monitors, Programming Environments.	**8**

TEXT BOOKS:

1. DhamdhereD.M., “System Programming and Operating Systems”, 2nd Edition., TMH, New Delhi.

REFERENCE BOOKS:

1. AbelPeter, “IBM PC Assembly Language and Programming”, 5th Edition, PHI, New Delhi-2003.
2. DonovanJ.J., “System Programming”, TMH, New Delhi.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Application of macros in Language processing system .
2. Application of text editors.

POs met through Gaps in the Syllabus

3, 5

Topics beyond syllabus/Advanced topics/Design

1. Algorithm for Single Pass Assembler and 2-Pass assembler.
2. Utility of system software for efficient code generation.

POs met through Topics beyond syllabus/Advanced topics/Design

2, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	1	1	2	2	1	1	3	2	2	3	3
CO2	3	1	1	1	1	3	1	1	1	2	1	1	2	3	1
CO3	2	3	3	1	2	1	2	2	2	1	3	1	3	2	2
CO4	1	1	3	3	1	1	1	1	1	1	2	2	3	1	2
CO5	3	3	3	1	2	1	1	2	1	2	1	1	2	3	1

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD8
CD2	Tutorials/Assignments	CO2	CD1, CD8and CD9
CD3	Seminars	CO3	CD1, CD2 and CD5
CD4	Mini Projects/Projects	CO4	CD1 CD5, CD8 and CD9
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1, CD2 and CD9
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

Course code: CA363
Course title: DECISION SUPPORT SYSTEM
Pre-requisite(s):
Co- requisite(s): Nil
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/3
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students:

A.	To understand the basic components of DSS
B.	To learn different phases and models for Decision making
C.	To understand how to create a distributed database using fragmentation.
D.	To learn transaction processing in a distributed environment.
E.	To understand how concurrency control is performed in a distributed environment.

Course Outcomes

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

CO1	Discuss the basic components of DSS
CO2	Classify the different phases and models for Decision making
CO3	Design a DSS according to the requirements.
CO4	Model and develop different levels in DSS using Software engineering principles
CO5	Analyse the system with pros and cons.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module I: Introduction to DSS: Definition. Types of DSS. Data and Model Management. DSS Knowledge Base. User interface. The DSS user. Categories and classes of DSS.	**8**
Module II: Decision and Decision-makers: Definition. Types of decision. Different levels of Decision makers in the organization and their requirement. Decision effectiveness. Simon's model of decision making. Rational decision making. Bounded rationality. Biases and heuristics in decision making.	**8**
Module III: Group Decision Support System (GDSS): Group decision making. GDSS modeling. Brainstorming process. MDM support technologies. Managing MDM activities. System perspective of a DSS: DSS in the context of information system. Information quality issues in DSS design. Role of internet in DSS development.	**8**
Module IV: Designing and building DSS: Strategies for DSS analysis and design. The DSS developer. Tools for DSS development. Implementing and Integrating DSS: DSS implementation. System evaluation. The importance of integration.	**8**
Module V: Intelligent Decision Support system: The intelligence of Artificial Intelligence. Future of Expert and Artificial Intelligence. Knowledge acquisition for Expert Systems. Future of Intelligent Software Agents and Delegation.	**8**

TEXT BOOK

1. Marakas George M., "Decision Support Systems in the 21st century", Pearson education.

REFERENCE BOOKS

1. Turban Efraim, "Decision Support Systems and Intelligent Systems", Pearson Education.

Gaps in the Syllabus (to meet Industry/Profession requirements)

1. Adoption of Information System
2. Selection of Strategy
3. Optimization Methods

POs met through Gaps in the Syllabus

3, 4, 12

Topics beyond syllabus/Advanced topics/Design

1. Model Development
2. Use of AI for Decision Making

POs met through Topics beyond syllabus/Advanced topics/Design

2, 3, 4, 12

Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
First Quiz	10
Mid Semester Examination	25
Second Quiz	10
Teacher's Assessment	5
End Semester Examination	50

Indirect Assessment

1. Students' Feedback on Course Outcome.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1	3	1	1	1				2	2	3	1
CO2	3	3	3	1	3	1	1	1				2	3	2	2
CO3	3	3	3	3	3	1	2	2		1	1	2	3	2	2
CO4	3	3	3	1	3		1	1		1	1	2	3	2	1
CO5	3	3	3	3	3	1	1	1	1	1	1	2	2	3	2

Correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping between COs and Course Delivery (CD) methods

CD Code	Course Delivery Methods	Course Outcome	Course Delivery Method Used
CD1	Lecture by use of Boards/LCD Projectors	CO1	CD1, CD7, CD 8
CD2	Tutorials/Assignments	CO2	CD1 and CD9
CD3	Seminars	CO3	CD1, CD2 and CD3
CD4	Mini Projects/Projects	CO4	CD1 and CD2
CD5	Laboratory Experiments/Teaching Aids	CO5	CD1 and CD2
CD6	Industrial/Guest Lectures		
CD7	Industrial Visits/In-plant Training		
CD8	Self- learning such as use of NPTEL Materials and Internets		
CD9	Simulation		

ANNEXURE - II

Course Code: CA173
Course Title: INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Pre-requisite(s):
Co- requisite(s): None
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

1.	Understand the concepts of Artificial Intelligence.
2.	Understand the various types of searching methods used in AI problems.
3.	Learn about basic concepts of knowledge representation
4.	Learn about reasoning in an uncertain domains.
5.	To understand the Artificial Neural Networks.

Course Outcomes

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

CO1	Understand the various approaches of artificial intelligence and Intelligent agent.
CO2	Apply different search techniques for solving real world problems and finding solutions.
CO3	Representing knowledge using predicate logic and reasoning process.
CO4	Explain the concepts of reasoning in an uncertain knowledge domains.
CO5	Develop neural networks models for various applications.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Overview of Artificial Intelligence, Applications, Agent and Environment, Different types of Agents, Problem Space & Search, Problem Characteristics.	**8**
Module – II **Searching Techniques:** Solving Problems by Searching, Problem Solving Agents, Uninformed Searching Strategies: BFS, DFS, Hill Climbing Search, Simulated Annealing Search, Informed Searching Strategies: Best First Search, A* Search.	**8**
Module – III **Using Predicate Logic:** Types of Knowledge and Representation, Representing Simple Facts in Predicate Logic, Conversion to Clausal Form, Resolution, Forward Reasoning, and Backward Reasoning.	**8**
Module – IV **Probabilistic Reasoning:** Representing Domain in an Uncertain Domain, Truth Maintenance System, Default Reasoning and the Closed World Assumption, Bayesian Networks.	**8**
Module – V **Artificial Neural Networks**: What is a Neural Network? Human Brain, Models of Neuron, Artificial Neural Network Architecture, Feed Forward and Feedback Network Architecture, Back Propagation Algorithm, Convolution Networks.	**8**

Text Books:

1. Rich E. & Knight, K., "Artificial Intelligence", 3rd Edition, TMH, New Delhi.
2. Russel S. and Norvig P., "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education.

Reference Books:

1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006.

Course Code: CA335
Course Title: DATA VISUALIZATION
Pre-requisite(s):
Co- requisite(s): None
Credits: 4 **L:** 3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/II
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Know the basics of data visualization
B.	To introduce visual perception and core skills for visual analysis.
C.	To translate and present data and data correlations in a simple way
D.	To have an understanding of various tools for creating data visualizations
E.	Learn to wisely use various visualization structures such as tables, spatial data, time-varying data, tree and network, etc.

Course Outcomes

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

CO1	Demonstrate understanding of Data Visualization and key Terms
CO2	demonstrate skills on creating visual representation of Data
CO3	Apply visualization techniques for various data analysis tasks
CO4	Demonstrate understanding of Visualization classification and its techniques
CO5	Demonstrate skills in creating different types of Representation

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction to data visualization, History of data visualization, importance of data visualization in data science, Principles of data visualization, Visual mapping and Elements of data visualization. Common tools and techniques for creating data visualizations.	**8**
Module – II Introduction of various charts and graphs, Design principles for charts and graphs, The do's and don'ts of charts and graphs making. The process of creating visualizations and selecting the appropriate visual display.	**8**

Module – III Visualization as exploration, visualizing categorical data, Visualizing time series data, Visualizing Geospatial data, Visualizing multiple variables .	**8**
Module – IV Introduction of Dashboard design, various types of Dashboards, Interactive visualizations, Story Telling through Data.	**8**
Module – V Visualization of groups, trees, graphs, clusters, networks. Data science use cases for data visualization.	**8**

Text Books:

1. Wong, D. (2011). The Wall Street Journal guide to information graphics: The dos and don'ts of presenting data, facts and figures. New York: W.W. Norton & Company. Available at the NYU Bookstore
2. Yau, N. (2013). Data Points: Visualization that means something. Indianapolis: O'Reilly. Available at the NYU Bookstore
3. Kieran Healy, Data Visualization: A Practical Introduction, 1st Edition, 2018

Reference Books:

1. Few, S. (2006). Information dashboard design: The effective visual communication of data. Sebastopol: O'Reilly.
2. Ware, C & Kaufman, M. (2008). Visual thinking for design. Burlington: Morgan Kaufmann Publishers.
3. Ward, Grinstein Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd. 1st Edition, 2014

Course Code: CA333
Course Title: MACHINE LEARNING
Pre-requisite(s): Fundamentals of Computer Algorithms
Co- requisite(s): Machine Learning Lab
Credits: 4 **L:** 3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives

This course enables the students to:

A.	To introduce the basic concepts and techniques of Machine Learning.
B.	To explore the application of Machine Learning.
C.	To understand the concept of supervised, unsupervised and semi-supervised learning.
D.	To understand the importance of assumptions in estimating the parameters in simple linear regression analysis.
E.	To learn the utility of clustering techniques.

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

CO1	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity.
CO2	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses.
CO3	Implement machine learning solutions to classification, regression, and clustering problems
CO4	Design and implement various machine learning algorithms in a range of real-world applications
CO5	Evaluate and analyse the performance of a machine learning algorithm or a system based on machine learning algorithm.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Machine Learning – what and why? Types of Machine Learning: Supervised, semi-supervised and unsupervised learning. Basics of Linear Algebra - matrices and vectors, Eigen value decomposition.	**8**
Module – II	

Supervised Learning: Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables. Logistic Regression: Classification using Logistic regression, Logistic regression vs. Linear regression, Logistic regression with one and multiple variables	**8**
Module – III **Classification:** Classification, Issues regarding classification, Techniques: Bayesian classification, Support Vector Machine, Decision Tree. Kernel trick **Prediction:** Prediction, Issues regarding prediction, Accuracy and Error measures, Evaluating the accuracy of a classifier or predictor.	**8**
Module – IV **Regularization:** Regularization and its utility: the problem of Overfitting, Application of Regularization in Linear and Logistic regression, Regularization and Bias/variance tradeoff **Unsupervised Learning**: Clustering: Introduction, agglomerative versus Divisive clustering **Dimensionality reduction:** Principal component Analysis	**8**
Module – V **Artificial Neural Networks**: Introduction, Model Representation, Perceptron, Forward propagation, Backpropagation algorithm, regularization and bias/variance. Recurrent networks	**8**

Text Books:

1. Mitchell Tom, "Machine Learning", Latest Edition, Mc-Graw Hill.

Reference Books:

1. Shwartz Shai Shalev, and David Shai Ben, "Understanding Machine Learning", Cambridge University Press.
2. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India.
3. Witten, Ian H., et al. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann.

Course Code: CA334
Course Title: MACHINE LEARNING LAB
Pre-requisite(s): Computer Algorithms Lab, Python Programming Lab
Co- requisite(s): Machine Learning
Credits: 2 **L:** 0 **T:** 0 **P:** 4
Class schedule per week: 4
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Make use of Data sets in implementing the machine learning algorithms
B.	To choose the appropriate machine learning design method for a specified application.
C.	Implement the machine learning concepts and algorithms in any suitable language of choice.
D.	Analyze and compare the different algorithms

Course Outcomes

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

CO1	Gain knowledge about basic concepts of Machine Learning
CO2	Identify machine learning techniques suitable for a given problem
CO3	Solve the problems using various machine learning techniques
CO4	Apply Dimensionality reduction techniques
CO5	Design application using machine learning techniques.

SYLLABUS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Text Books:

1. Geron A., "Hands on Machine Learning with Scikit Learn and Tensorflow", 2nd edition, O' Reilly Press, 2020
2. Muller A. C., Guido S., "Hands Machine Learning with Python", O'Reilly Press, 2016

Reference Books:

1. Coelho L. P., Richert W., "Building Machine Learning Systems in Python", O' Reilly Press, 2nd edition, 2016

Course Code: CA 337
Course Title: NATURAL LANGUAGE PROCESSING
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 **L:**3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
B.	To understand basic knowledge on various morphological, syntactic and semantic NLP tasks.
C.	To learn various parsing of language
D.	To learn various strategies for NLP system evaluation and error analysis.

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

CO1	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
CO2	understanding of the relationship between NLP and statistics & machine learning.
CO3	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
CO4	Develop systems for various NLP problems with moderate complexity.
CO5	Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcoming.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
MODULE-I Introduction to NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model.	**8**
Module-II Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, smoothing (basic techniques), Evaluating language models; Perplexity vs Entropy.	**8**
Module – III	

Parts-of-speech Tagging: basic concepts; English word classes; Tag-set; Early approaches: Rule based and TBL; POS tagging using HMM. HMM tagging as decoding.	**8**
Module – IV Parsing Basic concepts: top down and bottom-up parsing, treebank; Syntactic parsing: CKY parsing and its application. Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.	**8**
Module – V Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors: SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW.	**8**

Text Books:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

Reference books:

1. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing

Course Code: CA338
Course Title: NATURAL LANGUAGE PROCESSING LAB
Pre-requisite(s): Python
Co- requisite(s): Natural Language Processing
Credits: 2 **L:** 0 **T:** 0 **P:** 4
Class schedule per week: 04
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	The main objective of this course is to give a practical introduction to NLP.
B.	Understanding morphological processing, syntactic parsing and information extraction.
C.	Understanding NLP and classification of text using Python's NLTK Library.

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

CO1	Write Python programs to manipulate and analyse language data.
CO2	Understand key concepts from NLP and linguistics to describe and analyse language.
CO3	Understand the data structures and algorithms that are used in NLP.
CO4	Classify texts using machine learning.
CO5	Able to Access Text Corpora and Lexical Resources.

SYLLABUS

List Of Programs

1. Write python program to generate random text with bigrams.
2. Text segmentation: Segment a text into linguistically meaningful units, such as paragraphs, sentences, or words.
3. Write programs to segment text (in different formats) into tokens (words and word-like units) using regular expressions. Compare an automatic tokenization with a gold standard.
4. Find out the frequency of words in our text and plot the frequency graph.
5. Remove all punctuation from the text. Plot graph without punctuation.
6. Clean the data by removing all stopwords and find frequency distribution of cleaned data.
7. Word Cloud is a data visualization technique. Word cloud python Implementation.
8. Write program to perform stemming to normalize word.

9. Use lemmatization with the NLTK Python framework.
10. Part-of-speech tagging: Label words (tokens) with parts of speech such as noun,adjective, and verb using a variety of tagging methods , e.g., default tagger, regular expression tagger, unigram tagger, and n-gram taggers.
11. Write a program to find the most common verbs in any text, sort all the verbs by frequency
12.Write program for Chunk extraction, or partial parsing: Extract short phrases from a part-of-speech tagged sentence.
13. Write program to parse: parsing specific kinds of data, focusing primarily on dates, times, and HTML.
14. Write program to read search engine data find a most frequent word in the text.
15. Write program to check how many different definitions of a word are available in Wordnet.
16. Write program to find all synonyms and antonyms of any word from wordnet.
17.Write python program to find Bag of words for any text.
18. Write python program to find Tf-IDF of any text.
19. Write a python program to develop a language model.
20. Make use of the following preprocessing libraries:
- dateutil which provides datetime parsing and timezone conversion
- lxml and BeautifulSoup which can parse, clean, and convert HTML
- charade and UnicodeDammit which can detect and convert text character encoding

Text Books:
1. Rich E. & Knight, K., "Artificial Intelligence", 3rd Edition, TMH, New Delhi.
2. Russel S. and Norvig P., "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education.

Reference Books:
1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, New Delhi, 2006.

Course Code: CA369
Course Title: DEEP LEARNING
Pre-requisite(s): Introduction to Machine Learning
Co- requisite(s): Nil
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	To understand the basic concepts of Machine Learning.
B.	To explore the application areas of Neural Networks.
C.	To understand the idea of Convolutional Neural Networks.
D.	To explore the basic concepts of Feed forward Neural Networks.
E.	To understand the applications of Neural networks.

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

CO1	Able to differentiate between machine learning and deep learning
CO2	Identify problems suitable for application of deep learning
CO3	Use Neural network based model for classification and other tasks
CO4	Apply Convolutional Neural Networks to solve problems
CO5	Analyse the efficiency of deep learning systems

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction and Basics of Machine Learning:** Supervised and Unsupervised learning Algorithms, Over Fitting and Under fitting, Hyperparameters and Validation sets, Estimators, Bias and variance, Maximum Likelihood Estimation, Bayesian classifier. **Perceptron:** Perceptron, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs).	**8**
Module – II **Neural Network**: Beginning of ANN, From Cognitive Science to Deep Learning, NNs and their importance, Activation functions, Loss functions: Gradient Descent, Regularization. **Background**: History of Deep Learning, Deep Learning Success Stories.	**8**
Module – III	

Feed forward Neural Networks: Basic concept and terminology, Representing networks, Perceptron rule, Delta rule, From logistic regression to Backpropagation, Backpropagation, Complete Feedforward NNs	**8**
Module – IV **Convolutional Neural Networks**: Introduction, Kernel filter, Architecture, Principles behind CNNs, CNN applications **Deep Unsupervised learning:** Autoencoders: learning representations, different architectures	**8**
Module – V **Deep Learning Architectures:** Transformer networks, BERT, Capsule network **Applications**: Computer vision, sentiment analysis, text generation, image processing	**8**

Text Book

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Skansi S., Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence, 1 st Edition, Springer International Publishing, 2018.

References

1. Buduma N., Fundamentals of Deep Learning, 1st Edition, O Reilly Media, 2016.
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press, 2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Code: CA365
Course Title: IMAGE PROCESSING
Pre-requisite(s): Basics of Mathematics
Co- requisite(s):
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/III
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	Understand the fundamentals of digital image processing.
B.	Develop a broad knowledge of different transform methods for enhancing the image.
C.	Learn Image restoration techniques and noise models used for restoring an image.
D.	Understand about image compression and image segmentation.
E.	Know about Object Recognition & learn techniques to perform the same.

Course Outcomes

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

CO1	Understand the concept of image formation, digitization, and the role which human visual system plays in perception of image data
CO2	Acquire an appreciation for transform techniques for enhancing the appearance of an image and will be able to apply them in different applications.
CO3	Discern the difference between noise models, gain an insight into assessing the degradation function and apply noise removal technique.
CO4	Synthesize a solution to image compression.
CO5	Design pattern/object recognition system, evaluate its performance and apply improvement techniques.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I	**8**

Introduction to Digital Image Processing: Fundamental Steps in Digital Image Processing, Components of an Image Processing System; Color Image: Fundamentals, Color Models & various image formats like bmp, jpeg, tiff, png, gif, etc.	
Module – II **Digital Image Fundamentals:** Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	**8**
Module – III **Image Enhancement&Restoration:** Image Enhancement: Basic intensity transformation function, Histogram Processing, Image degradation/Restoration Process, Noise Models, Restoration in the presence of noise only-Spatial Filtering.	**8**
Module – IV **Image Compression & Segmentation**: Image Compression: Fundamentals, some basic compression methods; Image segmentation: Fundamentals, point, line & edge detection, thresholding, region-based segmentation.	**8**
Module – V **Image Processing Applications:** Object Recognition: Patterns & Patterns Classes, Recognition using Neural Network, matching shape numbers.	**8**

Textbooks:

1. Rafael. C. & Woods Richard E. "Digital Image Processing", 3rd Edition, Pearson Education, New Delhi, 2009.

Reference Books:

1. Pratt W.K. "Digital Image Processing", 4th Edition, John Wiley & sons Inc., 2006.
2. Sonka M., Hlavac Vaclav, Boyle Roger "Image Processing, Analysis and Machine Vision", 2nd Edition, Thomson Learning, India Edition, 2007.
3. Jayaraman "Digital Image Processing", Tata McGraw. Hill Education, 2011.

Course Code: CA367
Course Title: CRYPTOGRAPHY & NETWORK SECURITY
Pre-requisite(s): Computer Networks
Co- requisite(s): NIL
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	To Learn Basic Concepts of Cryptography and Network Security and Apply them in various Real-life Application.
B.	To understand the basic concepts of Network Security.
C.	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
D.	To understand how to deploy encryption techniques to secure data in transit across data networks
E.	To design security applications in the field of Information technology

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

CO 1	Understand the basic concept of Cryptography and Network Security and their mathematical models, and to be familiar with different types of threats
CO 2	Learning and applying various Ciphering Techniques
CO 3	Apply Symmetric and Asymmetric Cryptographic Algorithms and Standards in Networks.
CO 4	Examine the issues and structure of Authentication Service and Electronic Mail Security
CO 5	To explain and classify different malicious programs, worms and viruses, and to learn the working and design principles of Firewalls

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction to Cryptography**: Computer Security concepts, The OSI Security Architecture, Security Attacks, Security Services, A model for Network Security, Classical Encryption Techniques: Substitution and transposition techniques.	**8**
Module – II **Mathematical Foundations of Cryptography**: Modular Arithmetic, Euclidean Algorithm, Groups, Rings, Fields, Finite Fields of the Form GF(p), Polynomial	**8**

Arithmetic, Finite Fields of the Form GF (2^n), Prime Numbers, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Quadratic Congruence, Discrete Logarithms	
Module – III **Symmetric and Asymmetric Cryptography**: Difference Between Symmetric and Asymmetric Cryptography, DES, Triple DES, AES, RSA Cryptosystem, Symmetric and Asymmetric Key Cryptography Together, Elgamal Cryptosystem, Elliptic Curve Cryptosystems, Diffie-Hellman Key Exchange, Cryptographic Hash Functions, Message Authentication Codes, Digital Signature.	**8**
Module – IV **Internet Security Protocols**: Basic Concepts, Security Socket Layer (SSL), Secure Hyper Text Transfer Protocol (SHTTP), Time stamping Protocol (TSP), Secure Electronic Transaction (SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol (WAP) Security, Security in GSM.	**8**
Module – V **Network Security**: Application layer: PGP and S/MIME, Transport layer: SSL and TLS, Network layer: IPSec, System: Users, Trusts and Trusted Systems, Buffer Overflow and Malicious Software, Malicious Programs, Worms, Viruses, Intrusion Detection Systems (IDS), Firewalls: Definitions, Constructions and Working Principles.	**8**

Text Books:

1. Forouzan B. A., Mukhopadhyay D., "Cryptography and Network Security", 3rd Edition, Mcgraw Higher Education, 2016.

Reference Books:

1. Stallings W., "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson, 2017.
2. Kahate A., "Cryptography and Network Security", 3 rd Edition, McGraw Hill Education, New Delhi, 2013.
3. Schneier B., "Applied Cryptography: Protocols, Algorithms and Source Code In C", 2nd Edition, Wiley, 2007.

ANNEXURE - III

Course Code: CA175
Course Title: FOUNDATIONS OF DATA SCIENCE
Pre-requisite(s): None
Co- requisite(s): Nil
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: II/I
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	Understand the fundamental concepts of data science.
B.	Understand the concept of Exploratory Data Analysis
C.	Understand basics of Statistical methods
D.	Know about the different tools and techniques used in data science

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

CO1	Demonstrate key concepts related to Data Science
CO2	Utilize EDA, inference and regression techniques
CO3	Utilize Matrix decomposition techniques to perform data analysis
CO4	Apply data pre-processing techniques
CO5	Apply Data Visualization techniques

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction**: Importance of Data Science, Data Scientist Roles and responsibilities, Business Intelligence and Data Science, Facets of Data Science, Data science process, Application of data science, Data Security Issues.	**8**
Module – II **EDA:** Exploratory Data Analysis (EDA), statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery. **Linear Algebra Basics:** Matrices to represent relations between data, Linear algebraic operations on matrices.	**8**
Module – III	

Basic Statistical Inference: Developing Initial Hypotheses, Identifying Potential Data Sources, EDA case study, testing hypotheses on means, proportions and variances **Regression models:** Regression models: Simple linear regression, least-squares principle, MLR, logistic regression, Multiple correlation, Partial correlation	**8**
Module – IV **Data Pre-processing and Feature Selection:** Data cleaning - Data integration - Data Reduction - Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters-Wrappers - Decision Trees - Random Forests	**8**
Module – V **Visualizing Data**: Visualization Tools, Developing a Visualization Aesthetic, Effective Use of Color and Shading, The Power of Repetition, Chart Types, Great Visualizations, Reading Graphs **Data Science Tools and Techniques**: R, SAS Enterprise Miner, WEKA, MATLAB, Python, Hadoop	**8**

Text Book(s)

1. The Data Science Design Manual by Steven S. Skiena (Author)
2. Introducing Data Science by Davy Cielen, Arno D. B. Meysman, and Mohamed Ali

Reference Books

1. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
2. Data Science Concepts and Techniques with ApplicationsAuthors: **Qamar**,

Course Code: CA279
Course Title: STATISTICAL DATA ANALYSIS
Pre-requisite(s):
Co- requisite(s): Nil
Credits: 4 **L**: 3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: IV/II
Branch: BCA

Course Objectives:
This course enables the students to:

A.	Understand the concept and importance of data in the various fields. Use suitably the data collection methods, editing the data, organizing the data and representing the data.
B.	Apply preliminary techniques of descriptive statistics to solve the problems.
C.	Perform comparative study of descriptive statistical tools.
D.	Describe the suitable techniques for analyzing and interpreting the data.
E.	Select and implement the appropriate methods for data science.

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

CO1	Design the data collection instruments and represent the data.
CO2	Solve the problems based on data and statistics.
CO3	Making decisions on the basis of analysis of the data.
CO4	Apply the inferential statistics in the interpretation of large data.
CO5	Use the mathematical and analytical skills on data in management and technology.

SYLLABUS

	(NO. OF LECTURE HOURS)
Module I: **Statistics:** Introduction, need, importance, Scope, Data:definition, types, methods of collecting primary and secondary data, Merits and limitations, Designing questionnaire, Data Editing, Summarizing Data, Representing Data: Histogram, Frequency Polygon, Bar Chart; single, multiple, subdivided, Ogive, Pie-chart.	**8**
Module II: **Measures of Central Tendency:** introduction, Need, Characteristics of good measures of central tendency. Mean, Median, Mode, geometric mean, harmonic mean: introduction, Numerical examples to calculate, for discrete and grouped data. Merits and limitations.	**8**

Measures of Deviation: Introduction, scope, importance. Characteristics of Good Measures of Deviation. Range, Quartile, Mean Deviation, and Standard Deviation. Correlation and regression: Introduction, Numerical examples.	
Module III: **Probability and Probability Distribution:** Introduction, Conditional probability, Bayes' theorem, Random Variables, Binomial, Poisson, and Normal Distribution.	**8**
Module IV: **Sampling, Sampling Distribution and Hypothesis Testing:** Methods of Sampling. Merits and limitations of Sampling. Sampling distribution. Statistics and Parameters. Estimation of parameters: Interval estimation for one population mean. Level of significance.**:**Hypothesis, Steps in hypothesis testing, one tailed and two tailed tests. Errors in hypothesis testing.	**8**
Module V: **Methods of Data Analysis:** Exploratory Method of Data Analysis: Introduction, Importance in Data Science, Tools of Exploratory Data Analysis ,Types of Exploratory Data Analysis. Confirmatory Data Analysis: Introduction, Uses of Confirmatory Data Analysis, Need and Logic of Confirmatory Data Analysis. Difference Between Exploratory and Confirmatory Data Analysis. Problems and Analysis.	**8**

TEXT BOOKS

1. Miller James D. (2017), Statistics for Data Science (Packt Publishing: Birmingham- Mumbai) 1st ed.
2. Gupta S.P. and Gupta M.P. (2015), Business Statistics. (Sultan Chand & Sons: New Delhi).18th ed.

REFERENCE BOOKS

1. Richard I. Levin, David S. Rubin, Masood H. Siddiqui (2017), Statistics for Management. (Pearson: New Delhi) 8th ed.
2. Das N.G. (2017). Statistical Methods (combined volumes). (Tata McGraw-Hill: New Delhi).

Course Code: CA336
Course Title: DATA VISUALIZATION LAB
Pre-requisite(s): None
Co- requisite(s): Data Visualization
Credits: 2 **L:** 0 **T:** 0 **P:** 4
Class schedule per week: 4
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To interpret data plots and understand core data visualization concepts such as correlation, linear relationships, and log scales.
B.	To explore the relationship between two continuous variables using scatter plots and line plots.
C.	To translate and present data and data correlations in a simple way

Course Outcomes

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

CO1	Design effective data visualizations
CO2	Find and select appropriate data that can be used in order to create a visualization
CO3	Apply visualization techniques for various data analysis tasks

SYLLABUS

1. Exploring Data Visualization tools: Tableau, Power BI, R-Programming Language.
2. Hands on with Tableau
3. Creating charts and graphs with Tableau and R.
4. Visualization of Categorical Data using Tableau and R.
5. Geospatial Data visualization using Tableau and R.
6. Time-Series Data Visualization using Tableau and R.
7. Creating word cloud using Tableau and R.
8. Design interactive dashboard using Tableau.
9. Telling story with data by using Tableau.
10. Solve a case study which must cover all aspects of visualization.

Text Books:

1. **Visual Analytics with Tableau** by Alexander Loth (Author), Nate Vogel (Foreword), Sophie Sparkes (Foreword), Wiley Publication.
2. **R for data science : Import, Tidy, Transform, Visualize, And Model Data** by Hadley Wickham (Author), Garrett Grolemund (Author)

Course Code: CA339
Course Title: NoSQL DATABASE
Pre-requisite(s): Database Management System
Co- requisite(s): NoSQL Database Lab
Credits: 4 **L:** 3 **T:** 1 **P:** 0
Class schedule per week: 04
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	To introduce the basic concepts of NoSQL database
B.	To explore different types of NoSQL databases
C.	To understand the architecture of different types of databases
D.	To learn evaluation of NoSQL
E.	To explore the utility of search engines

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

CO 1	Describe and compare different types of NoSQL databases
CO 2	Compare and contrast NoSQL databases with RDBMS
CO 3	Analyze an understanding of the detailed architecture and performance tune Key-Value pair NoSQL databases.
CO 4	Apply NoSQL development tools on different types of NoSQL database
CO 5	Demonstrate the architecture, define objects, load data and performance tune Column-oriented, Document-oriented, Graph NoSQL databases

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Overview and History of NoSQL Databases, Understanding NoSQL Databases, History of NoSQL, Features of NoSQL, Scalability, Cost, Flexibility, NoSQL Business Drivers, Classification and Comparison of NoSQL Databases, Consistency – Availability – Partitioning (CAP), Limitations of Relational Databases, Comparing NoSQL with RDBMS, Managing Different Data Types, Columnar, Key-Value Stores, Triple and Graph Stores, Document, Search Engines, Hybrid NoSQL Databases, Applying Consistency Methods, ACID, BASE, Polyglot persistence, Need	**8**

for NoSQL, Advantages	
Module – II **Evaluating NoSQL**: Introduction, The Technical Evaluation, Choosing NoSQL, Search Features, Scaling NoSQL, Keeping Data Safe, Visualizing NoSQL, Extending Data Layer, Business Evaluation, Deploying Skills, Deciding Open Source versus commercial software, Business critical features, Security	**8**
Module – III **Key-Value & Document Based Databases**: Introduction to Key-Value Databases, Key Value Store, Essential Features, Consistency, Transactions, Partitioning, Scaling, Replicating Data, Versioning Data, How to construct a Key, Using Keys to Locate Values, Hash Functions, Store data in Values, Use Cases, Introduction to Document Databases, Supporting Unstructured Documents, Document Databases Vs. Key-Value Stores, Basic Operation on Document database, Partition, Sharding, Features, Consistency, Transactions, Availability, Scaling, Use Cases.	**8**
Module – IV **Column-oriented & Graph based Databases**: Introduction to Column Family Database, Features, Architectures, Differences and Similarities to Key Value and Document Database, Consistency, Transactions, Scaling, Use Cases, Introduction to Graph Databases, Advantages, Features, Consistency, Transactions, Availability, Scaling, Graph & Network Modelling, Properties of Graphs and Noes, Types of Graph, Undirected and directed Graph, Flow Network, Bipartite Graph, Multigraph, Weighted Graph, Conclusion of Unit	**8**
Module – V **Search Engine**: Introduction, Common Feature of Search Engine, Dissecting a Search Engine, Search versus query, Web crawlers, Indexing, Searching, indexing Data Stores, Altering, Using Reverse queries, Use Cases, Types of Search Engine, Elastic Search	**8**

Text Books:

1. NoSQL for Dummies, Adam Fowler, John Wiley & Sons
2. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications

Reference Books:

1. NoSQL for Mere Mortals, Dan Sullivan, Pearson Education

Course Code: CA340
Course Title: NoSQL DATABASE LAB
Pre-requisite(s):
Co- requisite(s): NoSQL Database
Credits: 2 **L: 0 T: 0 P:** 4
Class schedule per week: 4
Class: BCA
Semester / Level: V/III
Branch: Bachelor of Computer Applications

Course Objectives

This course envisions to impart to students to:

A.	To setup and configure the lab environment
B.	Make use of different commands in the lab environment
C.	To create and implement shards
D.	Understand the model of system existing in various IT companies

Course Outcomes

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

CO1	Design a database for a given set of requirements
CO2	Use NoSQL and its various commands
CO3	Apply commands on given database
CO4	Have knowledge of creating, adding shards to the structure
CO5	Understand the importance of migration to NoSQL

SYLLABUS
Below experiments can be performed on MongoDB Lab by creating single node cluster.
List of Programs
1. Prepare and install infrastructure for setting up MongoDB lab
2. Execute set of basic commands on MongoDB lab environment
- Login
- Display all databases
- Authenticate and logout from databases
- List down collections, users, roles
3. Execute set of basic commands on MongoDB lab environment
- Insert document
- Update document
- Save document
- Display collection records
- Drop function

4. XYZ Pvt Ltd. is a famous telecom company. They have customers in all locations. Customers use the company's network to make calls. Government has brought in a regulation that all telecom companies should store call details of their customers. This is very important from a security point of view and all telecom companies have to retain this data for 15 years. The company already stores all customer details data, for their analytics team. But due to a surge in mobile users in recent years, their current database cannot handle huge amounts of data. Current database stores only six months of data. XYZ Pvt Ltd now wants to scale their database and wants to store 15 years of data.
Data contains following columns:
Source : Phone number of caller
Destination : Phone number of call receiver Source_location : Caller's city
Destination_location : Call receiver's city
Call_duration : phone call duration
Roaming : Flag to check if caller is in roaming Call_charge : Money charged for call

After discussing the requirements with database and architecture team, it has been decided that they should use MongoDb. You have been given the task to Setup a distributed system (database) such that data from different locations go to different nodes (to distribute the load)

- Import data to sharded collection
- Check data on each shard for distribution

2. Execute below sets of problem by taking reference of previous experiment and find out:

- Add additional node to existing system
- Check the behavior of cluster on adding a shard
- Check the behavior of query for finding a document with source location Delhi.

3. Case study on 5 different IT Companies who are working on Mongo DB. Explain on the below parameters:

- Why moved to NoSQL
- Advantages over NOSQL
- Business Benefits Technology Adaptation

Text Books:

1. "Getting Started with NoSQL: Your guide to the world and technology of NoSQL", by Gaurav Vaish

Course Code: CA373
Course Title: INTRODUCTION TO MACHINE LEARNING
Pre-requisite(s): Fundamentals of Computer Algorithms
Co- requisite(s): Nil
Credits: 3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

1.	To introduce the basic concepts and techniques of Machine Learning.
2.	To explore the application of Machine Learning.
3.	To understand the concept of supervised, unsupervised and semi-supervised learning.
4.	To understand the importance of assumptions in estimating the parameters in simple linear regression analysis.
5.	To learn the utility of clustering techniques.

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

CO1	Formulate machine learning problems corresponding to different applications: data, model selection, model complexity.
CO2	Demonstrate understanding of a range of machine learning algorithms along with their strengths and weaknesses.
CO3	Implement machine learning solutions to classification, regression, and clustering problems
CO4	Design and implement various machine learning algorithms in a range of real-world applications
CO5	Evaluate and analyse the performance of a machine learning algorithm or a system based on machine learning algorithm.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Introduction:** Machine Learning – what and why? Types of Machine Learning: Supervised, semi-supervised and unsupervised learning. Basics of Linear Algebra - matrices and vectors, Eigen value decomposition.	**8**
Module – II	

Supervised Learning: Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables. Logistic Regression: Classification using Logistic regression, Logistic regression vs. Linear regression, Logistic regression with one and multiple variables	**8**
Module – III **Classification:** Classification, Issues regarding classification, Techniques: Bayesian classification, Support Vector Machine, Decision Tree. Kernel trick **Prediction:** Prediction, Issues regarding prediction, Accuracy and Error measures, Evaluating the accuracy of a classifier or predictor.	**8**
Module – IV **Regularization:** Regularization and its utility: the problem of Overfitting, Application of Regularization in Linear and Logistic regression, Regularization and Bias/variance tradeoff **Unsupervised Learning**: Clustering: Introduction, agglomerative versus Divisive clustering **Dimensionality reduction:** Principal component Analysis	**8**
Module – V **Artificial Neural Networks**: Introduction, Model Representation, Perceptron, Forward propagation, Backpropagation algorithm, regularization and bias/variance. Recurrent networks	**8**

Text Books:

1. Mitchell Tom, “Machine Learning”, Latest Edition, Mc-Graw Hill.

Reference Books:

1. Shwartz Shai Shalev, and David Shai Ben, “Understanding Machine Learning”, Cambridge University Press.
2. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India.
3. Witten, Ian H., et al. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann.

Course Code: CA371
Course Title: BIG DATA ANALYTICS
Pre-requisite(s): None
Co- requisite(s): None
Credits:3 **L:** 3 **T:** 0 **P:** 0
Class schedule per week: 03
Class: BCA
Semester / Level: VI/III
Branch: Bachelor of Computer Applications

Course Objectives
This course enables the students to:

A.	Understand the concepts related to Big Data and Artificial Intelligence for data driven decision making
B.	Understand the explosion of big data in organizations & cultural transformation
C.	Understand Big data & AI tools & technologies available in market

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

CO1	Ability to recognize related technologies like AI, IoT and Digital Reality
CO2	Ability to define big data & explain the various V's of Big Data
CO3	Understand the application of AI for Executives
CO4	Understand the people component of AI & Big Data
CO5	Understand the analytical aspects of Big Data

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Big Data and its Explosion in Organizations**: Challenges of Data Explosion, CEO's Perspective, Cultural Changes and Strategies for Cultural Transformation, Practising Managers, Practitioner's Perspectives, Formulating the Data Management Strategy **Basics of Big Data:** History of Big Data, Types of Big Data: Structured, Unstructured and Semi-structured Data, Vs of Big Data, Why Big Data Needs Analysis, Big Data: Creating Values for Businesses, Big Data Analytics: Types of Analytics, Steps for Big Data Analytics (BDA), Big Data Analytics: A Multidisciplinary Approach: Role of Statistics in BDA, Types of Statistical Analysis, Role of Computer Science in BDA	**8**
Module – II **Converging Technologies: Exploring New Dimensions:** Growth and Evolution of Disruptive Technologies, Internet of Things (IoT), Digital Reality Technologies: AR,VR and MR, Cloud, Artificial Intelligence **Big Data and AI Tools & Technologies:** Big Data Storage Platforms (Apache Hadoop – HDFS), CEPH, Big Data on Cloud, Big Data: Analytical Tools, Big	**8**

Data: Visualization Tools, Characteristics of Big Data Tools	
Module – III **Basics of Big Data Architecture (BDA):** Basic Components of a Big Data Architecture (BDA), Types of Big Data Architecture (BDA): Lambda Architecture, Kappa Architecture, Microservices Architecture, Zeta Architecture, IoT Architecture, Challenges of BDA, Benefits of BDA, Successful BDA Implementations	**8**
Module – IV **Big Data: Privacy, Security and Ethical Concerns:** Rise in Big Data: Raising Concerns, What is Big Data Privacy and Security, Big Data Posing Threats to Users' Privacy, Ensuring Big Data Privacy at Various Stages, Privacy Preserving Data Publishing (PPDP), Data Anonymization, Data Protection: Roles and Responsibilities, Challenges to Securing of Big Data, Ethical Issues and Principles of Big Data Ethics	**8**
Module – V **People Component of BDA:** People as a Prime Component of BDA, Role of a Data Analyst, Business Analyst, Data Engineer/Data Architect, Big Data Engineer, Data Scientist, Data Scientist vs Data Manager, Machine Learning (ML) Engineer, Quality Traits: Personality, Professional Quality Traits **Big Data and AI around us:** Applications of Big Data Analytics: Finance Domain, Insurance Sector, HR Domain, Supply Chain Domain, Healthcare Sector, Services Industry	**8**

Text Books:

1. Big Data Analytics Using Artificial Intelligence Technologies: Transforming Organizations, by Rinku Dixit and ShaileeChoudhary, Wiley Publishers

Reference Books:

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses by Michele Chambers, AmbigaDhiraj, and Michael Minelli
2. Big Data, Black Book, Dreamtech Press