MANGALORE UNIVERSITY

State Education Policy – 2024
[SEP-2024]

CURRICULUM STRUCTURE

FOR

BACHELOR OF COMPUTER APPLICATIONS
BCA-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

MANGALORE UNIVERSITY

Suggested programme structure for the Under Graduate Programmes

[BCA, BCA (A.I & M.L, BCA (D.A)]

Semester	Course 1	Course 2	Course 3	Elective / Optional	Course	Language	Compulsory	Total Credit	Total Working hour
I	5 (3T+2P)	5 (3T+2P)	5 T			3+3	2	23	4+4+4+4+5+4+4+2=31
II	5 (3T+2P)	5 (3T+2P)	5T			3+3	2	23	4+4+4+4+5+4+4+2=31
III	5 (3T+2P)	5 (3T+2P)	5T	2		3+3		23	4+4+4+4+5+4+4+2=31
IV	5 (3T+2P)	5 (3T+2P)	5T	2		3+3	2	25	4+4+4+4+5+2+4+4+2=33
V	8[(2x3T)+2P]	8[(2x3T)+2P]	8[(2x3T)+2P]				2	26	3+3+4+3+3+4+3+3+4+2=32
VI	3T	3T	3T		3T	Project work 12		24	3+3+3+3+24=36
								144	

Note:

- **Course1 and Course2: I to IV Semester: Theory 3 credit=4 contact hours & Practical 2 credit=4 contact hours**
- **Course3: I to IV Semester: Theory 5 credit=5 contact hours**
- **Course1, Course2 and Course3: V and VI Semester: Theory 3 credit=3 contact hours & Practical 2 credit=4 contact hours**
- **Elective/Optional: 2 credit=2 contact hours**
- **Languages: 3 credit=4 contact hours**
- **Compulsory: 2 credit=2 contact hours**

CURRICULUM STRUCTURE FOR BCA- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester I								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1		Fundamentals of Information Technology	Theory	4	80	20	100	3
2		Fundamentals of Information Technology Lab	Practical	4	40	10	50	2
3		Problem Solving using C	Theory	4	80	20	100	3
4		C Programming Lab	Practical	4	40	10	50	2
5		Computational Mathematics	Theory	5	80	20	100	5
6		Language-I	Lang	4	80	20	100	3
7		Language-II	Lang	4	80	20	100	3
8		Constitutional Values	Compulsory	3	40	10	50	2
Sub - Total				**32**	**520**	**130**	**650**	**23**
Semester II								
6		Data Structure using C	Theory	4	80	20	100	3
7		Data Structures Lab	Practical	4	40	10	50	2
8		Database Management System	Theory	4	80	20	100	3
9		Database Management	Practical	4	40	10	50	2
10		Computer Architecture	Theory	5	80	20	100	5

11		Language-I	Lang	4	80	20	100	3
12		Language-II	Lang	4	80	20	100	3
13		Environmental Studies	Compulsory	3	40	10	50	2
Sub - Total				**32**	**520**	**130**	**650**	**23**

Semester III								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1		**Language-I**	**Lang**	**4**	**80**	**20**	**100**	**3**
2		**Language-II**	**Lang**	**4**	**80**	**20**	**100**	**3**
3	**BCA - AIML -3.1**	**Object Oriented Programming using Java**	**Core**	**4**	**80**	**20**	**100**	**3**
4	**BCA- AIML -3.2**	**Operating Systems**	**Core**	**4**	**80**	**20**	**100**	**3**
5	**BCA- AIML- 3.3**	**Computer Networks**	**Core**	**5**	**80**	**20**	**100**	**5**
6	**BCA- AIML- 3.4**	**Object Oriented Programming Lab**	**Practical**	**4**	**40**	**10**	**50**	**2**
7	**BCA- AIML-3.5**	**Operating SystemsLab**	**Practical**	**4**	**40**	**10**	**50**	**2**
8	**BCA- AIML-3.6**	**A) Digital Marketing** **B) Web Content Management System** **C) DEVOPS**	**Elective**	**2**	**40**	**10**	**50**	**2**
Sub - Total				**31**	**520**	**130**	**650**	**23**

Semester IV								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1		**Language-I**	**Lang**	**4**	**80**	**20**	**100**	**3**
2		**Language-II**	**Lang**	**4**	**80**	**20**	**100**	**3**
3	**BCA – AIML-4.1**	**Artificial Intelligence-I**	**Core**	**4**	**80**	**20**	**100**	**3**
4	**BCA-AIML -4.2**	**Python Programming**	**Core**	**4**	**80**	**20**	**100**	**3**
5	**BCA – AIML-4.3**	**Software Engineering**	**Core**	**5**	**80**	**20**	**100**	**5**
6	**BCA-AIML-4.4**	**Artificial Intelligence-I Lab**	**Practical**	**4**	**40**	**10**	**50**	**2**
7	**BCA-AIML-4.5**	**Python Programming Lab**	**Practical**	**4**	**40**	**10**	**50**	**2**
8	**BCA – AIML-4.6**	**A) Cloud Computing** **B) Object Oriented Analysis and Design** **C) Digital Image Processing**	**Elective**	**2**	**40**	**10**	**50**	**2**
9	**BCA – AIML-4.7**	**Internet Basics**	**Compulsory**	**2**	**40**	**10**	**50**	**2**
Sub - Total				**33**	**640**	**160**	**800**	**25**

Semester V								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1	**BCA - AIML –5.1**	**Machine Learning Techniques**	**Core**	**3**	**80**	**20**	**100**	**3**
2	**BCA- AIML –5.2**	**Web Development**	**Core**	**3**	**80**	**20**	**100**	**3**
3	**BCA - AIML –5.3**	**Data Analytics Using R**	**Core**	**3**	**80**	**20**	**100**	**3**
4	**BCA - AIML –5.4**	**Internet Of Things**	**Core**	**3**	**80**	**20**	**100**	**3**
5	**BCA- AIML –5.5**	**Artificial Intelligence -II**	**Core**	**3**	**80**	**20**	**100**	**3**
6	**BCA- AIML –5.6**	**Natural Language Processing**	**Core**	**3**	**80**	**20**	**100**	**3**
7	**BCA- AIML –5.7**	**Web Development Lab**	**Practical**	**4**	**40**	**10**	**50**	**2**
8	**BCA- AIML –5.8**	**Data Analytics Lab**	**Practical**	**4**	**40**	**10**	**50**	**2**
9	**BCA- AIML –5.9**	**Machine Learning and IOTLab**	**Practical**	**4**	**40**	**10**	**50**	**2**
10	**BCA- AIML-5.10**	**AI Tools and Techniques**	**Compulsory**	**2**	**40**	**10**	**50**	**2**
Sub - Total				**32**	**640**	**160**	**800**	**26**

Semester VI								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1	**BCA-AIML -6.1**	**Artificial Neural Network**	**Core**	**3**	**80**	**20**	**100**	**3**
2	**BCA-AIML -6.2**	**Deep Learning**	**Core**	**3**	**80**	**20**	**100**	**3**
3	**BCA-AIML -6.3**	**Principles of Cyber Security**	**Core**	**3**	**80**	**20**	**100**	**3**
3	**BCA-AIML -6.4**	**Computer Vision**	**Core**	**3**	**80**	**20**	**100**	**3**
4	**BCA-AIML -6.5**	**Project Work**	**Project Work**	**24**	**300**	**100**	**400**	**12**
Sub - Total				**36**	**620**	**180**	**800**	**24**

SEMESTER - I

Program Name	**BCA-AIML**	Semester	**I**
Course Title	**Fundamentals of Information Technology(Theory)**		
Course Code:	**BCA- AIML -1.1**	No.of Credits	**03**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the fundamentals of computer system
- Identify different components within the computer system
- Understand different types of input and output devices
- Demonstrate the working concepts of different devices connected to computer
- Explain different generations of programming languages and their significance
- Exploring MS Office Word 2007,Access 2007,Excel 2007 And Powerpoint 2007

Unit	Description	Hours
1	**Computer Basics:** Introduction, Characteristics computers, Evolution computers, Generation of computers, Classification of computers, the computer system, Application of computers. Computer Architecture: Introduction, Central processing unit-ALU, Registers, Control unit, system bus, main memory unit,	

	cache memory, communication between various units of a computer system. Components inside a computer system – System case, Power supply, Mother board, BIOS, Ports and Interfaces, Expansion card, Ribbon cable, Memory chips, Processors	**13**
2	**Computer memory and storage :** Introduction, memory representation, memory hierarchy, Random access memory, Types of RAM, Read-only memory, Types of ROM,RAM, ROM and CPU interaction. **Secondary Storage:** Types of secondary storage device - Magnetic tape, magnetic disk, Floppy disk, Hard disk, Advantages and disadvantages of magnetic disk, **Computer Software: Introduction**, categories of software, system software, Operating Systems, device drivers, language translators, System Utility, Application Software **Operating Systems:** Introduction, Functions of an operating System, Classification of Operating Systems	**13**
3	**Input devices:** Introduction, Types of input devices, Keyboard, Mouse, Introduction to Track ball, Joystick, light pen, Touch screen and track pad. Speech recognition, digital camera, webcam, flat bed scanner, **Output devices:** Types of output, Classification of output devices, Printers- Dot matrix, drum printer, Ink jet, Laser, Hydra, Plotter, Monitor- CRT, Displaying graphics on CRT, Colour display on CRT,LCD, Differences between LCD and CRT **Computer programming languages:** Introduction, Developing a program, Program development cycle, Types of programming languages, generation of programming languages, Features of a good programming language.	**13**

4	**Word processing software:** Word environment, using files and folders ,working with text, working with tables ,checking spelling and grammar, printing document **Spreadsheet software:** Excel environment, formatting and Copying formulas, working with rows and columns, additional features and charting **Presentation software:** Introduction, PowerPoint environment, creating a new presentation, working with different views, using masters, adding animation, adding transition. **Microsoft Access:** Access environment, Database objects.	**13**

Text Book:

1. ITL Education Solution Limited, Introduction to Information Technology, Pearson- Second Edition.

Reference Books:

1. A K SHARMA, Computer Fundamentals and Programming in C, Universities Press, 2nd edition, 2018
2. Peter Norton, Introduction to Computers, 7th edition, Tata McGraw Hill Publication, 2011
3. Anita Goel, Computer Fundamentals, Pearson Education, 2011.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Program Name	**BCA -AIML**	Semester	**I**
Course Title	**Problem Solving using C(Theory)**		
Course Code:	**BCA –AIML- 1.2**	No.of Credits	**03**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Unit	Description	Hours
1	**Computer Programming and Languages –** Introduction, Algorithm, Flowchart, Program Control Structures, Programming Paradigms, Programming Languages. **Introduction to C**: Overview of C Program, Importance of C Program, Basic structure of a C-program, Programming style, Execution of C Program. **Constants, Variables & Data types**: Character set, C token, Keywords & identifiers, Constants, Variables, data types, Declaration of variables, Declaration of storage class, Assigning values to variables, defining symbolic constants.	**13**

2	**Operators and Expression**: Arithmetic, Relational, logical, assignment, increment & decrement, conditional, bit wise & special operators, Arithmetic expressions, Evaluation of expressions, Precedence of arithmetic operators, type conversions in expressions, operator precedence andassociativity, built in mathematical functions. **Managing Input and Output operations**: Reading a character, Writing a Character, formatted input-inputting integer numbers, inputting real numbers, inputting character strings, reading mixed-data types, formatted output-output of integer numbers, output of real numbers, printing of mixed data types. **Decision Making and Branching**: Decision making with if statement, simple if statement, the if else statement, nesting of if … else statements, the else if ladder, the switch statement, the?: operator, the go to statement.	**13**
3	**Decision making and looping**: The while statement, the do statement, for statement, jumps in loops **Arrays**: Introduction,one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initializing two dimensional arrays. **Handling of Strings**: Declaring & initializing string variables, reading strings from terminal, writing strings to screen, Arithmetic operations on characters, Putting strings together, Comparison of two strings, String Handling functions,table of strings. **User defined functions**: Need for user defined functions, Declaring, defining and calling functions return values and their types, Function calls, Function declaration, Categories of functions: With/without arguments, with/without return values. Recursive functions. The scope, visibility and lifetime of variables.	**13**
4	**Structures and union**: Defining a structure, Declaring structure variables, structure initialization, copying and comparing structure variables, operations on individual members, arrays of structures, arrays within structures, Unions. **Pointers**: Understanding pointers, initialization of pointer variables, accessing a variable through its pointer, chain of pointers, pointer expressions, pointer increments and scale	**13**

	factor, pointers and arrays. **File Management**- Defining and Opening a file, closing a file, Input/Output operations on files, Error handling during I/O operations	

Text Books:

1. Introduction to Information Technology ITL education solution Ltd, Second Edition
2. E Balagurusamy, Programming in ANSI C, 7th Edition, Tata McGraw Hill.

Reference Books:

1. Deitel, P., & Deitel, H. (2012). **C How to Program** (7th ed.). Prentice Hall.
2. Kanetkar, Y. (2016). **Let Us C** (15th ed.). BPB Publications.
3. Kernighan, B. W., & Ritchie, D. M. (1988). **The C Programming Language** (2nd ed.). Prentice Hall.
4. Schildt, H. (2017). **C: The Complete Reference** (4th ed.). McGraw Hill Education.
5. Kochan, S. G. (2014). **Programming in C** (4th ed.). Addison-Wesley.
6. K.R. Venugopal, Sudeep R Prasad, **Programming with C**, 4th Edition, Tata McGraw-Hill Education.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Program Name	**BCA -AIML**	Semester	**I**
Course Title	**Computational Mathematics(Theory)**		
Course Code:	**BCA –AIML- 1.3**	No.of Credits	**05**
Contact hours	**5 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

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

- Study and solve problems related to connectives, predicates and quantifiers under different situations.
- Develop basic knowledge of matrices and to solve equations using Cramer's rule.
- Know the concept of Eigen values.
- To develop the knowledge about derivatives and know various applications of differentiation.
- Understand the basic concepts of Mathematical reasoning, set and functions

Unit	Description	Hours
1	**Logarithms**: Introduction, Definition, Laws of operations, change of base. **Binomial theorems**: Introduction, Binomial theorem, Position of terms. **Analytical geometry**: Introduction, directed line, midpoint, distance between two points, Section formula, external division, coordinates of a centroid, Area of a triangle. **The straight line**: slope of a straight line, different forms of equations of the straight line. **Circle**: The equation of a circle, different forms of circles, General equation of the circle, equation of tangent and normal to	**15**

	the circle.	
2	**Matrix Algebra**: Definition, types of matrices, algebra of matrices – addition of matrices, subtraction of matrices, multiplication of matrices, determinant of a matrix, Adjoint of a matrix, orthogonal and unitary matrix, rank of a matrix, echelon form of a matrix, normal form of a matrix, equivalence of matrices. Inverse of matrix. **Solutions of Linear equations**: Matrix method, Cramer's rule. **Arithmetic progression**: Definition, formula for nth term, sum to n terms, Arithmetic mean, problems. **Geometric progression**: Definition, formula for nth term, sum to n terms, geometric mean, problems.	**15**
3	**Mathematical logic**: Introduction, statements, Connectives, negation, conjunction, disjunction, statement formulas and truth tables, conditional and bi Conditional statements, tautology, contradiction, equivalence of formulas, duality law, Predicates and Quantifiers, arguments, Joint Daniel. **Sets**: Definition, notation, inclusion and equality of sets, the power set, Operations on sets, Venn diagram, ordered pairs, and n-tuples, Cartesian product. **Relations**: Introduction, properties of a binary relation in a set, Relation matrix and graph of a relation, equivalence relations, compatibility relations, composition of Binary relation. **Functions**: Definition and introduction, types of functions, composition of functions, inverse functions.	**15**
4	**Counting**: Basics of counting, Pigeonhole principle, Permutation and combination, Generalized. **Permutations and Combinations**: Generating permutation and combination, inclusion and exclusion. **Graphs**: Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Colouring.	**15**

	Trees: Directed tree, leaf node, branch node, ordered tree, degree of a node, forest, descendent, m-ary tree, conversion of directed tree into a binary tree **Applications of Discrete Mathematics in Modelling Computation:** Language and Grammars – Introduction, Phrase-Structured, Types, Derivation Trees; Finite State Machines with Output – Introduction, Finite State Machines, Types; Finite State Machines without Output - Introduction, Set of Strings, Finite State Automata, Language Recognition by FSM; Language Recognition – Introduction; Turing Machine – Introduction, Definition	

Text Books:

1. D C Sancheti and V K Kapoor, Business Mathematics, Sultan Chand & Sons, 2011
2. P R Vittal, Business Mathematics and Statistics, Margham Publications, Chennai.
3. J P Trembley and R Manohar, Discrete Mathematical Structures, McGraw Hill Education Private Limited, New Delhi.
4. Kenneth H Rosen, Discrete Mathematics and Its Applications., Seventh edition, 2012
5. C. L. Liu, D. P, Mohapatra, Elements of Discrete Mathematics, 4th Edition McGraw Hill Education Private Limited, New Delhi.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Program Name	**BCA -AIML**	Semester	**I**
Course Title	**Fundamentals of Information Technology Lab**		
Course Code:	**BCA –AIML-1.4**	No.of Credits	**02**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A: MS WORD

1. Prepare a document using different formatting tools

Highlights of the National Education Policy (NEP) 2020

Note4Students

From UPSC perspective, the following things are important :

Prelims level : National Education Policy

Mains level : Need for imbibing competitiveness in Indian education system

New Policy aims for **universalization of education** from pre-school to secondary level with 100 % Gross Enrolment Ratio (GER) in school education by 2030. NEP 2020 will bring 2 crores out of school children back into the mainstream through the open schooling system.

- *The current 10+2 system to be replaced by a **new 5+3+3+4 curricular structure** corresponding to ages 3-8, 8-11, 11-14, and 14-18 years respectively.* **This will bring the hitherto uncovered age group of 3-6 years under the school curriculum, which has been recognized globally as the crucial stage for the development of mental faculties of a child.**
- The new system will have 12 years of schooling with three years of Anganwadi/ pre-schooling.
  - Emphasis on Foundational Literacy and Numeracy, no rigid separation between academic streams, extracurricular, vocational streams in schools; Vocational Education to start from Class 6 with Internships
  - Teaching up to at least Grade 5 to be in mother tongue/ regional language. No language will be imposed on any student.
- Assessment reforms with **360° Holistic Progress Card**, tracking Student Progress for achieving Learning Outcomes
- A new and comprehensive National Curriculum Framework for Teacher Education, NCFTE 2021, will be formulated by the NCTE in consultation with NCERT.
- By 2030, the minimum degree qualification for teaching will be a 4-year integrated B.Ed. degree.
- Gross Enrolment Ratio in higher education to be raised to **50% by 2035; 3.5 crore seats to be added in higher education.**
- The policy envisages broad-based, multi-disciplinary, holistic Under Graduate Program with flexible curricula, creative combinations of subjects, integration of vocational education and multiple entries and exit points with appropriate certification.
- **Academic Bank of Credits to be established to facilitate Transfer of Credits**

Multidisciplinary Education and Research Universities (MERUs), at par with IITs, IIMs, to be set up as models of best multidisciplinary education of global standards in the country.

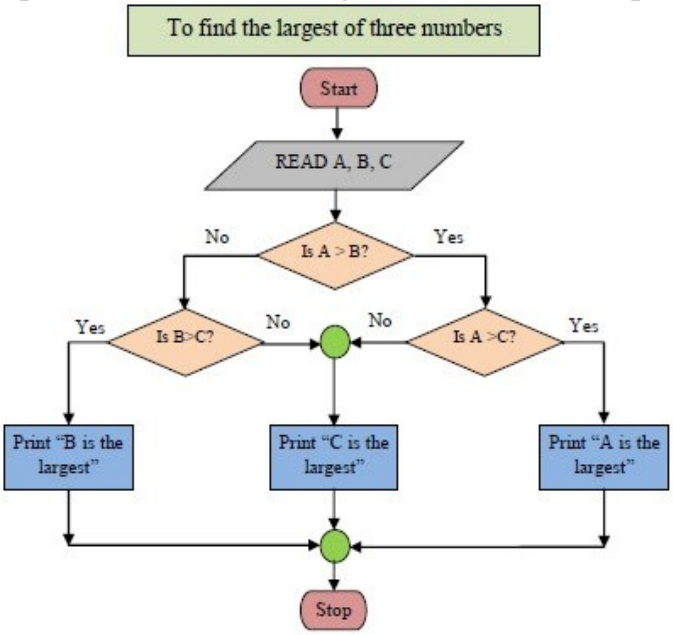
Affiliation of colleges is to be **phased out in 15 years** and a stage-wise mechanism is to be established for granting graded autonomy to colleges.

Over a period of time, it is envisaged that every college would develop into either an Autonomous degree-granting College or a constituent college of a university.

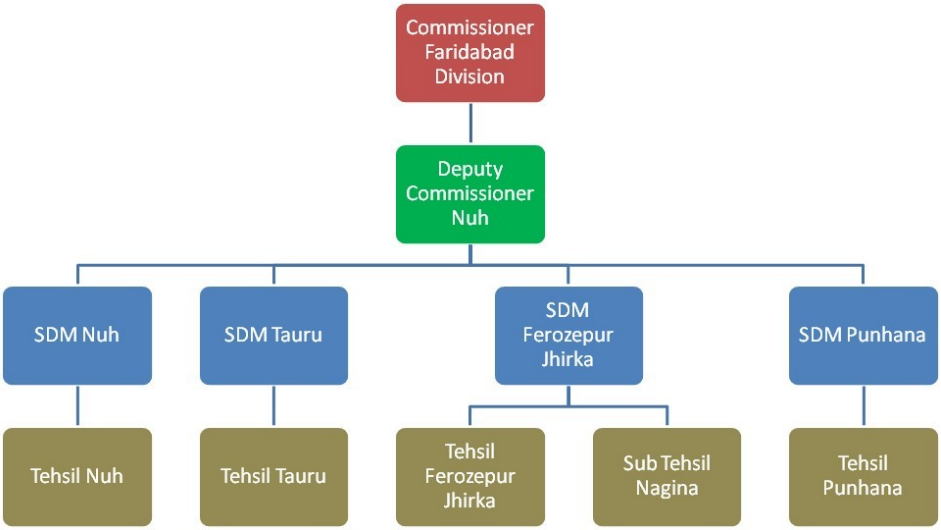
$$\frac{df}{dt} = \lim_{h \to 0} \frac{f(t+h) - f(t)}{h}$$

$$(a+b)^2 = a^2 + 2ab + b^2$$
$$(a-b)^2 = (a+b)^2 - 4ab$$
$$a^2 + b^2 = (a-b)^2 + 2ab$$

2. Prepare a document using SmartArt and Shapes tools



Organization Chart – Administration Faridabad Division



3. Prepare a document with table to store sales details of a company for different quarters and calculate total, average and find maximum, minimum sales value.

Branch Code	Branch	Sales in Quarters				Total	Avg
		1	2	3	4		
A101	Mangalore	354690	244610	383290	413670		
A102	Udupi						
Total (Across Branches)							
Average (Across Branches)							
Highest Sales (Across Branches)							
Lowest Sales (Across Branches)							

TIME TABLE

Class : I BCA						Room No. 206	
Day	I	II	III	IV		V	VI
Monday					LUNCH BREAK		
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday						***	

4. Prepare interview call letters for five candidates describing about the company and instructions about the interview. Use Mail merge feature

Interview call Letter Format

Date:
[Name of the candidate]
[Address]

Dear [name of the candidate]

This is to the reference of your application for the job [name of the job] indicating interest in seeking employment in our organisation. We thank you for the same.

We would like to inform you that your profile is being shortlisted for the job role and is best suited for it. Therefore, we would like to take a face to face interview with you on [date of interview] at [venue details].

We hope that the venue is suitable for you. If not please get in touch with us, so that we can arrange the date and venue according to your availability.

The company will reimburse you all the expenses incurred by you for this interview. This letter has an attachment in which you need to fill the details and carry it along on the date of interview. Please carry your CV also along with you.

Kindly confirm your availability for the date and venue. If there are any changes to be done, please contact us at phone number: [999xxxx999] and email id: abcnd@mail.com.

We look forward to seeing you.

Regards,
Name of the Manager
Designation Name
Company name

PART-B: MS POWERPOINT

1. Create a presentation (minimum 5 slides) about your college. It should contain images, chart, Bulleted text… The slides should be displayed automatically in a loop.

2. A simple quiz program. Use hyperlinks to move to another slide in the presentation to display the result and correct answer/wrong answer status. Use at least four questions.

[**Navigation must be done by hyperlink**]

3. Create a presentation for a business proposal (minimum 5 slides).
    - Slides must include company logo in header
    - A title slide with table of contents
    - financial data of the company in the table
    - Company sales and profit in charts
    - Make use of animation and transition

4. Create a presentation for a college project (minimum 5 slides).
    - Master slide
    - Add comments for each slide
    - Add Audio and video to the slide
    - Add header and footer.
    - Add source citation
    - Make use of animation and transition

[Presentation must include title slide, Module Design, Chart, references]

PART-C: MS EXCEL

(Note: Give proper titles, column headings for the worksheet. Insert 10 records for each exercise in such a way to get the result for all the conditions. Format the numbers appropriately wherever needed).

1. Create a worksheet to maintain student information such *as RollNo, Name, Class, Marks in three subjects* of 10 students. Calculate total marks, average and grade. Find grade for Distinction, First class, Second class, Pass and Fail using normally used conditions.

• Using custom sort, sort the data according to class: - Distinction first, First Class next, and so on. Within each class, average marks should be in descending order.

• Also draw the Column Chart showing the RollNo versus Average scored.

(Note: Worksheet creation and formatting 2 marks, calculations: 3 marks, sorting: 2 marks, chart: 3 marks)

2. Prepare a worksheet to store details of electricity consumed by customers. Details are Customer No, Customer Name, Meter No, Previous meter reading, Current meter reading of 10 customers. Calculate total number of units consumed and total amount to be paid by each consumer using following conditions:

• If unit consumed is up to 30, charge is 100.

• 31 to 100 units, 4.70 per unit

• 101 to 200 units, 6.25 per unit

• Above 200 units, 7.30 per unit.

• Use Data validation to see that current reading is more than previous reading.

• Arrange the records in the alphabetic order of names.

• Filter the records whose bill amount is more than Rs.1500.

(Note: Worksheet creation and formatting 2 marks, Data validation: 2 marks, calculations: 2 marks, sorting: 2 marks, filtering: 2 marks)

3. Create Employee worksheet having EmpNo, EmpName, DOJ, Department, Designation and Basic Pay of 8 employees. Calculate DA, HRA, Gross Pay, Profession Tax, Net Pay, Provident Fund as per the rule:

• DA = 30% of basic pay

• HRA = 10% of basic pay if basic pay is less than 25000, 15% of basic pay otherwise.

• Gross =DA +HRA+ Basic pay

• Provident fund =12% of Basic pay or Rs.2000, whichever is less.

• Profession Tax= Rs.100 if Gross pay is less than 10000, Rs.200 otherwise.

• NetPay = Gross - (Professional tax + Provident Fund)

• Using Pivot table, display the number of employees in each department and represent it using Pie chart.

(Note: Worksheet creation and formatting 2 marks, calculations: 3 marks, Pivot table: 3 marks, Chart: 2 marks)

4. Create a table COMMISSION containing the percentage of commission to be given to salesmen in different zones as follows:

Zone	Percentage
South	10
North	12.5
East	14
West	13

Create another table SALES in the same worksheet to store salesman name, zone name, place, name of the item sold, rate per unit, quantity sold. Calculate total sales amount of each salesman. Referring the COMMISSION table, write the formula to compute the commission to be given. (Hint: Use if function and absolute cell addresses)

Using advanced filtering show the result in other parts of the worksheet.
• Show the records of various zones separately.
• Show the records of only East and West zones.
• Display the details of the items sold more than 50, in South or North zones.

(Note: Worksheet creation and formatting: 2 marks, calculations: 2 marks, filtering: 6 marks)

PART-D: MS ACCESS

1. Create Employee database and table Emp using MS ACCESS with following Structure

Emp no	Ename	Designation	Dep tno	DOJ	Basic Salary
101	RAMESH	MANAGER	10	10/10/2000	25000
102	SMITHA	CLERK	12	12/5/1999	15000
103	DEVIKA	ATTENDER	10	11/9/2001	12000
104	RAJESH	HR	15	15/4/2000	12000
105	GIRISH	SUPERVISOR	12	6/11/2005	18000
106	SATHYA	DRIVER	16	11/9/2001	11000
107	MANOJ	SWEEPER	10	22/6/2006	8000
108	BHOOMIKA	SECURITY	15	12/5/1999	10500
109	KIRAN	CLERK	14	11/9/2001	15000
110	PRATHIKSHA	SUPERVISOR	10	8/8/2005	18000

Perform following operation

a) List all the Employees Who are working in Dept no.10
b) List all the Employees who get less than 20000 Salary
c) Update Salary by adding the increments as per the following:-
   i. 10% Increment in Basic Salary who get < 20000
   ii. 5% Increment in Basic Salary who get >=20000.

2. Create the " Order" database and a table "Orderdtl" having following records:

Order No	Order Date	Order Item	Order Qty	Order Price	Client Code	Delivery Type	Order Status
1011	12/02/2015	LED Monitors	100	750000	1025	Road	Delivered
1012	12/03/2015	CPU	12	500000	1026	SHIP	Not Delivered
1005	15/02/2014	Keyboard	80	48000	1027	Road	Delivered
1010	02/02/2016	LED Monitors	30	64000	1028	Flight	Delivered
1016	19/4/2015	Scanner	40	35000	1029	Road	Delivered
1009	9/05/2018	LED Monitors	25	125000	1030	Flight	Not Delivered
1008	13/8/2017	CPU	25	450000	1031	SHIP	Delivered
1014	1/7/2018	Printer	50	90000	1032	Road	Not Delivered

Execute following Query

a. Display all the Order No. which have not been yet Delivered.
b. Display all the Orders of LED Monitor and CPU.

c. Display all the Orders of LED Monitor and CPU which are not have been delivered yet.

3. Create a "Stock" database having "Inventory" table:

Item Code	Item Name	Opening Stock(Qty)	Purchase(Qty)	Sale (Qty)	Closing Stock(Qty)	Remark
101	MONITOR	100	25	35		
102	PRINTER	75	40	15		
103	SCANNER	120	30	20		
104	CPU	50	35	10		
105	KEYBOARD	105	45	55		

Perform the followings:

a) Calculate the closing stock of each item (Closing Stock = Opening Stock + Purchase – Sales)
b) Display all the Items which has closing stock < 100
c) If closing stock is less than 100 then set the remark as "Re-Order Level" otherwise "Enough Stock".

4. Create a "Company" database having "Sales" table with fields saleid, quarter, product, no_of_sales.

Perform the followings:

a. Design a form to insert records to Sales table
b. Generate a report to display Sales details of product based on quarters.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	**MS WORD**	**8Marks**
Program-2	**MS POWERPOINT**	**7 Marks**
Program-3	**MS EXCEL**	**10**
Program-4	**MS ACCESS**	**10**

Practical Record	**05 Marks**
Total	**40 Marks**

Program Name	**BCA-AIML**	Semester	**I**
Course Title	**C Programming Lab**		
Course Code:	**BCA-AIML-1.5**	No.of Credits	**02**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART – A

1. Program to find the roots of quadratic equation using else if ladder.
2. Program to read two integer values & a operator as character and perform basic arithmetic operations on them using switch case (+, -, *, / operations)
3. Program to reverse a number and find the sum of individual digits. Also check for palindrome.
4. Program to calculate and display the first ‘n’ Fibonacci numbers
5. Program to find given number is a prime or not.
6. Program to count occurrences of each character in a given string.
7. Program to read string with alphabets, digits and special characters and convert upper case letters to lower case and vice a versa and retain the digits and special characters as it is.
8. Program to search for number of occurrences of number in a list of numbers using one-dimensional array also display its positions.

PART-B

1. Program to find the largest and smallest elements with their position in a one-dimensional array.

2. Program to read ‘n’ integer values into a single dimension array and arrange them in ascending order using bubble sort method.
3. Menu driven Program to perform addition and multiplication of two Matrices
4. Program to find nCr and nPr using recursive function to calculate factorial.
5. Program to read a string and count number of letters, digits, vowels, consonants, spaces and special characters present in it using user defined function
6. Program sort a list of strings in ascending order using Pointers
7. Program to enter the information of a student like name, register number, marks in three subjects into a structure and display total, average and grade Display details in a neat form
8. Write a menu driven program to
    a. Create a text file
    b. Append the contents of a text file to another existing file by accepting filenames
    c. Display the content of entered filename
    d. Exit

    Create two text files during the execution of the program. Display their contents. Perform Appending. Display the contents again. Always check for the existence of the inputted file names.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	**PART-A** **Writing:7 Marks Execution:8Marks**	**15Marks**
Program-2	**PART-B** **Writing:10 Marks Execution:10 Marks**	**20 Marks**
Practical Record		**05 Marks**
Total		**40 Marks**

SEMESTER- II

Program Name	**BCA-AIML**	Semester	**II**
Course Title	**Data Structure using C(Theory)**		
Course Code:	**BCA-AIML-2.1**	No.of Credits	**03**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

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

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Unit	Description	Hours

1	**Introduction andOverview:**Definition, Elementary dataorganization,Data Structures,DataStructuresoperations, Abstractdatatypes, algorithmscomplexity, timespacetradeoff.Preliminaries:Mathematical notations andfunctions,Algorithmicnotations,controlstructures,Arrays:Definitio n,Linear arrays, , Representation of Linear Arrays in Memory, Traversing Linear arrays, Insertinganddeleting,Multi-dimensionalarrays,MatricesandSparsematrices. **Fundamentals of Algorithmic problem Solving:** Important Problem Type Fundamentals of Data Structures, Fundamentals of the Analysis of Algorithm Efficiency, Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average- case efficiencies. **Asymptotic Notations and Basic:** Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation	**13**
2	**Linked list:** Definition, Representation of Singly Linked List in memory, traversing a Singly linked list, searching in a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list. **Stacks:**Definition, Array representation of stacks, linked representation of stacks, Arithmetic Expressions: Polish Notation, Conversion of infix expression to postfix expression, Evaluation of Postfixexpression,Applications ofStacks,Recursion,TowersofHanoi,Implementationofrecursiveproced ures by stack. **Queues:** Definition, Array representation of queue, Linked list representation ofqueues. Typesofqueue:Simplequeue,Circular queue,Double-endedqueue,Priorityqueue,Operationson Queues, Applications of queues.	**13**
3	**Binary Trees:** Definitions, Tree Search, Traversal of Binary Tree, Tree Sort, Building a Binary Search Tree, Contiguous Representation of Binary Trees: Heaps, Lexicographic Search Trees: Tries, External Searching: B-Trees, Applications of Trees.	**13**

	Graphs: Mathematical Background,ComputerRepresentation,Graph Traversal,Topological Sorting	
4	**Searching:** Introduction and Notation, Sequential Search, Binary Search, Comparison of Methods. Sorting: Introduction and Notation, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer, Merge sort for Linked List, Quick sort for Contiguous List. **Hashing:** Sparse Tables, Choosing a Hash function,CollisionResolutionwithOpen Addressing, CollisionResolution by Chaining.	**13**

Text Books:

1. SeymourLipschutz,"DataStructureswithC",Schaum'soutLines,TataMcGrawHill, 2011.
2. Anany Levitin: "Introduction to The Design & Analysis of Algorithms"

Reference Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Computer Science Press, 1982.
2. Aaron M. Tenenbaum , Data structures using C, First Edition, Pearson Education
3. Kamathane, Introduction to Data structures, Pearson Education , 2004
4. Y. Kanitkar, Data Structures Using C, Third Edition, BPB
5. Padma Reddy: Data Structure Using C, Revised Edition 2003, Sai Ram Publications.
6. Sudipa Mukherjee, Data Structures using C – 1000 Problems and Solutions, McGraw Hill Education, 2007

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Program Name	**BCA-AIML**	Semester	**II**
Course Title	**Database Management System(Theory)**		
Course Code:	**BCA-AIML-2.2**	No.of Credits	**03**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

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

- Demonstrate an understanding of the basic concepts of database systems.
- Design a relational database using ER modelling and normalization techniques.
- Write complex SQL queries to retrieve and manipulate data from databases.
- Develop PL/SQL programs to implement business logic in databases.
- Explain the concepts of transaction management, concurrency control, and database recovery.

Unit	Description	Hours
1	**Database and Database Users**: DBMS Definition, Characteristics of the Database Approach, Advantages of Using a DBMS **Database System concepts and architecture**: Data Models, Schemas, and Instances, Three-schema architecture and Data	

	Independence, Database Languages and Interfaces, The Database System Environment, Classification of Database Management Systems. **Data Modeling Using the Entity-Relationship Model**: High-Level Conceptual Data Models for Database Design, An example database application, Entity Types, Entity Sets, Attributes and Keys, Relationships, Relationship Types, sets, roles, and Structural Constraints, Weak Entity Types, ER Diagrams.	**13**
2	**Relational Data Model, Relational Constraints**: Relational Model Concepts, Relational model Constraints and Relational Database Schemas, Update Operations, transactions and Dealing with Constraint Violations. **Disk Storage, basic file structures and Hashing:** Secondary storage devices, Buffering of Blocks, Placing File Records on Disk, Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques **Functional dependencies and Normalization for Relational databases:**Functional dependencies, Normal Forms based on primary keys, General definitions of second and third normal forms, Boyce-Codd Normal form.	**13**
3	**Interactive SQL**: Table fundaments, oracle data types, CREATE TABLE command, inserting data into table, Viewing Data in the table, sorting data in a table, creating a table from a table, insertingdata into a table from another table, Delete operations, Updating the contents of a table, Modifying the structure of tables, Renaming tables, destroying tables, displaying table structure. **Data Constraints**: Types of data constraints, IO constraints- The PRIMARY KEY constraint, The FOREIGN KEY constraint, The UNIQUE KEY constraint, Business Rule Constraints- NULL value concepts, NOT NULL constraints, CHECK constraint, DEFAULT VALUE concepts. **Computations on table data**: Arithmetic Operators, Logical Operators, Range Searching, Pattern Matching, Oracle Table – DUAL, Oracle Function- Types, Aggregate Function, Date Conversion Function. GROUPING DATA FROM TABLES IN SQL, Group By clause, Having clause, subqueries, JOINS, Using the UNION, INTERSECTION, MINUS clause	**13**

	SQL transaction commands COMMIT, ROLLBACK and SAVEPOINT. Security Management using SQL- Granting and Revoking Permissions	
4	**INTRODUCTION TO PL/SQL**: Advantages of PL/SQL, The Generic PL/SQL Block, PL/SQL-The character set, Literals, PL/SQL datatypes, variables, Logical comparisons, Displaying User Messages on The VDU Screen, comments. Control Structure - Conditional Control, Iterative Control **PL/SQL Transactions**: Cursor-Types of Cursor, Cursor Attributes. Explicit cursor ,Explicit cursor Management, cursor for loop PL/SQL **Database Objects**: Procedures and Functions, Oracle Packages, Error Handling in PL/SQL, Triggers	**13**

Text Books:

1. RamezElmasri and ShamkanthB.Navate, Fundamentals of Database Systems, 7th Edition, Pearson Education
2. Ivan Bayross, SQL/PL/SQL- the Programming language of Oracle, 2nd Revised edition (or 4th revised Ed), BPB Publications

Reference Books:

1. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
2. Introduction to Database System, C J Date, Pearson, 1999.
3. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6th Edition, McGraw Hill, 2010.
4. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill, 2002

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Program Name	**BCA-AIML**	Semester	**II**
Course Title	**Computer Architecture(Theory)**		
Course Code:	**BCA-AIML-2.3**	No.of Credits	**05**
Contact hours	**5 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

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

- Use number systems and complements
- Identify the importance of canonical forms in the minimization or other optimization of Boolean formulas in general and digital circuits.
- Minimize functions using any type of minimizing algorithms (Boolean algebra, Karnaugh map or Tabulation method).
- Analyze the design procedures of Combinational and Sequential circuits.
- Design the finite state machine using algorithmic state machine charts and perform simple projects with a few flip-flops.

Unit	Description	Hours
1	**Digital computers and Digital system**: Introduction to Number system, Decimal number, Binary number, Octal and Hexadecimal numbers, Number base conversion, Complements, Binary codes, Binary arithmetic's, Addition , Subtraction in the 1's and 2's complements system, Subtraction in the 9's and 10's complement system. Boolean Algebra: Basic definitions, Axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra, Venn diagram.	**15**

2	**Digital logical gate**: Boolean functions, Canonical and Standard forms, other logic operations, Digital logic gates, Universal gate. Simplification of Boolean function: The map method, Two and three variable maps, Four-variable maps, Don't care conditions, Product of sum Simplification, NAND implementation, NOR implementation. Implementation of EX-OR,EX-NOR using NAND and NOR gate	**15**
3	**Combinational Logic**: Introduction, Design Procedure, Half adder, Full adder, half Subtractor, Full Subtractor, Binary parallel adder, BCD adder. Combinational logic with MSI and LSI: Code converter, Exclusive-OR and Equivalence functions. Magnitude comparator, Decoders, Encoders, Multiplexers, Demultiplexers	**15**
4	**Sequential Logic**: Introduction, Flip flops,RS-FF ,D-FF, T-FF, and JK-FF,Triggering of flip-flops, Master slave Flip flop, state table, and State diagram. State equations, Flip Flop excitation tables, Sequential circuits design. Registers, Counters: Synchronous Counter Design using RS, JK, D & T flip flops. Ripple counters Introduction, Registers, Shift registers, Timing sequences, Bidirectional shift register.	**15**

Text Book:

1. M.Morris Mano,Digital Logic and Computer design, PHI, 2015

Reference Books:

1. Thomas L Floyd, Digital Fundamentals, 10th Edition, Pearson, 2011.
2. Thomas. C. Bartee, Digital Computer Fundamentals, 6th edition, TMH.

Pedagogy: Lecture / PPT/ Videos / Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe- Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Program Name	**BCA-AIML**	Semester	**II**
Course Title	**Data StructuresLab**		
Course Code:	**BCA-AIML-2.4**	No.of Credits	**02**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A

1. Program to sort the given list using selection sort technique.
2. Program to sort the given list using insertion sort technique
3. Program to solve Tower of Hanoi using Recursion
4. Program to reverse String using Stack
5. Program to search an element using recursive binary search technique.
6. Program to implement Stack operations using arrays.
7. Program to implement Queue operations using arrays.
8. Program to implement dynamic array. Find smallest and largest element.

PART-B

1. Program to sort the given list using merge sort technique.
2. Program to implement circular queue using array.
3. Program to sort the given list using quick sort technique.
4. Program to implement Stack operations using linked list.
5. Program to implement Queue operations using linked list.
6. Program to evaluate postfix expression.
7. Program to perform insert node at the end, delete a given node and display contents of single linked list.
8. Menu driven program for the following operations on Binary Search Tree(BST) of Integers

(a) Create a BST of N Integers
(b) Traverse the BST in Inorder, Preorder and Post Order.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	**PART-A** **Writing:5 Marks Execution:3Marks**	**15 Marks**
Program-2	**PART-B** **Writing:8 Marks Execution:4Marks**	**20 Marks**
Practical Record		**05 Marks**
Total		**40Marks**

Program Name	**BCA-AIML**	Semester	**II**
Course Title	**Database Management System Lab**		
Course Code:	**BCA-AIML-2.5**	No.of Credits	**02**
Contact hours	**4 Hours per Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A

1. Create a table EMPLOYEE using SQL command to store details of employees such as EMPNO, NAME, DESIGNATION, DEPARTMENT, GENDER and SALARY. Specify Primary Key and NOT NULL constraints on the table. Allow only 'M' or 'F' for the column GENDER. DEPARTMENT can be SALES, ACCOUNTS, IT. Choose DESIGNATION as CLERK, ANALYST, MANAGER, ACCOUNTANT and SUPERVISOR that depends on department

   Write the following SQL queries:

   a) Display EMPNO, NAME and DESIGNATION of all employees whose name ends with RAJ.
   b) Display the details of all female employees who is earning salary within the range 20000 to 40000 in SALES or IT departments.
   c) List the different DEPARTMENTs with the DESIGNATIONs in that department.
   d) Display the department name, total, average, maximum, minimum salary of the DEPARTMENT only if the total salary given in that department is more than 30000.
   e) List the departments which have more than 2 employees.

2. Create a table CLIENT to store CLIENT_NO, NAME, ADDRESS, STATE, BAL_DUE. Client no must start with 'C'. Apply the suitable structure for the columns. Specify Primary Key and NOT NULL constraints on the table. Insert 10 records.

   Write the following SQL queries:

   a) From the table CLIENT, create a new table CLIENT1 that contains only CLIENT_NO and NAME , BAL_DUE from specified STATE. Accept the state during run time.
   b) Create a new table CLIENT2 that has the same structure as CLIENT but with no records. Display the structure and records.
   c) Add a new column by name PENALTY number (10, 2) to the CLIENT.
   d) Assign Penalty as 10% of BAL_DUE for the clients C1002, C1005, C1009 and for others 8%. Display Records.
   e) Change the name of CLIENT1 as NEW_CLIENT.
   f) Delete the table CLIENT2.

3. Create a table BOOK using SQL command to store Accession No, TITLE, AUTHOR, PUBLISHER, YEAR, PRICE. Apply the suitable structure for the columns. Specify Primary Key and NOT NULL constraints on the table. Insert 10 records.

   Write the following SQL queries:

   a) List the details of publishers having 'a' as the second character in their names.
   b) Display Accession No., TITLE, PUBLISHER and YEAR of the books published by the specified author before 2010 in the descending order of YEAR. Accept author during run time.
   c) Modify the size of TITLE to increase the size 5 characters more.
   d) Display the details of all books other than Microsoft press publishers.
   e) Remove the records of the books published before 1990.

4. Create a table SALES with columns SNO, SNAME, MANAGER_NAME, JOIN_DATE, DATE_BIRTH, SALARY,SALES_AMOUNT and COMMISSION. Minimum age for joining the company must be 18 Yrs. Default value for Commission should be 0. Apply the suitable structure for the columns. Specify Primary Key and NOT NULL constraints on the table. Insert 10 records with data except commission.Manager of Manager can be NULL.

   Write the following SQL queries:

a) Display the details of Sales Persons whose salary is more than Average salary in the company.
b) Update commission as 20% of Sales Amount.
c) Display SNO, SNAME, MANAGER_NAME, SALARY, COMMISSION, MANAGER_SALARY of the sales persons getting sum of salary and commission more than salary of manager.(Self join)
d) Display the records of employees who finished the service of 10years.

5. Create a table Sales_Details with the columns SNO, MONTH, TARGET and QTY_SOLD to store the Sales Details of one year. Specify the composite primary key to the columns SNO and MONTH. TARGET and SALES must be positive numbers.

   Write the following SQL queries:

   a. Display the total sales by each sales person considering only those months sales where target was reached.

   b. If a commission of RS.50 provided for each item after reaching target, calculate and display the total commission for each sales person.

   c. Display the SNO of those who never reached the target.

   d. Display the SNO, MONTH and QTY_SOLD of the sales persons with SNO S0001 or S0003

6. Create a table Bank with the columns ACNO, ACT_NAME, ACT_TYPE and BAL. Specify the Primary Key. Initial BAL must be greater than 500.

   Write a PL/SQL program to perform debit operation by providing acct_no and amount required. The amount must be greater than 100 and less than 20000 for one transaction. If the account exist and BAL-amount>100 Bank table must be updated, otherwise "NO SUFFFICIENT BALANCE" message should be displayed. If account number is not present then display "NO SUCH ACCOUNT" message to the user.

7. Create a table STOCK_DETAIL with the columns PNO, PNAME and QTY_AVL to store stock details of computer accessories. Specify Primary Key and NOT NULL constraints on the table. QTY_AVL should be positive number.

   Write a PL/SQL Program to define a user defined exception named "LOW_STOCK" to validate the transaction. The program facilitates the user to purchase the product by providing product number and quantity required. It should display an error message "NO SUFFICIENT STOCK" when the user tries to purchase a product with quantity

more than QTY_AVL, Otherwise the STOCK_DETAIL table should be updated for valid transaction.

8. Write a PL/SQL cursor program to calculate electricity bill of several domestic customers. Accept Input RR No, name of the customer, previous meter reading, and current meter reading from the table. The rates of electricity consumption are as follows - For the first 30 units Rs. 2.5 per unit, for the next 70 units Rs. 3.5 per unit, for the next 100 units Rs. 4.5 per unit, for the next 100 units Rs. 6 per unit and for units above 300 Rs. 8 per unit. A fixed amount of Rs. 150 is also charged. 5% tax to be paid on the sum of bill amount & fixed amount. Use Data validation to see that current reading is more than previous reading. Assume the records of 5 customer details.

   Create the output which contains the RR number, name of the Customer, previous meter reading, and current meter reading, Units Consumed, Total Bill in the following format.

RR No.	Customer Name	Current Meter Reading	Previous Meter Reading	Units Consumed	Total Bill

PART-B

1. Create the following tables by identifying primary and foreign keys. Specify the not null property for mandatory keys.
   SUPPLIERS (SUPPLIER_NO, SNAME, SADDRESS, SCITY)
   COMPUTER_ITEMS(ITEM_NO,SUPPLIER_NO,ITEM_NAME, IQUANTITY)
   Consider three suppliers. A supplier can supply more than one type of items.

   Write the SQL queries for the following

   a. List *ITEM* and *SUPPLIER* details in alphabetical order of city name and in each city decreasing order of IQUANTITY.

   b. List the name ,city,and address of the suppliers who are supplying keyboard.

   c. List the supplier name, items supplied by the suppliers ‘Cats’ and ‘Electrotech’.

   d. Find the items having quantity less than 5 and insert the details of supplier and item of these, into another table NEWORDER.

2. Create the following tables identifying Primary and Foreign keys. Specify the not null property for mandatory keys.
   EMPLOYEE_MASTER (EMP_ID, EMP_NAME, EMAIL_ID, EMP_ADDRS, PHONE)
   ATTENDANCE (EMP_ID, MONTH, WOM, MHRS, THRS, WHRS, TRHRS, FHRS, SHRS, SUHRS).
   (Valid values for WOM<=5, MONTH can be 1-12). Apply appropriate constraints. Consider 3 employees. And attendance records for at least two months.

   Write the SQL queries for the following

   a) Display *EMP_ID*,*EMP_NAME* and *EMAIL_ID* of all employees who are working on every Sunday of 2nd and 4th week in a month.

   b) Display total hours worked by each employee in each month with EMP_ID.

   c) Display the names of the employees who never attended the duty so far(Attendances not given so far).

   d) Display the employee name, month, week, total hours worked for employees who have total no. of hours more than 20 hrs. a week.

3. Create the following tables by identifying primary and foreign keys, specify the not null property for mandatory keys.

PRODUCT_DETAIL				
P_NO	**PRODUCTNAME**	**QTYAVAILABLE**	**PRICE**	**PROFIT %**
P0001	Monitor	10	3000	20
P0002	Pen Drives	50	650	5
P0003	CD Drive	100	10	3
P0004	Key Board	25	600	10

PURCHASED_DETAIL		
CUSTNO	**P_NO**	**QTYSOLD**
C1	P0003	2
C2	P0002	4
C3	P0002	10
C4	P0001	3
C1	P0004	2

C2	P0003	2
C4	P0004	1

Write the following SQL queries:

a) Display total amount spent by C2.
b) Display the names of product for which either QtyAvailable is less than 30 or total QtySold is less than 5(USE UNION).
c) Display the name of products and quantity purchased by C4.
d) How much Profit does the shopkeeper gets on C1's purchase?
e) How many 'Pen Drives' have been sold?

4. Create table STUDENT_PROFILE includes Rollno, name, class, ECCC(Extra-Co curricular he belongs to such as SPORTs, NSS etc.) and another table MARKS_REPORT includes Rollno, Internal_Test, Marks1, Marks2, Marks3 and ECCC_marks.

Constraints

- Internal _Test can be either 1 or 2.
- Each mark can be 0-100. Absence in the test can be entered as -1.
- Consider atleast 3 classes.

Apply suitable data type and constraints to each column.
Insert 5 students marks report in the both the tests.

Write the following SQL queries:

a) Find number of students failed class- wise.
b) Display the complete details of the students secured distinction(Percentage>=70) in I BCA.
c) Display class and highest total marks in second internals in each class.
d) Display the student name with rollno and class of those who passed in I internals and failed in II internals.(use SET operator)

5. Write a PL/SQL program to compute the selling price of books depending on the book code and category. Use Open, Fetch and Close.The Book_detail table contains columns: Book Code, Author, Title, Category and Price.Insert 10 records.

The selling price=Price-Discount.

The discount is calculated as follows:

Book Code	Category	Discount Percentage
A	Novels	10% of Price
	Technology	12.5% of Price
B	Commerce	18% of Price
	Science	19% of Price
C	Songs	25% of Price
	Sports	24% of Price
D	All	28% of Price

Print the result in tabular form with proper alignment

Book Code category title author price discount % discount amount sell price

===== ======= ===== ==== ===== ====== =====

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6. Write a PL/SQL program to display employee pay bill (using Cursor For loop) Use a **Procedure** to receive basic pay and to compute DA, HRA, Tax, PF, Gross Pay and Net Pay(Use OUT). Base table contains the following columns empnum, empname, basic pay.Insert 3 records.

Allowances are computed as follows.

Basic Pay	DA	HRA
<=20000	35% of Basic	8% of Basic
>20000 &<=30000	38%	9%
>30000 &<=40000	40%	10%
>40000	45%	10%

Gross=Basic+DA+HRA
PF=12% of Gross or Rs. 2000 whichever is minimum.
PT=Rs. 100 upto Gross is 25,000 else Rs. 200.
Net=Gross-(PF+PT)

Print Pay slip as follows.

```
================PAYSLIP==================
Empno              :10011          Empname : Raj
Basic Pay          :20000             P.F.: 3432
DA                 :7000            P.T.: 200
H.R.A.             :1600
Gross              :28600         Net Pay : 24968
***************************************************
================PAYSLIP==================
Empno              :10012          Empname : Rani
Basic Pay          :30000             P.F.: 5292
DA                 :11400             P.T.: 200
H.R.A.             :2700
Gross              :44100         Net Pay : 38608
***************************************************
```

7. Given the following tables:
   ITEM_MASTER(itemno, name, stock, unit_price) [Apply the Primary key and check constraint for stock and price as >0] [Insert 5 records]
   ITEM_TRANS(itemno, quantity and trans_date)
   Create a **package** PCK_ITEM includes a function CHK_ITEM and a procedure PROC_ITEM.

   Function CHK_ITEM gets one argument itemno and is used to check whether the parameter itemno exists in ITEM_MASTER and should return 1 if exist. Otherwise 0 and displays proper message.
   Procedure PROC_ITEM gets two arguments itemno and quantity, and is used to perform the following if item exists. If required quantity is not available, give appropriate message. If available , insert a record of this transaction to ITEM_TRANS and modify the stock in ITEM_MASTER.

   Write a PL/SQL program to accept ITEM_NO and Quantity needed of required item. Use Package to do the transaction process(Transaction date can be current date).

   OUTPUT to be shown as follows:

```
Enter value for accept_itemno: 1
old   5:            X:=&accept_itemno;
new   5:            X:=1;
Enter value for quantity: 3
old   6:          M:=&quantity;
new   6:          M:=3;
Item :aa   Quantity  :3  Price  :15 Total Amount  :45
```

8. Consider the following tables

   LIBRARY(Accession no, Title, Author, Publication, Status). Status can be **A** for available and **I** for Issued. Insert 3 records with status '**A**' for all initially.

ISSUE(Rollno, Accession no, Borrowdate, returndate).

OUTDATED(Accession no, Title, Author, Publication, tdate),

Write the following Trigger programs.

i. Whenever the book is to be issued, Insert a new record to ISSUE without having return date. When the record is **inserted** to ISSUE table, trigger TRIG_ISSUE to be executed to update status in LIBRARY as ***'I'.***

ii. Whenever book is returned, update return date of that record as todays date in ISSUE table. When the record is **updated** to ISSUE table, trigger TRIG_ISSUE to be executed to update status in LIBRARY as ***'A'.***

iii. Whenever the book is **deleted** by accepting Accession no. for status 'A' (at SQL >), trigger TRIG_OUTDATE has to be executed to insert a record to OUTDATED.

Write a PL/SQL program to accept Rollno, Accession no and transaction(**B** for Borrow &**R** for Return). Check for the existence of given Accession no and proceed as follows.

- If does not exist, display the message 'Given accession no. is not available'
- If exist and transaction is B, check the status as 'A', then insert to ISSUE, and display the message with accno, author, title, publication and roll no to whom it is issued.
- If exist and transaction is R, then update return date as current system date in ISSUE by accepting Rollno and Aceession no(for the record having return date empty).
  If searched record is not available, raise the predefined exception.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	**PART-A** **Writing:5 Marks Execution:3Marks**	**15 Marks**

Program-2	**PART-B** **Writing:8 Marks Execution:4Marks**	**20 Marks**
Practical Record		**05 Marks**
Total		**40 Marks**

Questions Paper for Pattern Core Subjects

Duration:3 Hours Max.Marks:80

Note: Answer any ten Questions from Part-A. And one full Questions from each unit in Part-B

Part-A

1. 10*2=20

a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
l.

Part-B

UNIT-I, II, III, IV

Each unit contains two main questions and it carry 15 Marks.
Each main questions contain 2 or more sub question.

4*15=60

UNIT-I

2.

a.
b.
c.

3.

a.
b.
c.

MANGALORE UNIVERSITY

State Education Policy – 2024 [SEP-2024]

CURRICULUM

FOR

BACHELOR OF COMPUTER APPLICATIONS
BCA-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

MANGALORE UNIVERSITY

Suggested programme structure for the Under Graduate Programmes

[BCA, BCA (AI and ML), BCA (D.A)]

Semester	Course 1	Course 2	Course 3	Elective / Optional	Language	Compulsory	Total Credits	Total Working hour
I	5 (3T+2P)	5 (3T+2P)	5 T		3+3	2	23	4+4+4+4+5+4+4+2=31
II	5 (3T+2P)	5 (3T+2P)	5T		3+3	2	23	4+4+4+4+5+4+4+2=31
III	5 (3T+2P)	5 (3T+2P)	5T	2	3+3		23	4+4+4+4+5+4+4+2=31
IV	5 (3T+2P)	5 (3T+2P)	5T	2	3+3	2	25	4+4+4+4+5+2+4+4+2=33
V	8[(2x3T)+2P]	8[(2x3T)+2P]	8[(2x3T)+2P]			2	26	3+3+4+3+3+4+3+3+4+2=32
VI	3T	3T	3T	3T	Research Methodology + Project work 12		24	3+3+3+3+24=36
Total Credits for the Programme							**144**	

Note:

- Course1 and Course2: I to IV Semester: Theory 3 credits = 4 contact hours and Practical 2 credits=4 contact hours
- Course3: I to IV Semester: Theory 5 credits = 5 contact hours
- Course1, Course2 and Course3: V and VI Semester: Theory 3 credits = 3 contact hours and Practical 2 credits = 4 contact hours
- Elective/Optional: 2 credits=2 contact hours
- Languages: 3 credits=4 contact hours
- Compulsory: 2 credits=2 contact hours

CURRICULUM STRUCTURE FOR III AND IV SEMETER
BCA- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester III								
Sl. No	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week	SEE	IA	Total Marks	Credits
1		LANGUAGE-I	Lang	4	80	20	100	3
2		LANGUAGE-II	Lang	4	80	20	100	3
3	BCAAIMS301	Object Oriented Programming using Java	Core	4	80	20	100	3
4	BCAAIMS302	Operating System	Core	4	80	20	100	3
5	BCAAIMS303	Computer Network	Core	5	80	20	100	5
6	BCAAIPS304	Object Oriented Programming Lab	Practical	4	40	10	50	2
7	BCAAIPS305	Operating System Lab	Practical	4	40	10	50	2
8	BCAAIES301 BCAAIES302 BCAAIES303	A) Digital Marketing B) Web Content Management System C) DEVOPS	Elective	2	40	10	50	2
Sub - Total				31	520	130	650	23

Semester IV								
Sl. No	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week	SEE	IA	Total Marks	Credits
1		LANGUAGE-I	Lang	4	80	20	100	3
2		LANGUAGE-II	Lang	4	80	20	100	3
3	BCAAIMS401	Artificial Intelligence-I	Core	4	80	20	100	3
4	BCAAIMS402	Python Programming	Core	4	80	20	100	3
5	BCAAIMS403	Software Engineering	Core	5	80	20	100	5
6	BCAAIPS404	Artificial Intelligence-I Lab	Practical	4	40	10	50	2
7	BCAAIPS405	Python Programming Lab	Practical	4	40	10	50	2
8	BCAAIES401 BCAAIES402 BCAAIES403	A) Cloud Computing B) Object Oriented Analysis and Design C) Digital Image Processing	Elective	2	40	10	50	2
9	BCAAISS401	Internet Basics	Compulsory	2	40	10	50	2
			Sub - Total	33	640	160	800	25

Pedagogy: Lecture / PPT / Videos / Demonstration / Concept mapping / Case Studies examples / Tutorial / Problem Solving / Trouble shooting

SEMESTER III

SEMESTER III

Program Name	BCA-AIML	Semester	III
Course Title	**Object Oriented Programming using JAVA (THEORY)**		
Course Code:	**BCAAIMS301**	No.of Credits	03
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the features of JAVA and the architecture of JVM
- Write, compile, and execute JAVA programs that may include basic data types and control flow constructs and how type casting is done Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance
- The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language
- Write, compile, execute JAVA programs that include GUIs

Unit	Description	Hours
1	**Fundamentals of Object-Oriented Programming:** Introduction, Object Oriented Paradigm, Basic Concepts of OOP, Benefits and Applications of OOP. **Introduction to JAVA:** JAVA Features, JAVA Environment, Simple JAVA Program, JAVA Program Structure, JAVA Tokens, JAVA Statements, JAVA Virtual Machine. **JAVA Programming Basics:** Constants, Variables, Data Types, Declaration of variables, Giving values to the variable, Scope of variables, Symbolic constants, Type casting. **Operators and Expressions:** Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operator, Increment and Decrement Operators,	**13**

	Conditional Operator, Special Operators. **Using I/O:** Byte streams and character streams, predefined streams, reading console input, reading characters, strings, writing console output. **Decision Making and Branching:** Simple if statement, if..else statement, nesting of if..else, the else..if ladder, the Switch statement.	
2	**Decision making and Looping** -The while statement, the do statement, the for statement . Jumps in loops, Labelled loops. **Class and Objects** - Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, the 'this' keyword, Overloading Methods, Using Objects as Parameters, Returning Objects, Recursion, Understanding 'static', Introducing 'final ', Using Command-Line Arguments, Varargs : Variable-Length Arguments **Arrays and Strings:** One dimensional arrays, Creating an array, Two dimensional arrays, Strings	**13**
3	**Inheritance** - Inheritance Basics, using 'super', Creating Multilevel hierarchy, Method Overriding, Using Abstract Classes, Using final with Inheritance. **Packages and Interfaces** - Packages, Access protection in packages, Importing Packages, Interfaces. **Exception Handling** - Exception Handling Fundamentals – Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, finally, JAVA's built-in Exceptions **Multithreaded Programming-** Introduction, Creating threads, Extending the thread class, stopping and blocking thread, Life cycle of a thread.	**13**
4	**Event and GUI programming: Event Handling** - The delegation event model, Event Classes –ActionEvent, KeyEvent and MouseEvent Classes, Event Listener Interfaces –ActionListener, KeyListener and MouseListener interfaces. **Introducing Swing** – two key swing features, components and containers, the swing packages, a simple swing application **Exploring Swing-** Jlabel, JTextField, JButton, Checkboxes , Radio buttons , Jlist , JComboBox.	**13**

Textbooks :

1. E Balagurusamy, Programming with JAVA – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
2. Herbert Schildt, JAVA: The Complete Reference, 7th Edition, MGH Publication.

Reference Books:

1. Herbert Schildt, JAVA 2-The Complete Reference, Fifth Edition, McGraw Hill publication.
2. Cay S. Horstmann, Core JAVA Volume I–Fundamentals, Prentice Hall.
3. Somashekara, M.T., Guru, D.S., Manjunatha, K.S, Object Oriented Programming with JAVA, EEE Edition, PHI.

Program Name	BCA-AIML	Semester	III
Course Title	**Operating System (THEORY)**		
Course Code:	**BCAAIMS302**	No.of Credits	03
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes (COs):

At the end of the course, students will be able to:

- Understand the fundamentals of the operating system.
- Comprehend multithreaded programming, process management, process synchronization, memory management and storage management.
- Compare the performance of Scheduling Algorithms
- Identify the features of I/O and File handling methods.

Unit	Description	Hours
1	**Introduction:** Operating System, Simple Batch Systems, Multi programmed Batched Systems, Time Sharing Systems, Real-Time Systems, Multi-processor Systems. **System Components, Operating System Services. Process:** Process Concept, Process Scheduling, Cooperating Process, **Threads** (Thread Concept, Single and Multiple Threads, Benefits): **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms.	**13**
2	**ProcessSynchronization**: Introduction Race Condition, Critical Section, Semaphores; Synchronization in Linux. **Deadlocks:** Deadlock Characterization, Methods of Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	**13**

3	**Memory Management.** Logical versus Physical Address Space, Swapping, Contiguous Allocation (Memory Allocation, Fragmentation), Paging (Basic Method), Segmentation (Basic Method). **Virtual Memory.** Demand Paging, Page Replacement, Page Replacement Algorithms, Thrashing (concept). **File System.** File Concept, Access Methods **Disk Scheduling (I/O Management):** Introduction and Scheduling Algorithm	**13**
4	**Linux files system**, login and logout. **Linux commands:** Directory oriented command, wild card characters, File oriented commands, File Access Permissions, Process oriented commands, Background processing, Communication oriented commands, General purpose commands, **Pipe and Filter** related commands, **vi editor, Shell programming**,	**13**

Text Books:

1. Abraham Silberschartz and Peter Galvin, **Operating System Concepts** ,6thedition,TMH
2. K.L. James, **Linux: Learning the Essentials**, PHI learning private limited,2011
3. B Mohammed Ibrahim, **Linux: A Practical Approach**, FireWallMedia,2009

Reference Books:

1. Andrew S Tanenbaum, **Operating System Design and Implementation**, PHI
2. Milan Milenkovic, **Operating Systems**, TMH
3. Cristopher Negus, DreamTech, **RedHatLinux9 Bible**, Wiley Publication
4. Shital Vivek Ghate , Operating System Concepts and Basic Linux Commands ; Educreation Publishing.
5. Richard Fox , LINUX with Operating System Concepts, CRC PressMark
6. G Sobell, "**A Practical Guide to Linux**", PEARSON Publishers

Program Name	BCA-AIML	Semester	III
Course Title	**Computer Networks(THEORY)**		
Course Code:	**BCAAIMN303**	No.of Credits	05
Contact hours	60 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Apply the basics of data communication and various types of computer networks in real world applications.
- Compare the different layers of protocols.
- Compare the key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI.

Unit	Description	Hours
1	**Introduction:** Uses of Computer Networks-Business Applications, Home Applications, Mobile Users, Social Issues; Network Hardware-Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Home Networks, Internetworks. Network Software- Reference Models-the OSI Reference Model, The TCPIP Reference Model, A Comparison of the OSI and TCP/IP Reference Models.	**15**
2	**The Physical Layer**-Transmission Media-Twisted-Pair, Coaxial Cable, Fiber Optics, Multiplexing (FDM, TDM) Switching **Data Link Layer:** Design Issues-Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection and Correction, Error correcting codes, Error detecting Codes.	**15**
3	**The Network Layer:** Network Layer design issues, Store and Forward Packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of	**15**

	Connection-Oriented Service, Comparison of Virtual Circuit and Datagram. Internetworking-How Networks can be connected, Connectionless Internetworking, Tunnelling, Internetwork Routing, Fragmentation. The Network Layer in the Internet-the IP Protocol, IP Addresses, OSPF, BGP, Internet Multicasting, IPv6.	
4	**The Transport Layer**: The Transport Service-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols-Addressing, Connection Establishment, Connection Release. The Internet Transport Protocols-UDP-Introduction to UDP, Remote Procedure Call, The Real-Time Transport Protocol; TCP-Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release. **The Application Layer-DNS**-The DNS Name Space, Resource Records, Name Servers. Electronic Mail-Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery;	**15**

Text Book:

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.

Reference Books:

1. Data Communication and Networking, Behrouza A Forouzan, 3rd Edition, Tata McGraw Hill, 2001.
2. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2017.
3. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI, 2012.
4. Data Communication and Network, Dr. Prasad, Wiley Dreamtech.

Program Name	**BCA-AIML**	Semester	**III**
Course Title	**Object Oriented Programming Lab using JAVA**		
Course Code:	**BCAAIMPS304**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A

1. Write a Program to Program to accept student name and marks in three subjects. Find the total marks, average and grade (depending on the average marks).
2. Write a Program to Program to input Start and End limits and print all Fibonacci numbers between the ranges.(Use for loop)
3. Design a class: ShowRoom with the following description:
   Instance variables / Data members:
   String name — To store the name of the customer
   long mobno — To store the mobile number of the customer
   double cost — To store the cost of the items purchased
   double dis — To store the discount amount
   double amount — To store the amount to be paid after discount
   Member methods:
   ShowRoom() — default constructor to initialize data members
   void input() — To input customer name, mobile number, cost
   void calculate() — To calculate discount on the cost of purchased items, based on following criteria

Cost	Discount
Less than or equal to ₹10000	5%
More than ₹10000 and less than or equal to ₹20000	10%
More than ₹20000 and less than or equal to ₹35000	15%
More than ₹35000	20%

void display() — To display customer name, mobile number, amount to be paid after discount. Write a main method to create an object of the class and call the above member methods. [Class Basics]

4. Write a Program to create a class DISTANCE with the data members feet and inches. Use a constructor to read the data and a member function Sum ( ) to add two distances by using objects as method arguments and show the result. (Input and output of inches should be less than 12.).
5. Write a Program to create a class “Matrix” that would contain integer values having varied numbers of columns for each row. Print row-wise sum.
6. Define a class to accept a String and print the number of digits, alphabets and special characters in the string.

   Example: S = "Kapil Dev@83"
   Output:
   Total number of characters - 12
   Number of digits – 2
   Number of upper-case alphabets – 2
   Number of lower-case alphabets - 6
   Number of Special characters – 1
7. Write a Program to add, remove and display elements of a Vector

PART-B

1. Create a class named 'Member' having data members: Name, Age, PhoneNumber, Place and Salary. It also has a method named 'printSalary' which prints the salary of the members. Two classes 'Employee' and 'Manager' inherit the 'Member' class. The 'Employee' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an employee and a manager by making an object of both of these classes and print the same. [inheritance]
2. Write a Program to implement the following class hierarchy: Student: id, name StudentExam (derived from Student): Marks of 3subjects, total marks StudentResult (derived from StudentExam) : percentage, grade Define appropriate methods to accept and calculate grade based on existing criteria and display details of N students
3. Write a Program to calculate marks of a student using multiple inheritance implemented through interface

Create a class called student with

a) Data members namely, name and regno for keeping Name and RegNo of a Student

b) Member functions namely, getdata() and putdata() for initializing and displaying the contents of data members

Create a class called mark which inherits the properties of student class with

a) Data members namely, m1, m2 and m3 for keeping marks of three subjects

b) Member functions namely, getmarks( ) and putmarks( ) for initializing and displaying the contents of data members

Create an Interface Student, with a final data member pract_mark for keeping practical mark and initialize it and member method putPractMarks() to display it

Create a class called Result which inherits the properties of mark class and implements the interface student, with Data member total and Member function display( ) for computing total marks and checking whether a student is passed or failed in based on each subject. The display() function computes the total marks as total=m1+m2+m3+pract_mark. It checks for the condition ((m1 > 40) && (m2 > 40) && (m3 > 40) && (pract_mark > 20)). If the condition is True, then print that the result as PASS else print that the result as FAIL.

4. Write a Program to create an abstract class named shape that contains two integers, and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Ellipse such that each one of the classes extends the class shape. Each one of the class contains only the method printArea() that print the area of the given shape.[Abstract class]

5. Create a package named FINANCE to encapsulate functionality for calculating compound interest and simple interest. Within the FINANCE package, define a class containing a method to calculate compound interest. Also, within the FINANCE package, define another class containing a method to calculate simple interest.

   Create a package EKYC to encapsulate for account holders profile creation. Within EKYC package define class PERSONAL_INFO containing members(Name, Adhar number ,PAN, Mobile number and Address) and methods(input () and print()). Also within EKYC package define a class

ACCOUNT_INFO containing members(ACCOUNT_NUM, CUSTOMER_ID, BALANCE) and methods(input () and print()).

Create a main class BANK that resides outside the FINANCE AND EKYC package. Inside the main method, invoke the respective methods from the packages to perform the interest calculations and display all the details of bank customer.

6. Write a Program that creates a user interface to perform basic integer operations such as addition, subtraction, multiplication and division. The user enters two numbers in the TextFields - Num1 and Num2. The result of operations must be displayed in the ResultTextField when the operation(+ or – or x or /) button is clicked. Appropriate Exception handling message to be displayed in the Result TextField when Num1 or Num2 is not an integer or Num2 is Zero when division operation is applied.

7. Using the swing components, design the frame for shopping a book that accepts book code, book name, and Price. Calculate the discount on code as follows.

Code	Discount rate
101	15%
102	20%
103	25%
Any other	5%

Find the discount amount and Net bill amount. Display the bill.

Evaluation Scheme for Lab Examination:

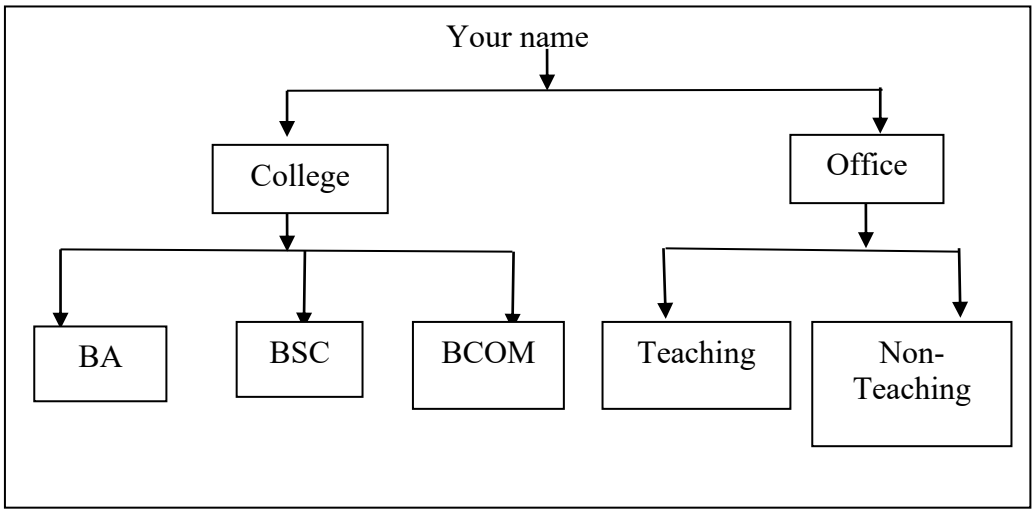
Assessment Criteria			
Program-1	PART-A:Writing:5 Execution:3Marks	Marks	15 Marks
Program-2	PART-B:Writing:8 Execution:4Marks	Marks	20 Marks
Practical Record			05 Marks
Total			40Marks

Program	**BCA-AIML**	Semester	**III**

Name			
Course Title	**Operating System Lab**		
Course Code:	**BCAAIMP305**	No.of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

PART-A

1. Use Linux commands to create the directory structure and perform the listed actions.



   a) Put one file each inside the directories BA, BCom, Teaching and Non-Teaching with meaningful content.
   b) Goto BA directory and then move its file to non-teaching directory.
   c) Change the directory to non-teaching from root directory using only single command.
   d) From BA copy the content to B.Com. Delete BA directory recursively
2. Consider the above directory structure. Write and execute Linux commands to

a) List the files in long format. Starting from root directory including sub directory contents
b) Count how many files exist in office directory.
c) Display the present path.
d) Display current date in the form MM/DD/YY HH:MM:SS

3. Write a Linux shell script to create a file which contains students' information such as Rollno, Name, Gender, class (BCA, BSc, BCom) and Total marks.
    a) Append the 2 more records.
    b) Display the contents.
    c) Display the records of only BSc course and sort on reverse order of name and store in BSCnew.txt.
    d) Display the contents of BSCnew.txt
    e) Rename the student.dat to stud.dat
4. Using the above stud.dat file, Write Linux shell scripts to
    a) Add the following permission
        i. Execute for user.
        ii. Remove write permission for group
        iii. Check the changes in the permission by listing the file.
    b) Select only the female names and store in female.dat and male names to male.dat
    c) Combine these names from both the files .Show the new file.
    d) Change the case of alphabets of the contents in male.dat.
    e) List all the files that start with "B" in the current directory.
5. Write a Linux shell script to Accept 'n' and check whether the number is a prime or not.
6. Write a Linux shell script to Accept 'n' and find the sum of the series 1!+3!+5!.....+n!.
7. Write a Linux shell script to Display all natural numbers between two integers and also find their sum.

PART B

1. Write a shell script to accept 'n' integers and count the positive, negative integers and zeros separately. Also find the sum of the positive and negative integers separately.
2. Write a shell script to accept many characters and count individual vowels, digits, spaces, special characters and consonants.

3. Write a Linux shell script to accept student name and marks in 3 subjects through command line arguments. Find Total marks, Average marks and Result(PASS if marks in each subject is more than or equal to 40 and FAIL if mark in any subject is less than 40) Grade (depending on average marks).
4. Write a Linux shell script to Accept a word and check whether it begins with lowercase vowel or uppercase vowel, ends with a digit or whether it is a three-letter word.
5. Write a menu driven shell script for the following.
    a) Display the current working directory.
    b) Rename a file(check for the existence of the source file)
    c) List the users logged in.
    d) Append the contents of a file to another file(display the message if the file doesn't exist in the directory).
6. Write a menu driven shell script for the following.
    a) Rename a file (check for the existence of the source file)
    b) List all file names/ directory names in the present working directory which has the specified pattern
    c) List of directory having all the permission
    d) List only files names in long format.
7. Write a shell script to accept many filenames through command line. Do the following for each filename
    a) If it is an ordinary file, display its content and also check whether it has Execute permission.
    b) If it is directory, display the number of files in it.
    c) If the file/directory does not exist, display a message

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing:5 Marks Execution:3Marks	15 Marks
Program-2	PART-B Writing:8 Marks Execution:4Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	**III**
Course Title	**Digital Marketing (ELECTIVE)**		
Course Code:	**BCAAIMES301**	No.of Credits	02
Contact hours	26 Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

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

- Understand the fundamental concepts and principles of digital marketing.
- Develop practical skills to implement various digital marketing strategies and techniques
- Analyze and evaluate the effectiveness of digital marketing campaigns.
- Create comprehensive digital marketing plans and strategies.

Unit	Description	Hours
1	**Introduction to Digital Marketing:** Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms **Digital Marketing Strategy and Planning:** Developing a digital marketing strategy, Setting goals and objectives, Budgeting and resource allocation. Campaign planning and execution, Monitoring and adjusting digital marketing campaigns	**8**

2	**Social Media Marketing:** Overview of social media marketing, social media platforms and their features, Creating and optimizing social media profiles, social media content strategy, social media advertising and analytics **Email Marketing:** Introduction to email marketing, building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics.	**8**
3	**Mobile Marketing:** Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics **Analytics and Reporting:** Importance of analytics in digital marketing, setting up web analytics tools (e.g., Google Analytics), Tracking and measuring key performance indicators (KPIs), Conversion tracking and optimization, Reporting and data visualization	**10**

Text Book:

1. "Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth.

Reference Books:

1. "Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White
2. "Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses" by Joe Pulizzi
3. "Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising" by Daniel Rowles
4. "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik

Program Name	BCA-AIML	Semester	**III**
Course Title	**Web Content Management System(ELECTIVE)**		
Course Code:	**BCAAIMES302**	No.of Credits	02
Contact hours	26 Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

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

- Understand content development basics.
- Gain Knowledge of tools for multimedia content development for audio/ video, graphics, animations, presentations, screen casting.
- Understand e-publications and virtual reality .
- Understand the use of e-learning platform Moodle and CMS applications Drupal and Joomla

Unit	Description	Hours
1	Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing.	**8**
2	Web Hosting and Managing Multimedia Content, Creating and Maintaining a Wiki Site. Presentation Software Part , Screen casting Tools and Techniques, Multilingual Content Development.	**8**
3	Planning and Developing Dynamic Web Content Sites, Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site. Content Management System: Joomla Content Management System: Drupal	**10**

Text Books:

1. Web Content Management: Systems, Features, and Best Practices 1st Edition by Deane Barker.
2. Content Management Bible (2nd Edition) 2nd Edition by Bob Boiko.
3. Using Joomla!: Efficiently Build and Manage Custom Websites 2nd Edition by Ron Severdia

Program Name	**BCA-AIML**	Semester	**III**
Course Title	**DEVOPS (ELECTIVE)**		
Course Code:	**BCAAIMES303**	No.of Credits	**02**
Contact hours	**26 Hours**	Duration of SEA/Exam	**2 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

Course Outcomes (COs):

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

- Understand the scalable VDI environment, addressing challenges such as boot storms and hardware limitations.
- Understand how to apply various DevOps tools to streamline and automate the software development lifecycle, including infrastructure as code and deployment automation.
- Understand how to utilize cloud services (IaaS, PaaS, Hybrid Cloud) to enhance DevOps practices, enabling full-stack deployments and efficient resource management.
- Understand how to integrate DevOps with ALM processes to improve the development, deployment, and management of mobile and multi-tier applications, scaling Agile methodologies across the enterprise.

Unit	Description	Hours
1	**Introduction to DevOps:** Business needs for DevOps, Business values for Devops, How DevOps works. **DevOps Capabilities:** Paths to DevOps Adoption, Plan, Devlop/Test, Deploy, Operate **Adopting DevOps:** Where to Begin, People in DevOps, Process in DevOps, Technology in DevOps	**8**

2	**Using Cloud in DevOps:** Cloud as DevOps enabler, Full Stack Deployments, cloud service model for DevOps, Hybrid Cloud **Using DevOps to solve Challenges:** Mobile applications, ALM processes, Scaling Agile, Multiple Tier Applications, DevOPs in the enterprise, Supply Chains, IOT. **DevOps Case Study:** Executive's Role, putting together a team, setting DevOps Goals, learning from the DevOps transformation, looking at the DevOps results. **DevOps Myths.**	**8**
3	**Basics of DevOps tools:** Git, Jenkins, Git lab, Docker, Kubernetes, Ansible, Terraform, Grafana, Sonar Qube	**10**

Textbooks:

1. Real-World DevOps Practices Paperback – 17 October 2024 by B. Thangaraju – Wiley Publishers, 2024
2. "DevOps For Dummies" by Sanjeev Sharma and Bernie Coyne. 2nd IBM Limited edition.

Reference Books:

1. Learning DevOps - Second Edition: A comprehensive guide to accelerating DevOps culture adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins By: Mikael Krief (Author) | Publisher: Packt Publishing Limited
2. DevOps For Beginners: A Step-By-Step Guide To DevOps Best Practices By: Liam Foster
3. Learning DevOps: Jenkins, Kubernetes, Terraform, Azure DevOps. Jenkins, M. K. Packt Publishing Limited.
4. Joakim Verona (2016).Practical DevOps. Packt Publishing Limited
5. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology" by Gene Kim, Jez Humble, Patrick Debois, John Willis
6. The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win" by Kim, Behr, Spafford

SEMESTER IV

SEMESTER IV

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Artificial Intelligence – I(THEORY)**		
Course Code:	**BCAAIMS401**	No.of Credits	**03**
Contact hours	**52Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

At the end of the course, students will be able to:

- Identify and describe different types of intelligent agents and their environments, and implement basic agent-based systems.
- Formulate problems and apply both uninformed and informed search strategies to solve them.
- Represent knowledge using propositional and first-order logic and perform inference using these representations.
- Understand and implement fundamental machine learning algorithms such as linear regression, decision trees, and neural networks.
- Demonstrate knowledge of advanced AI topics, including reinforcement learning, natural language processing, and robotics.
- Analyze and discuss the ethical considerations and societal impacts of AI technologies.

Unit	Description	Hours
1	**Introduction-** What is AI, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art. **Intelligent Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, Nature of Environments, Structure of Agents.	**13**
2	**Solving Problems by Searching**: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Avoiding	**13**

	Repeated States, Searching with Partial Information **Informed Search and Exploration:** Informed (Heuristic) Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems	
3	**Logical Agents:** Knowledge –Based Agents, The Wumps World, Logic, Propositional Logic: A Very Simple Logic, Reasoning Patterns in Propositional Logic, Effective propositional inference, Agents Based on Propositional Logic. **First Order Logic:** Representation Revisited, Syntax and Semantics of First Order Logic, Knowledge Engineering in First-Order Logic. **Inference in First-Order Logic:** Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining.	**13**
4	**Planning** –The Planning Problem, Planning with State-Space Search, Partial-Order Planning, Planning Graphs, Planning with Proposition Logic, Analysis of Planning Approaches. **Applications of AI** - Natural Language Processing, Text Classification and Information Retrieval, Speech Recognition , Image processing and computer vision, Robotics	**13**

Text Book:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003

Reference Books:

1. Tom Mitchell, “Machine Learning”, 1st Edition, McGraw-Hill,2017
2. Elaine Rich, Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition.

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Python Programming (THEORY)**		
Course Code:	**BCAAIMS402**	No.of Credits	**03**
Contact hours	**52Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving file handling.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Develop the emerging applications of relevant fields using Python.

Unit	Description	Hours
1	**Introduction to Python-** Features of Python, Flavors of python, Python Virtual machine, Memory management, Garbage Collection, Comparison between Python and C, JAVA and Python, Installing Python for Windows, Writing and executing Python program. **Python Basics**: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Association, Data Types, Indentation, Comments, Console Input and Console Output, Type Conversions. **Input and Output**: Input/output Statements, Command line arguments. **Control Statements** – if, if..else, if..elif, while loop, for loop, else suite, break, continue, assert, return	**13**

	Statements **Arrays in Python**- Creating arrays, importing array module, Indexing and slicing on arrays, types of arrays, working with arrays using numpy.	
2	**Functions** – Functions and methods, Defining, calling functions, returning multiple values, formal and actual parameters, Keyword argument Default arguments and variable argument, Local and Global variables, Anonymous functions and Lambdas, Decorators, and Generators, matrices in numpy, matrix functions, random numbers **Strings**: Creating and Storing Strings, Accessing Sting Characters; the str()function; Operations on Strings-Concatenation, Comparison, Slicing and Joining, Traversing, Python String Methods **Lists**: Creating Lists, Operations on Lists, Built-in Functions on Lists, Implementation of Stacks and Queues using Lists, Nested Lists **Dictionaries**: Creating Dictionaries, Operations on Dictionaries, Built-in Functions on Dictionaries, Dictionary Methods, Populating and Traversing Dictionaries. **Tuples and Sets**: Creating Tuples, Operations on Tuples, Built-in Functions on Tuples, Tuple Methods, Creating Sets, Operations on Sets, Built-in Functions on Sets, Set Methods.	**13**
3	**File Handling**: File Types, Operations on Files– Create, Open, Read, Write, Close Files, File Names and Paths **Classes and Objects**-Defining classes and Objects, constructors, types of methods and variables, Inner classes. **Inheritance and Polymorphism**: Type of Inheritance, super () method, method overloading and Overriding, Operator Overloading **Exception Handling** –Type of exceptions, assert Statement, Except Block, User defined exceptions, logging the exceptions. **Regular expressions**: Sequence characters, Quantifiers and Special characters in regular expressions.	**13**

4	**Graphical User Interface**: Root window, font and colors, Canvas and frames. Widgets: Button, Label, Message, Text, Scrollbar, Checkbutton, Radiobutton, Entry, Spinbox, Listbox and Menu, Creating Tables. **Database Connectivity**: Types of databases used with Python, Using MySQL from Python, Retrieving and Inserting, updating and deleting data in a table, Creating Database tables through Python. Using Oracle database from Python Stored Procedures **Data Science Using Python**: Introduction, Data Frame, Data Visualization, Machine Learning	**13**

Text Books:

1. Dr. R. Nageswara Rao, Core Python Programming (2nd ed.). DreamTech Press.
2. Gowrishankar S., and Veena A. (2019). Introduction to Python Programming. CRC Press.
3. Dr. R. Nageswara Rao,(2021). Core Python Programming (3rd ed.). DreamTech Press.

Reference Books:

1. Brown, M. C. (2018). Python: The complete reference. McGraw Hill Education
2. Summerfield, M. (2010). Programming in Python 3: A complete introduction to the Python language (2nd ed.). Addison-Wesley.
3. Zelle, J. M. (2010). Python programming: An introduction to computer science (2nd ed.). Franklin, Beedle and Associates Inc.
4. Lutz, M. (2013). Learning Python (5th ed.). O'Reilly Media.
5. Matthes, E. (2019). Python crash course: A hands-on, project-based introduction to programming (2nd ed.). No Starch Press.
6. Ramalho, L. (2015). Fluent Python: Clear, concise, and effective programming. O'Reilly Media.

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Software Engineering (THEORY)**		
Course Code:	**BCAAIMS403**	No.of Credits	**05**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

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

- How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment.
- An ability to work in one or more significant application domains.
- Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.
- Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.
- Demonstrate an ability to use the techniques and tools necessary for engineering practice.

Unit	Description	Hours
1	**Introduction:** The Software Problem, Software Engineering Problem, The Software Engineering Approach. **Software Processes:** Software Process, Characteristics of a Software Process, Software Development Process, Waterfall Model, Prototyping, Iterative Enhancement, Spiral Model, Project Management Process, Phases of management process, Metrics, Measurement, and Models, Software Configuration Management Process, Configuration Identification, change control, Status	**15**

	accounting and auditing, Process Management Process, Building estimation models, Process Improvement and maturity.	
2	**Software Requirements Analysis and Specification:** Software Requirements, Need for SRS, Requirement process, Problem Analysis, Analysis Issues, Informal Approach, Structured Analysis, Prototyping, Requirements Specification, Characteristics of an SRS, Components of an SRS, Specification Languages, Structure of a Requirements Document, Validation, Requirement Reviews. **System Design**: Design Principles, Module-Level Concepts, Design Notation and Specification, Data Flow Diagrams, Structured Design Methodology, Verification.	**15**
3	**Detailed Design:** Module specification, specifying functional module, Detailed design, PDL, Logic/Algorithm Design, Verification, Design Walkthroughs, Critical Design Reviews, Consistency checkers. **Coding:** Programming Practice, Top-Down and Bottom-Up, Structured Programming, Information Hiding, Programming Style, Internal Documentation, Verification, Code Reading, Static Analyses, Symbolic Execution, Proving Correctness, Code Inspections or Reviews, Unit Testing.	**15**
4	**Testing and Maintenance:** Testing Fundamentals, Error, Fault, and Failure, Test Oracles, Top-Down and Bottom-Up Approaches, Test Cases and Test Criteria, Psychology of Testing, Functional Testing, Equivalence class partitioning, Boundary value analysis, Cause effect graphing, Structural Testing, Control flow-based criteria, Data flow-based testing, Preventive and Corrective Maintenance. **Introduction to Testing tools:** Features of Test	**15**

	tools, Guidelines for selecting a tool, Tools and skills of testers, Types of testing tools, Difficulties while introducing new tools, Process of procurement of COTS.	

Text Books:

1. Pankaj Jalote, **An Integrated Approach to Software Engineering**, 2nd Edition, Narosa Publishing House, 2004
2. M G Limaye, **Software Testing- Principles, Techniques and Tools**, McGraw Hill Education, 2009

Reference Books:

1. Waman S Jawadekar-Software Engineering Principles and Practice,Tata McGrawHill,2004
2. Roger S. Pressman, **Software Engineering: A Practioner's Approach**, McGraw Hill, 2009

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Artificial Intelligence -I Lab**		
Course Code:	**BCAAIMPS404**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

Note: Part A practicals(IoT) can be carried out using either hardware kits like Arduino or RasberryPi OR using Simulation softwares like Tinkercad.

SI NO	PROGRAM NAME
PART - A	
1	Controlling the Light Emitting Diode (LED) with a push button
2	Interfacing the RGB LED with the Arduino
3	Controlling the LED blink rate with the potentiometer
4	Detection of the light using photo resistor
5	Interfacing the temperature sensor LM35 with Arduino
6	Interfacing Servo Motor with the Arduino
7	Interfacing the Active Buzzer with Arduino
PART - B	
1	Write a Program to implement Breadth First Search (BFS) using Python.
2	Write a Program to implement Depth First Search (DFS) using Python.
3	Write a Program to implement Tic-Tac-Toe game using Python.
4	Write a Program to Implement 8-Puzzle problem using Python
5	Write a Program to Implement Water-Jug problem using Python.
6	Write a Program to Implement Tower of Hanoi using Python.
7	Write a Program to Implement 8-Queens Problem using Python

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing:5 Marks Execution:3Marks	15 Marks
Program-2	PART-B Writing:8 Marks Execution:4Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Python Programming Lab**		
Course Code:	**BCAAIMPS405**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A

1. Write a program create list with N elements. find all unique elements in the list. If an element is found only once in the list, then add that element to the unique list.
2. Write a Program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
3. Consider a tuple t1= (1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
    a) Print half the values of tuple in one line and the other half in the next line.
    b) Print another tuple whose values are even numbers in the given tuple.
    c) Concatenate a tuple t2= (11,13,15) with t1.
    d) Return maximum and minimum value from this tuple.
4. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
5. Write a program to create a text file and compute the number of characters, words and lines in a file.
6. Program using user defined exception class that will ask the user to enter a number until he guesses a stored number correctly. To help them figure it out, a hint is provided whether their guess is greater than or less than the stored number using user defined exceptions.
7. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
   Sample Python dictionary data and list labels: exam_data = {'name': ['Asha', 'Disha', 'Risha', 'Sasha', 'Nisha', 'Prisha', 'Usha',

'Raasha', 'Felisha', 'Jisha'], 'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19], 'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1], 'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

a) Write a Pandas program to display a summary of the basic information about the specified DataFrame and its data
b) Write a Pandas program to select the rows where the number of attempts in the examination is greater than 2

PART-B

1. Program to create a class Employee with empno, name, depname, designation, age and salary and perform the following function
   i) Accept details of N employees
   ii) Search given employee using empno
   iii) Display employee details in neat format

2. Write a program menu driven to create a BankAccount class. class should support the following methods for
   i) Deposit
   ii) Withdraw
   iii) GetBalanace .

   Create a subclass SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest.

3. Write a GUI program to implement Simple Calculator

4. Create a table student table (regno, name and marks in 3 subjects) using MySQL and perform the followings
   a. To accept the details of students and store it in database.
   b. To display the details of all the students
   c. Delete particular student record using regno.

5. Create a table employee (empno, name and salary) using MySQL and perform the followings
   a) To accept the details of employees and store it in database.
   b) To display the details of a specific employee
   c) To display employee details whose salary lies within a certain range

6. Create a table electricity_bill(TariffCode, Customer_Name, Meter Number, Previous_Reading and Current_Reading) using MySQL and perform the Following:
   a) To accept the details of customers and store it in database.
   b) To Update the customer details by Meter Number.
   c) Calculate Bill of a particular customer using below criteria.

Tariff Code	Units Consumed	Rate/Unit
LT1	0-30	2.0
	31-100	3.5
	101-200	4.5
	Above 200	5.0
LT2	0-30	3.5
	31-100	5.0
	101-200	6.0
	Above 200	7.5

7. Consider following data and draw the bar graph using matplot library.(Use CSV or Excel).Add the data Using GUI.

Batsman	**2017**	**2018**	**2019**	**2020**
Virat Kohli	2501	1855	2203	1223
Steve Smith	2340	2250	2003	1153
Babar Azam	1750	2147	1896	1008
Rohit Sharma	1463	1985	1854	1638
Kane Williamson	1256	1785	1874	1974
Jos Butler	1125	1853	1769	1436

Display appropriate title for axis and chart. Also show legends.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing:5 Marks Execution:3Marks	15 Marks
Program-2	PART-B Writing:8 Marks Execution:4Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	IV
Course Title	Cloud Computing (ELECTIVE)		
Course Code:	BCAAIMES401	No.of Credits	02
Contact hours	26Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

- After the successful completion of the course, the student will be able to:
- Explain the core concepts of the cloud computing paradigm such as how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.
- Identify resource management fundamentals like resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

Unit	Description	Hours
1	**Introduction:** Different Computing Paradigms- Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing etc., Comparison of various Computing Technologies; Cloud Computing Basics- What is Cloud Computing? History, Characteristic Features, Advantages and Disadvantages, and Applications of Cloud Computing; Trends in Cloud Computing; Leading Cloud Platform Service Providers.	**8**

2	**Cloud Architecture:** Cloud Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), Comparison of different Service Models; Cloud Deployment Models- Public Cloud; Private Cloud, Hybrid Cloud, Community Cloud; Cloud Computing Architecture- Layered Architecture of Cloud. **Virtualization**-Definition, Features of Virtualization; Types Of Virtualizations-Hardware Virtualization, Server Virtualization, Application Virtualization, Storage Virtualization, Operating System Virtualization; Pros and Cons of Virtualization	**8**
3	**Cloud Application Programming and the Aneka Platform**: Aneka Cloud Application Platform- Framework Overview, Anatomy of the Aneka Container. **Cloud Applications**: Scientific Applications- Healthcare (ECG Analysis in the Cloud) Biology (Protein Structure Prediction and Gene Expression Data Analysis for Cancer Diagnosis), Geoscience (Satellite Image Processing);	**10**

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi: "Mastering Cloud Computing Foundations and Applications Programming", Elsevier, 2013

Reference Books:

1. Barrie Sosinsky:"Cloud Computing Bible", Wiley- India, 2010
2. K Chandrashekaran: "Essentials of Cloud Computing", CRCPress, 2015
3. Derrick Rountree, Ileana Castrillo:"The Basics of Cloud Computing", Elsevier, 2014

Program Name	BCA-AIML	Semester	IV
Course Title	Object Oriented Analysis and Design(ELECTIVE)		
Course Code:	BCAAIMES402	No.of Credits	02
Contact hours	26 Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

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

- Explain the principles and requirements of OOA and Design
- Describe the object-oriented approach to system development, modeling objects, relationships and interactions.
- Analyze Objects and Classes of the software system.
- Construct object model using object types, attributes, structures and associations.
- Analyze Functional and Dynamic Modeling

Unit	Description	Hours
1	**Introduction:** Object orientation concept, OO development concept - Modeling concept, OO methodology, three methods, OO Themes - Abstraction, Encapsulation, combining data and behavior, sharing, Emphasis on the essence of an Object, Synergy **Modeling as a design Technique:** Modelling, Abstraction, The three models **Class modelling:** Object and class concepts - Objects, Classes, Class diagram, Values and attributes, Operation and methods, Link and Association Concepts - Link and association, Multiplicity, Association and names, Ordering, Bags and Sequences, Association Class, Qualified Association, Generalization and Inheritance- Definition, Use of generalization, Overriding	**8**

	features	
2	**State Modelling :**Events - Signal event, change event, Time event, States, Transistors and conditions State Diagrams - Sample State Diagram, one shot state Diagrams, Summary of Basic state diagram notations, State Diagram Behavior - Activity Effects, Do Activities, Entry and Exit Activities, Completion Transition, Sending Signals **Sequence Model**: Scenarios, Sequence Diagram, Communication Diagram, Activity Model - Activities, Branches, Introduction and termination, Concurrent Activities, Executable Activity diagram, Guidelines for Activity models, Deployment Diagram	**8**
3	**Class Design** Overview of Class Design, Bridging the Gap, Realizing Use Cases, Designing Algorithms - Choosing Algorithms, Choosing Data structures, Defining Internal classes and Operations, Assigning Operations to Classes, Recursing Downward - Functionality Layers, Mechanism Layers, Refactoring, Design Optimization - Adding Redundant associations for Efficient Access, Saving derived values to avoid Re-computation, Rectification of Behavior, Adjustment of Inheritance - Rearranging Classes and Operations, Abstracting out Common Behavior, Using Delegation to share Behavior	**10**

Text Book

1. Object Oriented Modeling and Design with UML Michael R. Blaha James R. Rumbaugh, Second Edition, Pearson

Reference Books

1. UML™ 2 Toolkit – Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY Publishing
2. Object Oriented Analysis and Design with Applications Grady Booch Second Edition (Pearson Education)
3. Object Oriented Software Engineering Bernd Brugge and Allen H. Dutoit Pearson Education

Program Name	BCA-AIML	Semester	IV
Course Title	Digital Image Processing (ELECTIVE)		
Course Code:	BCAAIMES403	No.of Credits	02
Contact hours	26Hours	Duration of SEA/Exam	2 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

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

- Remember the fundamental concepts of Image Processing
- Explain different Image enhancement techniques
- Understand and review image transforms
- Analyse and evaluate digital images.

Unit	Description	Hours
1	**Introduction:** What is Digital image processing, The origin of DIP, Examples of fields that use DIP, Fundamentals steps in DIP, Components of an image processing system. **Digital Image Fundamentals:** Elements of Visual perception, Light and the electromagnetic spectrum, Image sensing and acquisition, Image sampling and Quantization, Some Basic relationship between Pixels	**8**
2.	**Image Enhancement in the Spatial Domain:** Background, some basic Gray Level Transformations, Histogram Processing, Enhancement using Arithmetic / Logic operations, Basics of spatial filtering, Smoothing Spatial Filters, Sharpening spatial filters.	**8**

3	**Color Image Processing:** Color Fundamentals, Colour Models, Pseudocolor Image Processing, Colour transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images	**10**

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition, PHI/Pearson

Reference Books:

1. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.
2. Nick Efford, "Digital Image Processing a practical introducing using JAVA", Pearson Education, 2004.
3. Kothari, Ashish M, Digital Image Processing using SCILAB, Springer publication, 2019.

Program Name	**BCA-AIML**	Semester	**IV**
Course Title	**Basic Web Designing Skills (Compulsory)**		
Course Code:	**BCAAIMSS401**	No.of Credits	**02**
Contact hours	**26Hours**	Practical	
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

Course Outcomes (COs):

- After completing this course satisfactorily, a student will be able to:
- Understand the fundamentals of HTML5 and its evolution from previous versions.
- Identify the structure and components of an HTML5 document.
- Utilize HTML5 semantic elements to create well-structured web pages.

Work to be carried out by the students:

1	Prepare the text document using all the text formatting tags including HR, BR, etc.
2	Prepare HTML document using ordered lists and unordered lists of all types..
3	Create an HTML document using definition lists, pre tag, marquee, Block quotes with meaningful contents.
4	Prepare students mark cards using all table attributes with an image.
5	Create an HTML document using frames as shown. Heading with marquee effect Three tourist Places | Relevant information with images
6	Prepare neat biodata with all form control events.
7	Create a website (your own choice) with minimum 10 web pages.

Note:
The work done by the student needs to be compiled and printed as a record book and presented to the examiners.

Scheme of valuation:

a) Internal Assessment	10 Marks (C1) Basis for Internal Assessment Continuous Evaluation: 10 Marks
b) Evaluation of Report	40 Marks (C2) i) Preparation and presentation: 25 Marks ii) Viva-Voce: 10 Marks iii) Record Book : 05 Marks

Questions Paper for Pattern Core Subjects

Duration:3 Hours

Max.Marks:80

Note: Answer any TEN Questions from Part-A. And one full Questions from each unit in Part-B

Part-A

1. 10*2=20
   a.
   b.
   c.
   d.
   e.
   f.
   g.
   h.
   i.
   j.
   k.
   l.

PART B

Each unit contain two main questions, and it carry 10 Marks. Each main questions contain 2 or more sub question.

3*10=30

UNIT-I

2.
   a.
   b.
   c.

3.
   a.
   b.

UNIT-II

4.
   a.
   b.
   c.

5.
   a.
   b.
   c.

UNIT-III

6.
   a.
   b.
   c.

7.
   a.
   b.
   c.

UNIT-IV

8.
   a.
   b.
   c.

9.
   a.
   b.

Questions Paper Pattern for Elective Subjects

Duration:2Hours Max.Marks:40

Note: Answer any 5 Questions from Part-A. And one full Questions from each unit in Part-B

Note: Answer any Five Questions from Part-A. And any six Questions out of Nine Questions from Part-B

Part-A

1. 5*2=10
   a.
   b.
   c.
   d.
   e.
   f.
   g.
   h.

Part-B

Answer any Six questions out of Nine questions.

6*5=30

2.
3.
4.
5.
6.
7.
8.
9.
10.

MANGALORE UNIVERSITY

State Education Policy – 2024
[SEP-2024]

CURRICULUM

FOR

BCA-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

MANGALORE UNIVERSITY

Suggested programme structure for the Undergraduate Programmes

[BCA, BCA (A.I & M.I), BCA (D.A)]

Sem	Course 1	Course 2	Course 3	Elective / Optional	Course	Language	Compulsory	Total Credit	Total Working hour
I	5 (3T+2P)	5 (3T+2P)	5 T			3+3	2	23	4+4+4+4+5+4+ 4+2=31
II	5 (3T+2P)	5 (3T+2P)	5T			3+3	2	23	4+4+4+4+5+4+ 4+2=31
III	5 (3T+2P)	5 (3T+2P)	5T	2		3+3		23	4+4+4+4+5+4+ 4+2=31
IV	5 (3T+2P)	5 (3T+2P)	5T	2		3+3	2	25	4+4+4+4+5+2+ 4+4+2=33
V	8[(2x3T)+2P]	8[(2x3T)+2P]	8[(2x3T)+2P]				2	26	3+3+3+3+3+3+ 4+4+4+2=32
VI	3T+2P	3T+2P	Research Methodology + Project Work- 12					22	3+3+4+4+22=36
							Total Credits	**142**	

Note:

- Course1 and Course2: I to IV Semester: Theory 3 credits = 4 contact hours and Practical 2 credits=4 contact hours
- Course 3: I to IV Semester: Theory 5 credits = 5 contact hours
- Course1, Course2 and Course3: V and VI Semester: Theory 3 credit=3 contact hours and Practical 2 credits =4 contact hours
- Elective/Optional: 2 credits=2 contact hours
- Languages: 3 credits=4 contact hours
- Compulsory: 2 credits=2 contact hours

Curriculum Structure

Semester V								
Sl. No	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week	SEE	IA	Total Marks	Credits
1	BCAAIMS501	Machine Learning Techniques	Core	3	80	20	100	3
2	BCAAIMS502	Web Application Development using PHP and MySQL	Core	3	80	20	100	3
3	BCAAIMS503	Statistical Analysis and Data Visualization Using R	Core	3	80	20	100	3
4	BCAAIMS504	Internet Of Things	Core	3	80	20	100	3
5	BCAAIMS505	Advanced Artificial Intelligence	Core	3	80	20	100	3
6	BCAAIMS506	Natural Language Processing	Core	3	80	20	100	3
7	BCAAIPS507	Web Application Development Lab	Practical	4	40	10	50	2
8	BCAAIPS508	Statistical Analysis and Data Visualization Lab	Practical	4	40	10	50	2
9	BCAAIPS509	Machine Learning and IoT Lab	Practical	4	40	10	50	2
10	BCAAISS501	AI Tools and Techniques	Compulsory	2	40	10	50	2
			Total	**32**	**640**	**160**	**800**	**26**

Semester VI								
Sl. No	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week	SEE	IA	Total Marks	Credits
1	BCAAIMS601	Artificial Neural Network	Core	3	80	20	100	3
2	BCAAIMS602	Computer Vision	Core	3	80	20	100	3
~~3~~	BCAAIPS603	Artificial Neural Network Lab	Practical	~~4~~	40	10	50	2
4	BCAAIPS604	Computer Vision Lab	Practical	4	40	10	50	2
5	BCAAIPS605	Research Methodology and Project Work	Project Work	22	400	100	500	12
			Total	**36**	**620**	**180**	**800**	**22**

SEMESTER V

Program Name	**BCA (AI – ML)**	Semester	**V**
Course Title	**Machine Learning Techniques (Theory)**		
Course Code:	**BCAAIMS501**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes:

At the end of the course the students will be able to

1. Identify machine learning techniques suitable for a given problem.
2. Solve the problems using various machine learning algorithms
3. Apply data processing techniques
4. Apply the design of intelligent machines
5. Evaluate different clustering techniques

Unit	**Description**	**Hours**
I	Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Evaluation, Model Prediction, Search and Learning.	09
II	Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.	10

III	Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification , Class Conditional Independence and Naive Bayes Classifier (NBC).	10
IV	Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization , Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering. Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression.	10

Textbook:

1. M N Murty and Ananthanarayana V S., " Machine Learning : Theory and Practice", Universities Press. 2024
2. S Sridhar and M Vijayalaxmi, "Machine Learning", Oxford University Press.

Reference Books:

1. Mark E Fenner., " Machine Learning with Python for Everyone", Pearson Publishers. 2020
2. Abdul Hamit Subasi.,"Practical Machine Learning for Data Analysis Using Python"
3. John Hearty "Advance Machine Learning with Python".
4. Sebastian Raschka and Vahid Mirjalili. "Python Machine Learning: Machine Learning and Deep Learning with Python, Scikit-Learn, and Tensor Flow", Packt 2019.
5. Aurélien Géron."Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"
6. Andreas C. Müller, Sarah Guido.,"Introduction to Machine Learning with Python". O'Reily Publishers

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Web Application Development using PHP and MySQL (THEORY)**		
Course Code:	**BCAAIMS502**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the basics of PHP and MySQL, including their roles in web development.
- Write and execute PHP scripts to create dynamic web pages.
- Use PHP sessions and cookies to manage state and user information.
- Understand the fundamentals of JavaScript, including its syntax and data types.
- Write and execute JavaScript code to create interactive web pages.

Unit	Description	Hours
I	Basics of HTML, Overview and features of CSS3. **Animation**: Introduction, Start and End States, Interpolation, Animations in HTML. All About CSS Animations, creating a Simple Animation, Detailed Look at the CSS Animation Property, Keyframes, Declaring Multiple Animations, Wrap-up. All About CSS Transitions, Adding a Transition	09

II	**Introduction to PHP:** Introduction to PHP, History and Features of PHP, Understanding PHP, Writing Comments in PHP, Sending Data to the Web Browser, Data types in PHP, Keywords in PHP, Using Variables, Constants in PHP, Expressions in PHP, Operators in PHP, Conditional statements: if, if-else, switch, The ? Operator, Looping statements: while Loop, do-while Loop, for Loop.	10
III	**Arrays in PHP**: Creating Arrays, Accessing Array elements, Indexed v/s Associative arrays, Multidimensional arrays, using Array Functions. Functions in PHP, Function definition, Creating and invoking user-defined functions, Formal parameters versus actual parameters, Function and variable scope. Strings in PHP: What is String? Creating and Declaring String, String Functions. **Classes and Objects in PHP:** Creating and accessing a Class & Objects, Object properties, object methods.	10
IV	**Form Handling**: Creating HTML Form, Handling HTML Form data in PHP **Database Handling using PHP with MySQL**: Introduction to MySQL, Database terms, Data Types, Accessing MySQL using MySQL Client and Using phpMyAdmin, MySQL Commands, Using PHP with MySQL, PHP MySQL Functions, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Inserting, deleting and Updating Records with PHP.	10

Textbooks:

1. Animation in HTML, CSS, and JavaScript, Kirupa Chinnathambi, 1st Edition, CreateSpace Independent Pub, 2013.
2. Kevin Tatroe, Peter MacIntyre and Rasmus Lerdorf, Programming in PHP, 3rd Edition O'Reily Publications
3. Robin Nixon, Learning PHP, My SQL, JavaScript, CSS and HTML5, 3rd Edition, O'Reily Publications

4. Larry Ullman, PHP and MySQL for Dynamic Websites 5th Edition Peachpit Press

Reference Books:

5. Deitel, Paul_Deitel, Harvey_Deitel, Abbey - Internet and World Wide Web How to Program-Pearson Education (US) (2011)
6. Steven Holzner, PHP the Complete Reference
7. Chris Bates - Web Programming_ Building Internet Applications-Wiley (2002)
8. Web Programming with HTML5, CSS, and JavaScript-John Dean
9. **Complete Set of Scripts and SQL Commands:** https://github.com/LarryUllman/phpmysqlvqp-5ed

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Statistical Analysis and Data Visualization Using R (THEORY)**		
Course Code:	**BCAAIMS503**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes:

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

1. Demonstrate proficiency in R programming concepts including data types, vectors, matrices, arrays, lists, data frames, file handling, functions, conditional statements, loops, and exception handling.
2. Develop and interpret graphical representations and data visualizations using R and ggplot2
3. Apply descriptive statistical techniques to analyse ungrouped and grouped data
4. Analyse relationships between variables using correlation and regression techniques and interpret statistical results for decision-making and predictive analysis.

Unit	Description	Hours
I	Introduction of the language: Numerics, Arithmetic, Assignment, and Vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Reading and Writing Files. Programming Basics: Calling Functions, Conditions and Loops, Writing Functions Exceptions, Timings, and Visibility.	09

II	Plotting Basics and Basic Data Visualization: Using plot with Coordinate Vectors, Graphical Parameters, Automatic Plot Types, Title and Axis Labels, Line and Point Appearances, Plotting Region Limits, Adding Points, Lines and Text to an Existing Plot. The ggplot2 Package, A Quick Plot with qplot, Bar plots and Pie Charts, Building a Bar plot, A Quick Pie Chart, Histograms, Scatterplots.	08
III	Data Measurement: Types of Data, Nominal, Ordinal, Scale and Ratio. Descriptive Statistics: Measures of Central Tendency: Ungrouped Data: Mode, Median, Mean, Percentiles, Quartiles Measures of Variability: Ungrouped Data: Range, Interquartile Range, Mean Absolute Deviation, Variance, and Standard Deviation, Mean Absolute Deviation, Variance , Standard Deviation, *z* Scores, Coefficient of Variation. Measures of Central Tendency and Variability: Grouped Data: Measures of Central Tendency, Mean, Median, Mode, Measures of Variability Measures of Shape: Skewness and the Relationship of the Mean, Median, and Mode, Coefficient of Skewness. Distributions: Binomial, Poisson, Continuous Probability Distribution, Normal Distribution, Uniform Distribution. Estimating the population mean using the t-distribution.	12
IV	Statistical Inference and Hypothesis Testing: Types of Hypotheses, and Sample, Null and Alternate Hypothesis, Level of Significance, Type I and Type II Errors, One Sample t-test, Chi Square Test of Independence, One way ANOVA. Correlation and	10

	Regression: Analysis of Relationship, Positive and Negative Correlation, Perfect Correlation, Karl Pearson Coefficient of Correlation, Correlation Matrix, Scatter Plots, Simple Regression Analysis.	

Text Books:

1. Tilman M. Davies, “The book of R: A first course in programming and statistics”, San Francisco, 2016.
2. Ken Black, Business Statistics, New Delhi, Wiley, 2013.

Reference Books:

1. Vishwas R. Pawgi, “Statistical computing using R software”, Nirali Prakashan publisher, 2022.
2. Garrett Grolemund “Hands-On Programming with R” Oreily Publications.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Internet Of Things(THEORY)**		
Course Code:	**BCAAIMS504**	No.of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes

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

1. Explain the fundamental concepts of IoT, including its evolution, applications, impact, challenges, and the convergence of Information Technology (IT) and Operational Technology (OT).
2. Analyse IoT network architectures and design principles considering scalability, security, constrained devices and networks, data management, and legacy device integration, including the oneM2M standardized architecture.
3. Describe and apply the core IoT functional stack, including sensors and actuators, communication networks, gateways, network management, applications, analytics, and IoT data management using edge, fog, and cloud computing.
4. Evaluate and select suitable IoT communication technologies based on range, frequency, power consumption, topology, data rate, latency, security, and other communication requirements, with emphasis on IEEE 802.15.4 and related technologies.
5. Explain and implement IoT networking and application-layer protocols, including IPv6, 6LoWPAN, RPL, CoAP, and MQTT, for connecting constrained smart objects and enabling efficient IoT communication**.**

Unit	Description	Hours
I	Introduction to IoT: 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- Scale, Security, Constrained Devices and Networks, A Simplified IoT Architecture.	09
II	The Core IoT Functional Stack: Layer 1: Things: Sensors and Actuators Layer. Layer 2: Communications Network Layer Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer. Layer 3: Applications and Analytics Layer, Analytics Versus Control Applications, Data Versus Network Analytics, Data Analytics Versus Business Benefits, Smart Services.	10
III	Connecting Smart Objects: Communications Criteria- Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks Data Rate and Throughput Latency and Determinism Overhead and Payload IoT Access Technologies IEEE 802.15.4 Standardization and Alliances Physical Layer MAC Layer Topology Security Competitive Technologies IEEE 802.15.4, Conclusions- IEEE 802.15.4g and 802.15.4e	10
IV	IP as the IoT Network Layer: The Business Case for IP, The Key Advantages of Internet Protocol Adoption or Adaptation of the Internet Protocol, IP Versions, Optimizing IP for IoT From 6LoWPAN to 6Lo, Header Compression Fragmentation. RPL: Objective Function (OF), Rank RPL Headers, Metrics. Application Protocols for IoT: IoT Application Layer Protocols CoAP Message Queuing Telemetry Transport (MQTT).	10

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

Reference Books:

1. Raj Kamal, “INTERNET OF THINGS - Architecture and Design Principles” MGH, 2017
2. Olivier Hersent, David Boswarthick and Omar Elloumi, “The Internet of Things - Key Applications and Protocols”, Wiley Publishers.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Advanced Artificial Intelligence (THEORY)**		
Course Code:	**BCAAIMS505**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Outcomes (COs):

1. Apply appropriate problem-solving strategies and search techniques to design intelligent agents that operate efficiently in deterministic and nondeterministic environments.
2. Analyze and implement probabilistic reasoning techniques including Bayesian networks and temporal models for decision-making under uncertainty.
3. Evaluate learning strategies including reinforcement learning and sequential decision-making methods to solve real-world decision problems.
4. Design machine learning models using supervised learning techniques such as decision trees, regression, and neural networks to make predictions and classifications.

Unit	Description	Hours
I	Solving Problems by Searching: Problem-Solving Agent - Problem formulation, searching solutions and executing actions. Measuring Problem-Solving Performance -Completeness, Optimality, Time complexity, Space complexity. Search in Complex Environments: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions.	10
II	Uncertain Knowledge: Uncertainty - Quantifying uncertainty - Acting under uncertainty – basic probability notation – inference using full joint	10

	distributions – independence - Bayes' rule and its use.	
III	Reinforcement Learning: Basics of Reinforcement learning–Active and Passive reinforcement learning–Generalization–Applications of Reinforcement Learning. Making simple decisions: combining beliefs and desires – The basis of utility theory – Utility functions – multi attribute utility functions – decision networks – The value of information, Decision Networks.	10
IV	Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees. Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Linear Regression and Classification.	09

Textbooks:

1. Russell, S. & Norvig, P. (2021) Artificial Intelligence: A Modern Approach (4th ed.). Pearson Publishers

Reference Books:

1. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning by James V Stone, Sebtel Press, 2019.
2. Artificial Intelligence by Example: Acquire advanced AI, machine learning, and deep learning design skills by Denis Rothman, 2nd Edition, 2020.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Natural Language Processing (THEORY)**		
Course Code:	**BCAAIMS506**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

COURSE OUTCOMES:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammar.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems.
3. Able to manipulate probabilities, construct statistical models over strings and trees
4. Will be able to estimate parameters using supervised and unsupervised training methods.
5. Able to design, implement, and analyze NLP algorithms. Able to design different language modeling Techniques.

Unit	**Description**	**Hours**
I	Natural Language processing (NLP) : Introduction, Applications and Components of NLP, Finding the Structure of Words: Words and Their Components, Lexemes, Morphemes, Morphology, Problems in morphological processing, Natural Language Processing with python NLTK .	10
II	Text Preprocessing Tasks: Word Tokenization, Sentence Tokenization, Filtering Stop words, Term Frequency- Inverse Document Frequency (TF-IDF). Only concepts of Stemming, Lemmatization, Parts of	10

	Speech tagging, Named Entity Recognition.	
III	Text Representation Techniques: Basic Representations - Bag-of-Words (BoW), TF, TF-IDF; Limitations, One-hot Encoding vs. Dense Representations; Word Embeddings - Word2Vec, GloVe, FastText; Limitations; Contextual Embeddings - BERT, GPT.	10
IV	NLP Tasks and Classical Models: Language Modeling - n-gram models, Laplace Smoothing; Text Similarity and Clustering; Topic Modeling – LDA; Text Classification - Sentiment Analysis, Spam Detection; Part-of-Speech (POS) Tagging.	09

TEXTBOOKS:

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

REFERENCE BOOKS:

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

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

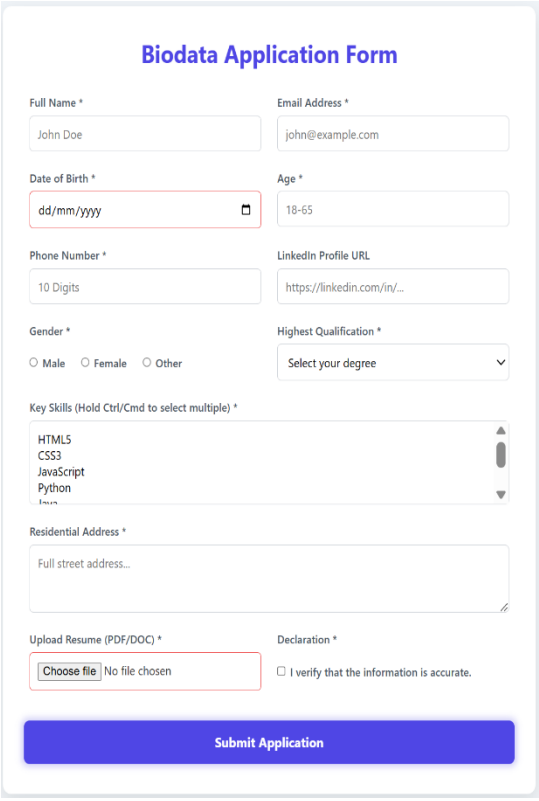
Program Name	**BCA-AIML**	Semester	**V**

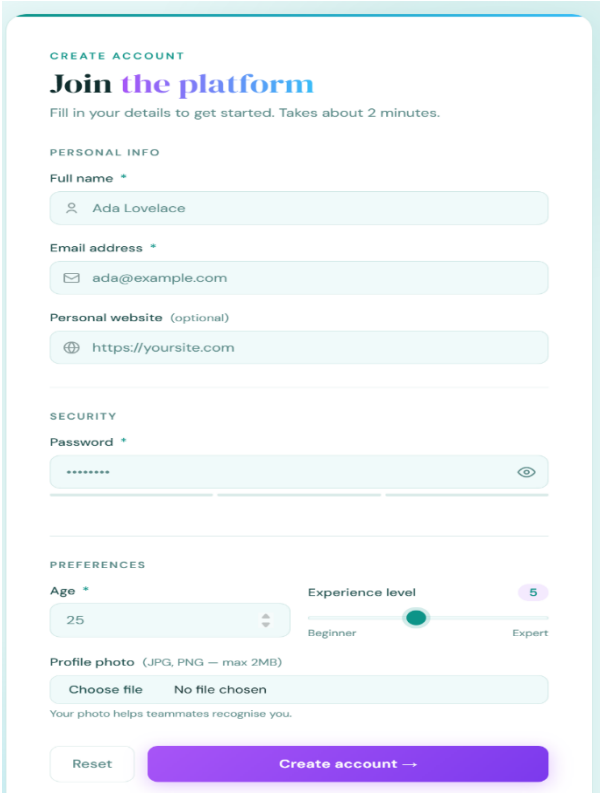
Course Title	**Web Application Development Lab**		
Course Code:	**BCAAIPS507**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

List of Practical Exercises to be carried out by the students:

PART – A

1. Design a HTML5 web page containing a form with text, number, option button, list box with multiple select, email, URL, file, submit and reset elements which must be styled using CSS3 according to any one of the following screenshots or similar.



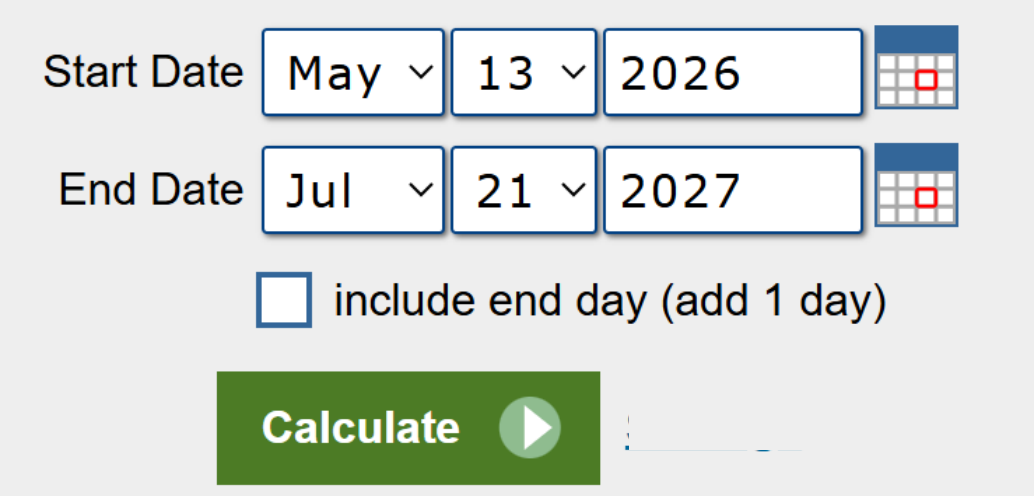


2. Design and implement a web page using HTML and CSS to create a box that performs multiple animations simultaneously.

3. Write a PHP program demonstrating the usage of sessions to store and retrieve user credentials like username and password. Combine the login, welcome, and logout functionalities into two files – 'index.php' and 'welcome.php'.

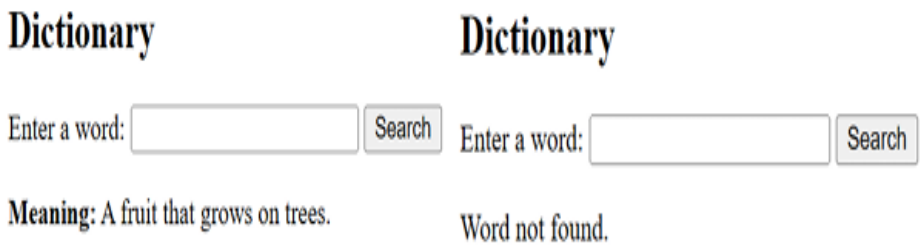


4. Write a PHP program with a user interface for calculating the number of days between two given dates. Display the difference in years, months, and days.



5. Write a PHP script to create gif, jpeg and png images with text and display those images in a html webpage.

6. Write a PHP program to create an associative array representing a dictionary with words as keys and their meanings as values. Allow users to input a word and display its meaning if found, otherwise, display a "Word not found" message. (Please keep 10 pairs of keys and their meanings)



7. Write a PHP program that includes a user form with a text field and submit buttons for various string manipulations. It will display the result accordingly. (for replace, replace 'a' with 'x').

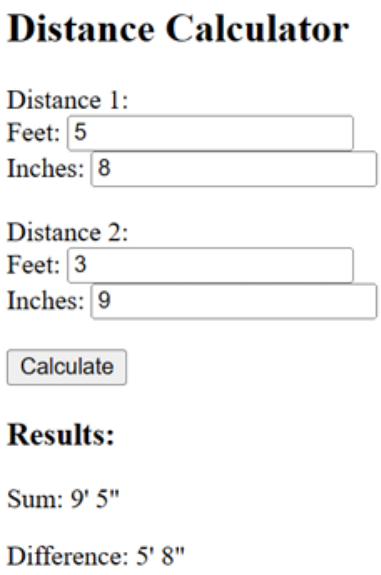


PART – B

1. Create a PHP webpage for an **Online Product Gallery** that displays product cards with images, product name, price, and description fetched using PHP variables or arrays. Apply **CSS transitions and transformations** so that when the user hovers over a product card:
   a) The card smoothly enlarges
   b) Rotates slightly
   c) Changes its shadow and opacity
   d) The image zooms in with different timing functions
2. Create a PHP program to implement an **Employee Information Form** using Labels, Text Boxes, Text Area, Checkboxes, Radio Buttons, Select Menu, and Submit Button.

   The form should collect the following details: Employee ID, Employee Name, Department, Address, E-Mail, Mobile Number, Gender, Skills Known, Salary Range and Date of Joining. After submitting the form, display all the user-entered details on a new PHP page in a well-formatted table or card layout using PHP.

3. Write a PHP program that implements a class to add and find the difference of two distance values given in feet and inches. The user inputs are collected through an HTML form.



4. Program to implement a login form where users enter their username and password. Validate the credentials against data stored in a MySQL database and grant access if they are correct.
5. Program to create a feedback form with fields for name, email, subject, and message. Store the submitted feedback data in a MySQL database for later review.
6. Create a PHP-MySQL application for a Student Attendance Management System. Create a MySQL database and a table to store student attendance details such as Student USN, Student Name, Class, Subject, Attendance Percentage, Attendance Status. Design a webpage using HTML and CSS to input the above fields. Apply appropriate CSS styling and validation for input fields. Use PHP to establish a connection with the MySQL database, insert student attendance details into the database table, fetch and display all

records in a formatted table. Provide options to Save Record, Clear Form and View Attendance Details.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic :5 Marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 Marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Statistical Analysis and Data Visualization Lab**		
Course Code:	**BCAAIPS508**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

List of Practical Works to be carried out:

PART-A

1. Write a program to create a 3 X 3 matrices A and B and perform the following operations
    a) Add, subtract, multiply and divide(corresponding elements $\frac{a_{ij}}{b_{ij}}$) the two matrices.
    b) Find the Inverse and Transpose of Matrix A
    c) Add a row and a column to Matrix B using rbind() and cbind()
    d) Find the size, number of rows, number of columns and number of elements of Matrix A
    e) Modify the diagonal elements of Matrix B.
2. Write a R program to print the multiplication table of a given number using a for loop
3. Write an R program to create a list containing strings, numbers, vectors and logical values and do the following manipulations over the list
    a) Access the first element in the list
    b) Give the names to the elements in the list
    c) Add element at some positions in the list
    d) Remove the element

e) Print the first and third element
f) Update the third element

4. a) Construct a histogram of grouped data and superimpose a frequency polygon on the histogram for the given frequency table:

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	8	11	15	12	6	3

b) The actual outlay on the public health sector in the 7th and 8th five-year plan of India is shown below:

Heads	7thplan	8thplan
Agriculture and Allied services	30317	32025
Irrigation and flood control	16719	23771
Industries and minerals	30052	46889
Transport and communication	38804	80798
Energy	63615	122356
Services	39576	84088
Miscellaneous	3186	44173

Draw pie chart to show the relative importance attached to various heads in each plan

5. Write an R program to create a Data Frame with following details and do the following operations.

ItemCode	itemCategory	ItemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
c) Subset the Data frame and display the items where the Itemprice between 300 and 700
d) Compute the sum of all ItemPrice
e) Create another Data Frame called “item-details” with three different fields ItemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.

6. Create a factor marital_status with levels Married, single, divorced. Perform the following operations on this factor
   a) Check the variable is a factor
   b) Access the 2nd and 4th element in the factor
   c) Remove third element from the factor
   d) Modify the second element of the factor
   e) Add new level widowed to the factor and add the same level to the factor marital_status
7. Write R language Scripts for following operations on Iris Data Set
   a) Load the Iris Dataset
   b) View first six rows of iris dataset
   c) Summarize iris dataset
   d) Display number of rows and columns
   e) Display column names of dataset.
   f) Create histogram of values for sepal length
   g) Create scatterplot of sepal width vs. sepal length
   h) Create boxplot of sepal width vs. sepal length
   i) Find Pearson correlation between Sepal.Length and Petal.Length
   j) Create correlation matrix for dataset

PART-B

Note: Implement Using R Script and Solve Manually

1. Write a R program to create a Vector containing following 8 values and perform the following operations.

4	3	0	5	2	9	4	5

   a) Find mean, median, mode.

b) Find the range.
c) Find the 35th and 78th percentile.
d) Find the variance and standard deviation
e) Find the interquartile range.
f) Find the z-score for each value.

[R Script: 5 Marks Manual Solution: 7 Marks]

2. Write R script to find the correlation coefficient and type of correlation between advertisement expenses and sales volume using Karl Pearson's coefficient of correlation method (Direct Method).

Firm	1	2	3	4	5	6	7	8	9	10
Advertisement Exp. (Rs. In Lakhs)	11	13	14	16	16	15	15	14	13	13
Sales Volume (Rs. In Lakhs)	50	50	55	60	65	65	65	60	60	50

[R Script: 5 Marks Solution: 7 Marks]

3. Write R script to compute the regression equation of y on x from the following data. Predict the value of y when x=7.

X	2	4	5	6	8	11
Y	18	12	10	8	7	5

[R Script: 5 Marks Solution: 7 Marks]

4. The times taken by a large group of students to complete a piece of homework, T minutes, are Normally distributed with a mean of 57 minutes and standard deviation of 6.5. Find the probability that the time taken by a random student from the group to complete this homework will be less than 60 minutes. Write R script to Find the probability that the time taken by a random student from the group to complete this homework
   a) Will be less than 60 minutes
   b) Between 50 and 80 minutes

[R Script: 6 Marks Manual Solution: 6 Marks]

5. Write R script to perform the following using binomial distribution
   a) If n=4 and p=0.10, find P(x=3)
   b) If n=12 and p=0.45, find P(5<=x<=7)

   [R Script: 6 Marks Manual Solution: 6 Marks]

6. Perform the following using uniform distribution between 200 and 240.
   a) P(x>230)
   b) P(205≤x≤220)

   [R Script: 6 Marks Manual Solution: 6 Marks]

7. A company has three manufacturing plants, and company officials want to determine whether there is difference in the average age of workers at the three locations. The following data are the ages of five randomly selected workers at each plant. Perform a one-way ANOVA to determine whether there is a significant difference in the mean ages of the workers at three plants. Use α=0.01. Write R script for the above problem.

	Plants		
Employee Age	1	2	3
	29	32	25
	27	33	24
	30	31	24
	27	34	25
	28	30	25

Assessment Criteria		
Program-1	PART-A : Writing: 5 Marks ; Logic: 5 Marks Execution: 5 Marks	15 Marks
Program-2	PART-B: Writing/Solving: 12 Marks Execution: 8 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Machine Learning and IOT Lab**		
Course Code:	**BCAAIPS509**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

List of Practical Works to be carried out: (Note:Part B practicals can be carried out using either using hardware kits like NodeMCU, Arduino or RasberryPi OR using Simulation softwares like Tinkercad)

PART-A

1. Assume a regression algorithm generates a model $y = 0.54 + 0.66\,x$ for data pertaining to week sales data of a product. Here, x is the week, and y is the product sales. Write Python Code to find the prediction for the 5th and 8th week. Also tabulate the Week wise Sales Prediction for a year. Visualize the sales prediction using Line Graph.
   Sample Output:

```
Week       Predicted Sales
---------------------------
1          1.20
2          1.86
3          2.52
4          3.18
5          3.84
6          4.50
7          5.16
```

2. Write a Python Code to generate 100 values of x in the range [0,1]. let them be $x_1, x_2, x_3, \ldots x_{100}$. Perform the following on the data set generated.

a. Label the first 50 points {x_1, x_2, ,....x_{50}} as follows: if x_i<=0.5 the x_i is member of Class - Lower Range else x_i is the member of class Upper Range.
b. Classify the remaining points x_{51},.... x_{100} using KNN. Perform this for 1,2,3,4,5,20,30.

3. Download the Olivetti Face dataset. There are 40 classes (corresponding to 40 people), each having 10 faces of individuals. So, there are 400 images in total. Here each face is viewed as an image of size 64x64=4096 pixels; each pixel having values 0 to 255 which are ultimately converted into floating numbers in the range [0,1]. Split the data set into train and test parts. Carry out this splitting repeatedly 10 times by varying train and test data set sizes and report the average accuracy. Perform the following tasks on the dataset.
   a. Build a decision tree using the training data. Tune the parameters corresponding to pruning the decision tree. Use the best DT to classify the test data set and obtain accuracy. Use both Gini and Entropy impurities.
   b. Build a Random Forest Classifier using the training data set. Use RF with 50 DTs. Obtain the classification accuracy on the test data with number of features as 20%, 40% and 60% of the given set of features.
4. Write a Python 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.
5. Write a Python program to implement k-Nearest Neighbor algorithm to classify the IRIS data set. Print both correct and wrong predictions.
6. Write a Python program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file.

PART-B

1. Design and build an Intrusion Detection System with Arduino and PIR Sensor
2. Design and develop an application that measures the room temperature and posts the temperature value on the cloud platform.

3. Design and develop an application to calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD.
4. Design and develop an application to upload humidity & temperature data to Thing Speak, periodically logging ambient light level to Thing Speak
5. Design and develop an application to interface a motor/bulb using relay with Arduino / Raspberry Pi and write a program to turn on motor/bulb when push button is pressed from the smartphone.
6. Design a traffic simulator with Arduino/Raspberry Pi.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Designing: 12 Marks Execution: 8 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**V**
Course Title	**Artificial Intelligence Tools and Techniques (Skill Based Practical Course - Compulsory)**		
Course Code:	**BCAAISS501**	No.of Credits	**02**
Contact hours	**26 Hours**	Duration of SEA/Exam	**--**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Identify and study different types of AI tools and their environments and develop various projects using them
2. Use the some of the current AI tools.

Q. No	**Works to be carried by the students**
1	Create an invitation (image format) for the College Annual Day Programme by giving appropriate prompts to AI Tools such as Gemini, ChatGPT, Adobe Firefly or Canva
2	Create a thirty second video story about a historical or mythological event using any video creation AI Tool
3	Create a Presentation about any topic using Gamma or NoteBookLM or any other Presentation creation AI Tools
4	Create a Lesson for 7th Standard Science subject using Nearpod. Create at least five activities.
5	Create a static website with at least 10 pages using Claude, Caffeine, Gemini or Antigravity or any other Web Development AI Tool

6	Create a Shopping Cart web Application using Claude, Caffeine, Gemini or Antigravity or any other Web Development AI Tool
7	Create a dynamic web application which contains a mock test or a Quiz.
8	Create a mobile App using AI enabled Android Studio, Replit, Emergent or any other mobile App development AI Tools to detect a car, it's make, model and colour from an image.

Evaluation:

A printed report shall be prepared by the student under the guidance of the identified mentor/supervisor in the college and submitted to the Head of the Department for evaluation. The report shall be evaluated by the two internal faculty members and submit the summative marks to the university.

Scheme of valuation:

Internal Assessment	10 Marks (C1) Basis for Internal Assessment Continuous Evaluation: 10 Marks
Evaluation of Report	40 Marks (C2) i) Preparation and presentation: 25 Marks ii) Viva-Voce: 10 Marks iii) Record Book: 05 Marks

SEMESTER VI

Program Name	**BCA-AIML**	Semester	**VI**
Course Title	**Artificial Neural Network(THEORY)**		
Course Code:	**BCAAIMS601**	No. of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Unit	**Description**	**Hours**
I	Introduction to Artificial Intelligence, Machine Learning, and Deep Learning. Types of Learning: Supervised and Unsupervised. Introduction to Artificial Neural Networks: Fundamentals of Neural Networks, Biological Neuron and Artificial Neuron. History and Evolution of Neural Networks. Characteristics and Applications of Neural Networks. Single Layer Perceptron: Basic Architecture, McCulloch-Pitts Neuron Model. Activation Functions: Binary Step, Linear, Sigmoid, Tanh, ReLU and Softmax. Limitations of Single Layer Perceptron.	10
II	Introduction to Multi-Layer Perceptron (MLP). Multi-Layer Neural Networks and Training: **Multi-Layer Perceptron:** Architecture of Multi-Layer Perceptron. Feed Forward Neural Networks. Forward and Backward Propagation. Error Calculation and Weight Update Mechanism.	09

III	**Training Neural Networks:** Training and Testing Datasets. Hyperparameters in Neural Networks. Batch, Stochastic and Mini-Batch Gradient Descent. Epochs and Iterations. Learning Rate and Momentum. **Optimization and Regularization:** Overfitting and Underfitting. Cross Validation. Regularization Techniques: Dropout and Early Stopping. Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score and Confusion Matrix.	10
IV	**Deep Neural Networks:** Introduction to Deep Learning. Deep Feed Forward Networks. Hidden Layers and Feature Extraction. Vanishing and Exploding Gradient Problems. Advanced Neural Networks and Applications: **Recurrent Neural Networks:** Introduction to Sequential Data. Recurrent Neural Networks (RNN). Working of RNN. Limitations of RNN. Introduction to LSTM and GRU. Applications in Text Processing. **Emerging Neural Network Applications:** Neural Networks in Natural Language Processing (NLP), Recommendation Systems, Generative AI.	10

TEXT BOOKS:

1. Charu C. Aggarwal "Neural Networks and Deep Learning" –, Springer.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville "Deep Learning" – MIT Press. 2016
3. Laurene V. Fausett "Fundamentals of Neural Networks" Prentice Hall. 1994

REFERENCE BOOKS:

1. B. Yegnanarayana "Artificial Neural Networks" – PHI Learning 1999.

2. Simon Haykin., “Neural Networks: A Comprehensive Foundation” – Prentice Hall.
3. Aurélien Géron., “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow” 3rd Edition – O’Reilly Media.
4. François Chollet., “Deep Learning with Python” 2nd Edition 2021 – Manning Publications.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	**BCA-AIML**	Semester	**VI**
Course Title	**Computer Vision(THEORY)**		
Course Code:	**BCAAIMS604**	No.of Credits	**03**
Contact hours	**39 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

1. Course Outcomes: After completing this course, the student must demonstrate the knowledge and ability to:
2. Recognize and describe both the theoretical and practical aspects of image formation and computing with images.
3. Understand the basics of 2D and 3D Computer Vision and Connect issues from Computer Vision to Human Vision.
4. Become familiar with the significant technical approaches in computer vision, including registration, alignment, and image matching.
5. Get exposure to advanced concepts leading to object categorization and segmentation in images.
6. Build computer vision applications.
7. Implement computer vision applications using OpenCV, integrating machine learning algorithms for advanced tasks**.**

UNIT – I	**9 Hours**
Fundamentals of Image Processing and Computer Vision: Brief history of Computer Vision Image formation: Geometric primitives,2D transformations, 3D transformations, 3D rotations, 3D to 2D projections, Lens distortions Photometric image formation- Lighting, Reflectance and shading. Camera projections: Sampling and aliasing	Book1: Page 29 to 91.
UNIT – II	**10 Hours**
Image processing Local operators -Pixel transforms, Colour transforms,	Book1: Page 97

Compositing and matting, Histogram equalization Neighbourhood operators- Linear filtering, Non-linear filtering, Morphology, Distance transforms, Connected components. Pyramids and wavelets: Interpolation and decimation, multi-resolution representations, Wavelets.	to 160
UNIT – III	**10 Hours**
Image Features and Recognition Techniques: Image Features, Image Descriptors, and Features, Texture Descriptors, colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform.	Book1: Page 203 to 253, Study Material
UNIT – IV	**10 Hours**
OpenCV and Applications of Computer Vision: Introduction to OpenCV and Applications of Computer Vision: What Is OpenCV? The Origin of OpenCV, Downloading and Installing OpenCV, First Program—Display a Picture, Second Program—AVI Video, A Simple Transformation OpenCV Primitive Data Types, CvMat Matrix Structure. Machine Learning Algorithms and their Applications in Medical, Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples.	Book 3
TEXTBOOKS: 1. Computer Vision: Algorithms and Applications, Richard Szeliski, February 27, 2010 2. Computer Vision and Image Processing Manas Kamal Bhuyan CRC Press 1st Edition 2020 3. Gary Bradski and Adrian Kaehler. “Learning OpenCV: Computer Vision with the OpenCV Library,” First Edition, O’Reilly Media, 2008. 4. Computer Vision: A Modern Approach David A. Forsyth, Jean Ponce Pearson 2nd 2012 5. Machine Vision R. Jain, R. Kasturi, and B. G. Schunk McGrawHill 1995	

Program Name	**BCA-AIML**	Semester	**VI**
Course Title	**Artificial Neural Networks Lab**		
Course Code:	**BCAAIPS603**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART-A

1. Write a Python program to implement a single-layer Perceptron to determine attendance eligibility of students. Train the network using the Perceptron learning rule and test it with new attendance values. Display the eligibility status for each test input.
2. Write a Python program to implement a single-layer Perceptron to realize the OR logic gate. Display the final weights, bias, and predicted outputs.
3. Write a Python program to implement the LMS algorithm for identifying an unknown system defined by $d(n) = 0.5x(n) + 0.3x(n-1)$ and plot the convergence.
4. Write a Python program to implement a Competitive Learning Neural Network for clustering two-dimensional input patterns.
5. Write a Python program to train a single-layer perceptron using given input patterns and plot the learning curve.
6. Using the learning rate annealing technique on $f(x) = x^2 + 4x + 4$, plot a graph showing learning the convergence.

PART-B

1. Write a Python program to implement the Perceptron learning algorithm with a step activation function and train it to classify the AND, OR, and XOR logic gates and plot the results.
2. Write a Python program to design and train a Multi-Layer Perceptron using TensorFlow/Keras for a simple classification problem.
3. Write a Python program to implement a single-layer neural network for the OR gate. Train the network using different activation functions. Compute the Mean Squared Error (MSE), and compare the performance of the activation functions
4. Implement a Hopfield Network in Python to store and recall multiple binary patterns. Test it with noisy inputs and visualize the energy convergence over iterations.
5. Write a Python program to implement a Self-Organizing Map (SOM) for clustering two-dimensional input data. Display the final neuron weight vectors representing clusters.
6. Write a Python program to demonstrate the Hopfield Network approach for solving a simple optimization problem such as the Traveling Salesman Problem (TSP) with a small number of cities.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**VI**
Course Title	**Computer Vision Lab**		
Course Code:	**BCAAIPS604**	No.of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

PART - A

1. Write a Python program using the OpenCV library to upload a digital image and perform operations related to image brightness enhancement, contrast adjustment, illumination variation. The program should display both the original and processed images.
2. Write a Python program to perform image translation, rotation, scaling, and shearing using OpenCV.
3. Write a Python program to Implement a simple image reconstruction technique from multiple projections using Radon Transform concepts.
4. Write a Python program to perform point processing operations such as image negative, thresholding, brightness enhancement, and contrast stretching.
5. Write a Python program to Implement smoothing and sharpening filters such as Mean Filter, Gaussian Filter and Median Filter
6. Write a Python program to Implement RGB←→HSV and RGB←→Grayscale image conversions and perform color enhancement and histogram equalization.

PART -B

1. Write a Python program to detect edges using Sobel and Prewitt edge detection algorithms.
2. Write a Python program to Develop a simple image classification system using Linear Regression.
3. Write a Python program to Build and train a CNN model using TensorFlow/Keras for handwritten digit or object classification.
4. Write a Python program to Create applications using OpenCV for Face detection and facial expression recognition.
5. Write a Python program to upload an image from the computer using File open dialog box and Implement Harris Corner Detection and extract basic image features.
6. Write a Python program to Create a simple real-time application such as Webcam edge detection

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	**BCA-AIML**	Semester	**VI**
Course Title	**Research Methodology and Project Work**		
Course Code:	**BCAAIPS605**	No. of Credits	**12**
Contact hours	**22 Hours/Week**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**100**	Summative Assessment Marks	**400**

PROJECT GUIDELINES

Preamble: The project work has been incorporated into the BCA programme to provide students with practical exposure to the design, development, and implementation of modern computing solutions. The primary objective of the project work is to enable students to understand and apply the principles of software engineering, problem-solving, innovation, and emerging technologies in real-world scenarios. During the development of the project, students are expected to actively participate in all phases of the Software Development Life Cycle (SDLC), including problem identification, requirements analysis, system design, development/coding, testing, deployment, documentation, and maintenance, with emphasis on building reliable, scalable, and user-oriented systems.

In view of rapid advancements in technology, students are encouraged to undertake projects in contemporary domains such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Data Analytics, Cloud Computing, Cyber Security, Mobile Applications, and Web Technologies. AI/ML/DL projects may focus on intelligent systems, predictive analytics, automation, computer vision, natural language processing, or recommendation systems. IoT-based projects may involve sensor integration, smart automation, real-time monitoring, and connected devices. Robotics and Drone projects may include autonomous systems, embedded controllers, navigation, surveillance, industrial automation, or smart agriculture applications. Students may

also integrate hardware and software components wherever applicable to develop interdisciplinary and innovative solutions.

Since the project work spans the entire final semester, students are encouraged to select projects addressing the needs of industry, research organizations, startups, government agencies, or socially relevant real-life problems suggested by the faculty in charge of BCA project work in the institution. The selected project topic must be meaningful, analytical, application-oriented, and technically significant. It should demonstrate originality, creativity, and substantial development effort based on the chosen theme.

Use of ready-made, copied, off-the-shelf, pirated, or previously implemented work is strictly prohibited. Any form of plagiarism, fabrication, or use of unfair means shall result in rejection of the project work. All stages of project development must be carried out in a systematic and time-bound manner, and equal participation and contribution from all team members are expected throughout the project lifecycle.

GENERAL GUIDELINES TO THE INSTITUTIONS

- The Project Work Calendar shall be announced before the commencement of the VI Semester.
- The calendar shall include tentative schedules for:
    - Project Proposal Submission
    - Project Approval
    - Synopsis Submission
    - Problem Analysis Document
    - System Design Document
    - Database Design /Detailed Design
    - Coding and Testing
    - Project Demonstration and Internal Viva-Voce
    - Final Report Submission
- A project team shall consist of a maximum of four students. A project supervisor (from among the faculties of the institution) must be assigned for each team, before the commencement of the project work.
- Students shall undertake projects based on real-life, application-oriented, or research problems relevant to industry, society, or emerging technologies.
- Projects may be carried out within the institution or in collaboration with industries, research laboratories, startups, or

software companies, subject to approval by the faculty in charge/ project supervisor and the Head of the Department.

- The faculty in charge/ Project Supervisor shall ensure that industry-based projects are genuine, original, and academically relevant.
- Institutions shall conduct at least two Internal Assessment evaluations during the project period.
- Internal Assessment may include:
  - Project Presentations
  - Document Verification
  - Coding Demonstration
  - Viva-Voce
  - Group Discussion
  - Progress Review
- Internal Assessments shall evaluate the students' technical understanding, contribution, implementation skills, documentation, and overall project progress.

EVALUATION OF THE PROJECT

- Project evaluation shall be conducted jointly by one Internal Examiner and one External Examiner appointed by the University during the End Semester Examination.
- The examiners shall understand and follow the evaluation procedure, guidelines and marking scheme before commencement of the evaluation process.
- Each student in the project team shall individually present and explain their contribution to the project work.
- Evaluation shall include:
  - Project Demonstration
  - Viva-Voce
  - Technical Presentation
  - Verification of Documentation
  - Assessment of Individual Contribution
- Students shall demonstrate the working of the developed system, model, application, device, or prototype.
- For projects in domains such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Data Analytics, and Embedded Systems, evaluation may include:
  - Dataset Preparation and Usage
  - Model Training and Testing

    - Accuracy and Performance Metrics
    - Hardware Integration
    - Sensor/Device Connectivity
    - Real-Time Monitoring or Automation
    - Simulation or Prototype Demonstration
    - Innovation and Practical Relevance
- AI/ML/DL projects shall include proper validation of models using suitable evaluation metrics such as accuracy, precision, recall, F1-score, confusion matrix, or similar performance measures wherever applicable.
- IoT, Robotics, and Embedded System projects shall include demonstration of hardware functionality, communication protocols, device integration, and system reliability.
- If live demonstration is not possible due to confidentiality, copyright, licensing, cloud restrictions, or industry policies, students may present:
    - Screenshots
    - Recorded Demonstrations
    - Simulation Results
    - Deployment Reports
    - Performance Analysis
    - Technical Documentation
- In such cases, students shall submit valid supporting documents or authorization letters issued by the concerned organization or company.
- The evaluation shall primarily focus on:
    - Originality of the Work
    - Problem Identification and Solution Design
    - Technical Knowledge and Understanding
    - Implementation Skills
    - Innovation and Creativity
    - Testing and Validation
    - Documentation Quality
    - Practical Utility and Social/Industrial Relevance
- Examiners shall verify whether appropriate development methodologies and engineering practices have been followed throughout the project lifecycle.
- For software-based projects, adherence to Software Development Life Cycle (SDLC) principles shall be examined.
- For AI, ML, DL, IoT, Robotics, and interdisciplinary projects, suitable design, development, testing, deployment, and validation

practices relevant to the domain shall be considered during evaluation.

- Project evaluation shall be fair, objective, and based on the scope, complexity, originality, and outcomes of the project work.

SCHEME OF VALUATION and Marks Distribution

	Particulars	**Marks**
Internal Assessment		
	Progressive assessment for two times with award of 50 marks each time	100
Project Report Valuation (During End Semester Examination):		300
Viva-Voce: 100 marks		
1	Live Demonstration (Software execution) or Dry runs (Presentation of authentic screenshots or captured videos may be used to walk through complete scenarios)-consistency and completeness	80
2	Question and Answer (Oral)	20
Grand Total Marks		500

FORMAT OF PROJECT SYNOPSIS

The Project Synopsis is a concise summary of the proposed project work. It shall clearly present the objectives, methodology, technologies used, implementation plan, and expected outcomes of the project. The synopsis shall not exceed 20 pages.

The synopsis shall include the following:

1. Title of the Project
2. Introduction, Objectives, and Scope
    - Problem Statement
    - Objectives of the Project
    - Scope and Expected Outcomes
3. Project Domain/Category
    - Software Application
    - Web/Mobile Application
    - Database Management System
    - Client-Server System
    - Networking
    - Cloud Computing
    - Artificial Intelligence (AI)
    - Machine Learning (ML)

- Deep Learning (DL)
- Internet of Things (IoT)
- Robotics/Drone Technology
- Data Analytics
- Embedded Systems
- Simulation/Game Development
- Cyber Security
- Any other relevant category

4. Tools, Platforms, and Requirements
   - Programming Languages
   - Frameworks/Libraries
   - Development Tools and Platforms
   - Hardware Requirements
   - Software Requirements
   - Dataset Requirements (for AI/ML/DL projects)
   - Sensors/Controllers/Communication Modules (for IoT/Robotics projects)
   - Cloud or Deployment Requirements, if any
5. System Analysis and Design
   - Architecture Diagram
   - DFD/UML/Class Diagrams/ER Diagrams/System Flowcharts as applicable
   - Database Design
   - Hardware Architecture (for IoT/Embedded/Robotics projects)
   - Model Architecture (for AI/ML/DL projects)
6. Project Structure and Methodology
   - Module-wise Description
   - Functional Requirements
   - Data Structures/Algorithms Used
   - Process Flow and Logic
   - Training and Testing Methodology (for AI/ML/DL projects)
   - Communication Protocols and Device Interaction (for IoT projects)
   - Simulation/Prototype Details, if applicable
7. Testing and Validation
   - Testing Methods and Tools
   - Performance Evaluation Metrics
   - Accuracy/Precision/Recall or other relevant measures for AI/ML projects
   - Reliability and Functional Testing for IoT/Robotics projects

8. Project Type
    - Industry Defined
    - Client Defined
    - User Defined
    - Research/Innovation Based
      (Mention the name and address of the Industry/Client/Organization, if applicable.)
9. Limitations of the Project
10. Future Scope and Enhancements
11. References
    - Books
    - Research Papers
    - Websites/APIs/Datasets/Documents referred to during project planning.

ORGANISATION OF THE DISSERTATION

The Dissertation Report shall be organized into clearly defined chapters and sections. The report shall present the complete development process, implementation details, testing, results, and conclusions of the project work. The structure may be adapted suitably depending on the project domain such as Software Development, AI, ML, DL, IoT, Robotics, Drone Technology, Embedded Systems, Data Analytics, or related interdisciplinary areas.

Sequence of Items in the Dissertation Report

- Cover Page (Hard Bound Cover)
- Title Page
- Certificate from the Institution
- Certificate from the Company/Industry (if applicable)
- Declaration by Students
- Acknowledgement
- Table of Contents
- List of Figures
- List of Tables
- List of Abbreviations and Acronyms
- Chapters
- Bibliography / References
- Appendices (if any)

CHAPTERS

1. Introduction

a. Project Overview

- Project Title
- Project Domain/Category
- Problem Statement
- Overview of the Proposed System

b. Background Study
- Organization/Industry Profile (if applicable)
- Existing System and Limitations
- Need for the Proposed System

c. Objectives
- Project Objectives
- Expected Outcomes

d. Scope of the Project

e. System Architecture
- Overall Architecture Diagram
- Workflow/Process Flow

f. End Users and Applications

g. Tools and Technologies Used
- Software Tools
- Programming Languages
- Frameworks/Libraries
- Hardware Components (if applicable)

h. Deployment Requirements
- Hardware Requirements
- Software Requirements
- Network/Cloud Requirements

2. Software Requirement Specification (SRS)

a. Introduction to SRS

b. Overall Description
- Product Perspective
- Product Features and Functions
- User Characteristics
- Assumptions and Constraints

c. Functional Requirements
- Module-wise Functional Requirements

d. Non-Functional Requirements
- Performance
- Security
- Reliability
- Scalability
- Usability

e. Special Requirements
- Dataset Requirements (AI/ML/DL Projects)
- Sensor/Device Requirements (IoT/Robotics Projects)
- Communication Protocols
- Cloud/API Requirements

3. System Design
- Introduction to System Design
- Functional Design
- Functional Decomposition
- Module Description

c. Design Diagrams
- Context Diagram
- Data Flow Diagrams (DFD)
- UML/Class Diagrams
- Use Case Diagrams
- Sequence/Activity Diagrams (if applicable)

d. Architecture Design
- Software Architecture
- Hardware Architecture (for IoT/Embedded/Robotics Projects)
- Model Architecture (for AI/ML/DL Projects)

4. Database Design / Data Design

a. Introduction

b. Database/Data Structure Design (For Web Application/ App Development Projects)
- Table Definitions
- ER Diagram
- Schema Design

c. Data Collection and Preprocessing (For AI/ML/DL Projects)
- Dataset Description
- Data Cleaning
- Feature Engineering

d. Sensor/Data Acquisition Design(For IoT/Robotics Projects)

5. Detailed Design and Methodology

a. Module-wise Design

For each module:
- Inputs
- Process Logic/Algorithms
- Outputs
- Interfaces

- Implementation Details

b. Algorithms and Techniques Used
- AI/ML Algorithms
- Deep Learning Models
- Data Processing Techniques
- Control Logic/Automation Logic

c. Communication and Integration
- API Integration
- Device Communication
- Cloud Connectivity

d. Structure Charts / Workflow

6. Implementation and Code Description

a. Coding Structure

b. Important Code Modules
- Authentication/Authorization
- Database Operations
- Data Processing
- Search and Retrieval
- API/Device Integration
- Parameter Passing
- Error Handling
- Backup and Recovery

c. Model Training and Deployment
(For AI/ML/DL Projects)

d. Embedded/Hardware Programming
(For IoT/Robotics Projects)

e. Internal Documentation

7. User Interface and Outputs

a. User Interface Screens
- Login Page
- Dashboard/Home Page
- Data Entry and Management Screens
- Reports and Visualizations

b. System Outputs
- Reports
- Graphs/Charts
- Prediction Results
- Alerts/Notifications

c. Prototype Demonstration (For IoT/Robotics/Drone Projects)

8. Testing and Validation

a. Introduction to Testing

b. Testing Methods

- Unit Testing
- Integration Testing
- System Testing
- Performance Testing

c. AI/ML/DL Validation

- Accuracy
- Precision
- Recall
- F1-Score
- Confusion Matrix
- Loss/Performance Analysis

d. IoT/Robotics Testing

- Hardware Testing
- Sensor Validation
- Connectivity Testing
- Reliability Testing

e. Test Reports and Results

9. Results and Discussion

- Results Obtained
- Performance Analysis
- Comparison with Existing System
- Interpretation of Outputs

10. Conclusion and Future Scope

- Conclusion
- Limitations
- Future Enhancements and Scope

REFERENCES

- Books
- Research Papers
- Journals
- Websites
- APIs/Datasets
- Technical Documentation

APPENDICES (if any)

- Source Code
- User Manual
- Sample Outputs
- Installation Guide
- Published Papers/Certificates (if applicable)

Do not include any header or footer on any page of the report other than foot notes. Only page numbers should be mentioned at the bottom center of each page. 'n+1' copies of dissertation should be prepared by n number of candidates in the team.

DISSERTATION FORMAT

The dissertation shall be prepared in a clear, professional, and standardized format suitable for project works in Software Development, Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Embedded Systems, Data Analytics, and related domains.

1. PAPER AND PRINTING FORMAT

1.1 Paper Quality

- The dissertation shall be printed on white A4 bond paper of minimum 70 GSM quality.
- Paper whiteness shall preferably be 95% or above.

1.2 Paper Size

- Standard A4 Size:
  - Height: 297 mm
  - Width: 210 mm

1.3 Printing and Font Specifications

- The dissertation shall be printed using LaserJet or Inkjet printers.
- Text shall be prepared using standard word processing software.

Recommended Formatting

- Font Style: Times New Roman/Bookman Old Style/ Book Antiqua / Adobe Garamond Pro
- Font Size:
  - Main Text: 12 pt
  - Chapter Titles: 18 pt Bold
  - Section Headings: 16 pt Bold
  - Subsection Headings: 14 pt Bold
- Line Spacing: 1.5

- Text Alignment: Justified

1.4 Margins

The following margins shall be maintained:

- Top Margin: 0.5 inch
- Bottom Margin: 0.5 inch
- Left Margin: 1 inch
- Right Margin: 0.75 inch

1.5 Pagination

- Page numbers shall be placed at the centre of the footer.
- Preliminary pages shall use lower-case Roman numerals (i, ii, iii, iv, …).
- Main chapters shall use Arabic numerals starting from 1.

1.6 Length of Dissertation

- The dissertation shall normally contain a minimum of 60 pages excluding:
  - References
  - Appendices
  - Source Code Listings
  - Annexures
  - Questionnaires
  - Datasheets
- AI/ML/DL, IoT, Robotics, and Embedded projects may additionally include:
  - Dataset Samples
  - Model Architectures
  - Sensor Specifications
  - Hardware Schematics
  - Experimental Results
  - Performance Metrics

2. PARAGRAPH AND TEXT FORMAT

2.1 Paragraph Spacing

- A vertical spacing of approximately 2.5-line spaces shall be maintained between paragraphs.

2.2 Paragraph Indentation

- The first line of each paragraph may be indented by approximately 12 mm or 5 characters.
- Indentation may be omitted if adequate spacing between paragraphs is maintained.

2.3 Text Formatting Guidelines

- Avoid single-line paragraphs.

- Avoid leaving a single line at the top or bottom of a page (widows/orphans).
- Excessive hyphenation shall be avoided.

3. CHAPTER AND SECTION FORMAT

3.1 Chapter Format

- Each chapter shall begin on a new page.
- Chapter titles shall be centred and printed in 18 pt bold font.
- Chapters shall be numbered using Arabic numerals:
  - Example: Chapter 1, Chapter 2
- Adequate spacing shall be maintained:
  - Between chapter number and title
  - Between title and chapter content

3.2 Sections and Subsections

- Chapters may be divided into:
  - Sections
  - Subsections
  - Sub-subsections

Numbering Format

- Section: 2.1
- Subsection: 2.1.1

Formatting

- Section Headings:
  - 16 pt Bold
  - Left aligned
- Subsection Headings:
  - 14 pt Bold
  - Left aligned
- Further subdivisions may use smaller bold or italic fonts.

3.3 Table of Contents

The Table of Contents shall include:

- Chapters
- Sections
- Subsections
- Corresponding Page Numbers

4. TABLES, FIGURES, AND DIAGRAMS

4.1 General Guidelines

- Tables and figures shall preferably be in portrait orientation.
- Large figures or tables may be placed on separate pages.

4.2 Numbering

- Tables and figures shall be numbered chapter-wise.

Examples

- Table 3.2
- Fig. 5.4

4.3 Captions

- Table captions shall appear above the table.
- Figure captions shall appear below the figure.

4.4 Types of Figures

Depending on the project domain, figures may include:

- DFDs/UML Diagrams
- ER Diagrams
- Architecture Diagrams
- Flowcharts
- Neural Network Architectures
- Training Graphs
- Accuracy/Loss Curves
- IoT Block Diagrams
- Sensor Layouts
- Circuit Diagrams
- Drone/Robot Design Schematics
- Dashboard Screenshots
- Data Visualization Charts

4.5 References for Figures/Tables

- Sources reproduced from books, journals, websites, or research papers shall be properly cited.

Example:

(Source: After McGregor [12])

5. CODE, DATASET, AND EXPERIMENTAL RESULTS FORMAT

5.1 Source Code

- Important source code snippets may be included in the report.
- Large code files shall be included in appendices or digital media.

5.2 AI/ML/DL Project Requirements

Projects involving AI/ML/DL shall include:

- Dataset Description
- Training Parameters
- Model Architecture
- Performance Metrics
- Confusion Matrix/Graphs
- Experimental Results

5.3 IoT/Robotics/Embedded Project Requirements

Such projects shall include:

- Hardware Specifications
- Sensor Details
- Circuit Diagrams
- Communication Protocols
- Prototype Images
- Testing Results

6. BINDING AND COVER FORMAT

6.1 Binding

- The dissertation shall be hard-bound using rexine or equivalent material.

6.2 Front Cover

The front cover shall contain:

- Title of the Dissertation
- Name(s) of Student(s)
- Register Number(s)
- College Emblem/Logo
- Department Name
- Institution Name
- Degree and Semester
- Academic Year

6.3 Lettering

- Lettering on the cover and spine shall preferably be embossed in Gold/White/Silver color.

6.4 Spine Content

The following shall appear on the bound side:

- Student Name
- Degree Name
- Year of Submission

7. PRELIMINARY PAGES

7.1 Blank Pages

- One blank page may be inserted at the beginning and end of the dissertation for binding purposes.

7.2 Title Page

The title page shall include:

- Title of the Project
- Statement of Submission
- Degree Name
- Student Name and Register Number

- Name(s) of Guide/Supervisor
- Department and Institution Name
- Academic Year

7.3 Certificates and Declarations

The dissertation shall include:

- Institution Certificate
- Industry Certificate (if applicable)
- Student Declaration
- Plagiarism Declaration (optional/recommended)

8. REFERENCES AND CITATIONS

- References shall follow only IEEE citation style.
- All datasets, APIs, research papers, software libraries, frameworks, and online resources used in the project shall be properly acknowledged.
- AI-generated tools or services used during development/documentation, if any, shall be appropriately disclosed.

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Questions Paper Pattern for Core Subjects

Duration:3 Hours Max.Marks:80

Note: Answer any ten Questions from Part-A. And one full Question from each unit in Part-B

Part-A

1. 10*2=20
   a.
   b.
   c.
   d.
   e.
   f.
   g.
   h.
   i.
   j.
   k.
   l.

Part-B

Each unit contains two main questions, and each carry 15 Marks. Each main question contains two or more sub question. Answer any ONE full main question from each Unit. 4*15=60

UNIT-I

2.
   a.
   b.
   c.

3.
   a.
   b.
   c.

UNIT-II

4.

a.
b.
c.

5.
a.
b.
c.

UNIT-III

6.
a.
b.
c.

7.
a.
b.
c.

UNIT-IV

8.
a.
b.
c.

9.
a.
b.
c.

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