Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION
& SYLLABUS

of

Bachelor of Computer Applications (BCA)

(Artificial Intelligence & Machine Learning)

UNDER

Faculty of Information Technology
w.e.f. Session 2023-24

Kalinga University,

Naya Raipur, Chhattisgarh
Bachelor of Computer Applications
(W.e.f. 2023- 2024)

Semester- I					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML101	Problem Solving Using Programming	3	30	70	100
BCAAIML102	Computer Fundamentals	3	30	70	100
BCAAIML103	Introduction to Artificial Intelligence	2	30	70	100
BCAAIML104	Mathematics-I	3	30	70	100
BCAAIML105	English-I	3	30	70	100
BCAAIML106	Environmental Science	2	30	70	100
BCAAIML107	Health and Wellness	2	30	70	100
BCAAIML108P	Coding and Computational Thinking-I-Lab	2	20	30	50
BCAAIML109P	Problem Solving Using Programming-Lab	2	20	30	50
Total		**22**	**250**	**550**	**800**

Semester- II					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML201	Data Structures and Algorithms	3	30	70	100
BCAAIML202	Database Management Systems	2	30	70	100
BCAAIML203	Operating Systems	2	30	70	100
BCAAIML204	Knowledge Representation and Reasoning	2	30	70	100
BCAAIML205	Maths-II	3	30	70	100
BCAAIML206	English-II	3	30	70	100
BCAAIML207	Understanding India	2	30	70	100
BCAAIML208P	Coding and Computational Thinking-II-Lab	2	20	30	50
BCAAIML209P	Data Structures and Algorithms-Lab	1	20	30	50
BCAAIML210P	Database Management System (DBMS)-Lab	1	20	30	50
BCAAIML211P	Operating System-Lab	1	20	30	50
Total		**22**	**290**	**610**	**900**

* Student has to undergo for Internship Assessment completion of 2nd Semester which is to be evaluated in 3rd Semester

Semester- III					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML301	Programming in Python	4	30	70	100
BCAAIML302	Fuzzy Logic and Neural Networks	4	30	70	100
BCAAIML303	Graph Theory and its Application	4	30	70	100
BCAAIML304	Internet of Things (IOT)	3	30	70	100
BCAAIML305	Web Development with PHP	4	30	70	100
BCAAIML306P	Programming in Python-Lab	1	20	30	50
BCAAIML307P	Mini Project/Internship Assessment	2	20	30	50
Total		**22**	**190**	**410**	**600**

Semester- IV					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML401	R Programming	4	30	70	100
BCAAIML402	Cloud Computing and its Security	4	30	70	100
BCAAIML403	Computer Network	4	30	70	100
BCAAIML404	Machine Learning Basics	3	30	70	100
BCAAIML405	Big data & IOT Security	4	30	70	100
BCAAIML406P	R Programming-Lab	1	20	30	50
Total		**20**	**170**	**380**	**550**

* Student has to undergo for Internship Assessment completion of 4th Semester which is to be evaluated in 5th Semester

Semester- V					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML501	Machine Learning Techniques	4	30	70	100
BCAAIML502	Deep Learning	4	30	70	100
BCAAIML503	Software Engineering and Testing	4	30	70	100
BCAAIML504	Design and Analysis of Algorithms	3	30	70	100
BCAAIML505	Advance Neural Network & Deep Learning	4	30	70	100
BCAAIML506P	Machine Learning-Lab	1	20	30	50
BCAAIML507P	Internship Assessment	2	20	30	50
Total		**22**	**190**	**410**	**600**

Semester- VI					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCAAIML601	Natural Language Processing	3	30	70	100
BCAAIML602	Ethical Hacking	4	30	70	100
BCAAIML603P	Natural Language Processing-Lab	1	20	30	50
BCAAIML604P	Major Project	12	150	200	350
Total		**20**	**230**	**370**	**600**

SEMESTER- I

Problem Solving Using Programming

Course Objectives:

- Understand the basic architecture of a computer and the basic structure of a C program.
- Illustrate different data types, decision control and looping statements.
- Explore functions and arrays.
- Introduce strings and pointers concepts.
- Implement file handling, structures, unions and enumerated data types.

Course Outcomes:

- Describe the basic architecture and functionalities of a Computer.
- Implement programming constructs of C language to solve the real-world problems.
- Understand different user-defined data structures like arrays, structures and pointers in implementing solutions to problems.
- Implement strings and pointers.
- Apply structured programming constructs such as functions and procedures to different problems.

UNIT-I Introduction to Programming and C 9 Hours

Introduction to computers- input and output devices, Introduction to computer-based problem solving, Program design and implementation issues- Flowcharts & Algorithms, Top down design & stepwise refinement, Programming environment-Assemblers, Compilers, Interpreters. Introduction to C, Structure of a C program, pre-processor directives ,Compiling and executing C programs.

UNIT- II Data Types, Decision Control and Looping Statements 9 Hours

Data Types: Input/output statements in C Constants, Variables, scope of variables, Operators & Expressions, Type conversion, type casting, Decision control- if, if-then-else, nested if, nested else, Looping statements- while, Do-While, for; switch. Break continue and goto statements. Type modifiers and storage class specifiers for data types.

UNIT- III Functions and Arrays 9 Hours

Functions: Introduction to functions, function definition, function declaration, function call, return statement, passing parameters to functions: Call by Value , Call by reference, , recursive functions.

Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, two dimensional arrays, operations on two-dimensional arrays, multidimensional arrays, applications of arrays.

UNIT- IV Strings and Pointers 9 Hours

Strings: Introduction, string taxonomy, operations on strings, Miscellaneous string and character functions, arrays of strings.

Pointers- The & and * operator, pointer expression, initializing pointers ,malloc vs calloc, array of pointers, pointers to pointers, pointers to functions, function returning pointers.

UNIT- V Files, Structures, Unions and Enumerated data types. 9 Hours

File Handling- Files: Introduction to files, using files in C, reading and writing data files, Detecting end of file .The file pointer, file accessing functions, fopen, fclose, putc, getc, fprintf. Structure, Union, and Enumerated Data Type: Introduction, structures and functions, Unions, unions inside structures, Enumerated data type.

Text Books:

1. The C Complete Reference by Herbert Schildt - 4th edition ,McGraw Hill Education , July 2017.
2. "C Programming: The Complete Guide for Beginners to Master C Programming Step by Step" by Byron Francis, published by Independently published in 2021.
3. "C Programming: The Complete Guide for Beginners to Master C Programming Step by Step" by Byron Francis, published by Independently published in 2021.

References:

1. Programming in ANSI C by Balaguruswamy, 3rd Edition, 2005, Tata McGraw Hill.
2. Let us C by Yashwant Kanetkar, 6th Edition, PBP Publication
3. The C programming Language by Richie and Kenninghan, 2004, BPB Publication

Computer Fundamentals

Course Objectives:

Computer fundamentals form an essential component for a better understanding of higher concepts. It's vital to know the computer's working process, how the computer stores the data and interprets the information and converts it into machine-understandable form for processing, and later renders the output back in a human-readable format.

Course Outcomes:

- Learn the number systems and fundamentals of logic gates.
- Simplify Boolean expressions and use data processing circuits.
- Understand working of Arithmetic Logic Unit.
- Apply different addressing modes.
- Interpret Input/Output Organization, interrupts and memory system.

UNIT- I

Number Systems and Logic Gates and Combining Logic Gates: 9 Hours

Number Systems: decimal system; Binary; Octal and Hexadecimal number systems, Place Value, number conversion, Binary Coded Decimal

Logic Gates : The AND Gate; The OR Gate; The Inverter and Buffer; The NAND Gate; The NOR Gate; The Exclusive OR Gate; The Exclusive NOR Gates; The NAND and NOR Gate as an Universal Gate; Gates with more than Two Inputs.

Combining Logic Gates : Constructing Circuits from: Boolean Expression, Drawing a Circuit from a Maxterm and Minterm Boolean Expression; Truth Tables and Boolean Expressions;, Boolean postulates, Demorgan’s theorem.

UNIT-II

Simplification of Boolean Expression: 9 Hours

Simplifying Boolean Expression using boolean postulates; Karnaugh Maps with Two, Three, Four, Five Variables, Don't care condition; Tabulation method.

Data Processing Circuits: Multiplexers, Demultiplexers, Decoders of 16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Parity Generators and Checkers, Magnitude Comparator.

UNIT-III

Arithmetic Circuits and Arithmetic Unit: 9 Hours

Binary Addition; Half Adders; Full Adders; Three Bit Adders; Binary Subtraction; Parallel Subtractors; 2's Complement Notation; Addition & Subtraction of Signed Numbers; 2's Complement Adders/Subtractor.; Design of Fast Adders.

Binary Multiplication; Multiplication of Positive Numbers; Binary Multipliers; Signed-Operand Multiplication; Fast Multiplication; Integer Division; Floating-Point Numbers & Operations.

UNIT-IV

Machine Instruction and Programs: 9 Hours

Basic operational concepts, Memory Location and Addresses, Memory Operations; Instructions & Instruction Sequencing; Addressing Modes, Stacks and Queues, Subroutines, Subroutine nesting and processor stack, parameter passing

UNIT - V

Input / Output Organization: 9 Hours

Input / Output Organization: Accessing I/O Devices, Interrupts, Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Buses, Direct Memory Access.

Memory Systems : Memory System: Some Basics Concepts; Semiconductor RAM Memories; Read-Only Memories; Cache Memories - Mapping Functions

Text Books:

1. Roger L Tokheim : Digital Electronics Principles and Applications, Sixth Edition, McGraw Hill, 2004
2. M Morris Mano, "Digital Logic and Computer Design", 10th Edition, Pearson, 2008
3. Carl Hamacher, Z Varnesic and S Zaky : Computer Organization, Fifth Edition, McGraw Hill, 2002

Reference:

1. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", 2nd Edition, Tata McGraw Hill, 2005.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles".
3. Computer Organization and Architecture Books Collection Free Download-Learnengineering.in

Introduction to Artificial Intelligence

Course Objectives:

- Know about the basic building block of Artificial Intelligence.
- Explain the concept of machine thinking.
- Describe the evolution of AI and modern concepts and programming platforms for AI.

Course Outcomes:

- Discuss about the basic principle of AI.
- Analyse the concept of machine thinking.
- Understanding the modern concept in AI..

UNIT- I **10 hours**

Introduction to Artificial Intelligence (AI):

What is Artificial Intelligence (AI)? Brief history of AI. Intelligence and artificial intelligence. Elements of Intelligence- Reasoning, Learning, Problem Solving, Perception, Linguistic Intelligence. Coming together of cognition, philosophy, math, linguistics, control theory and computer science. Introduction to agent-Agent performance-Example of Agents- Agent Faculties

UNIT - 2: **10 hours**

Philosophy of AI

Can machine think?: 'Turning and testing-The Chinese room. Computation and representation-Applications eras of AI-Computationalism-Ethics of AI-Impacts of AI, Limitations and possibilities of AI, Concerns about AI, AI and the future.

UNIT - 3: **10 hours**

Intelligent System

What is intelligence? Structure of intelligent system-Biological brain -Basic neural model-Intelligent Agents- Rationality- Agent Environment- Agent architectures-the concept of rationality-The structure of agent-The impact of AI in human-Labor-AI and the social equality.

Text Books:

1. "Artificial Intelligence A Modern Approach", by Stuart J. Russell and Peter Norvig, Second Edition, Pearson Education, Inc., Upper Saddle River; New Jersey 07458.
2. "Artificial Intelligence: The Basics", by Kevin Warwick, Professor of Cybernetics Kevin, first published 2012 by Routledge.
3. "Artificial intelligence A systems approach", by M. Tim Jones, INFINITY SCIENCE PRESS LLC, 2008.

Reference Books:

1. "Artificial Intelligence: Foundations of Computational Agents", by D. Poole, Cambridge University Press, 2010.
2. "Artificial Intelligence and Intelligent Systems", by Padhy N.P, 4th impression, Oxford University Press, 2007.
3. "Super Intelligence Paths, Dangers and Strategies", by Nick Bostrom, Oxford University Press.

Mathematics-I

Course Objectives:

To identify the concepts of Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

Course Outcomes:

- Understand the basic concepts of Linear Equations and linear dependence.
- Solve the functions using Taylor's Series and Maclaurin's Series expansion
- Apply the concept of differential equations and how such equations are used in modelling.
- Apply the concepts of partial differentiation like maxima and minima for two and several variables, Jacobians and their applications.

Unit-1

Matrices **9 Hours**

Characteristic equation of a matrix, Eigen values and Eigen vectors, Properties of Eigen values, Diagonalization of matrix, Cayley-Hamilton Theorem (without proof) verification, Finding Inverse and Power of a matrix using it.

Unit-2

Set theory and Relations **9 Hours**

Introduction theorems on sets, sets and elements, Venn diagrams, set operations, algebra of sets, duality, classes of sets, power sets, real vector spaces and subspaces null spaces, dimension of vector spaces, column spaces, geometrical vectors in a plane, vectors in a Cartesian plane, scalar multiplications, Euclidean inner product of two vectors, application of dot and scalar multiplications, vectors in three dimensional spaces, cross product in three dimension, relations and its properties, order relations, Hasse diagrams.

Unit 3

Functions and Algorithms **9 hours**

Introduction to functions and algorithms, functions and types of functions, interjections and surjections, bijections and inverse functions, One-to-One, Onto, invertible functions, mathematical, exponential and logarithmic functions, sequences and indexed classes of sets, recursively defined functions, cardinality, data base: functional dependence and normal forms, algorithms and functions, complexity of algorithms.

Unit 4

Descriptive Statistics **9 hours**

Data and Data Sources, Types of Data, Measures of Central Tendency- Mean, median mode for raw and grouped data, measures of dispersion- Range, standard deviation, variance, coefficient of variation, mean deviation, mean absolute deviation, measures of symmetry: Skewness and Kurtosis.

Unit 5

Elements of Probability and Sampling Distributions **9 Hours**

Experiments and events, Basic Relations of Probability, Conditional Probability, Joint Probability, conditional probability on discrete case and continuous case, computing expectations by conditioning, introduction to Bayes theorem, problems related to Bayes Theorem, Discrete Probability Distribution (Binomial and Poisson), Continuous Probability Distribution (Normal). Various types of Probability and Non-probability Sampling, Sampling distribution of important statistic.

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication).
2. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co. 2003

Reference Books:

1. Greenberg, M.D. Advanced Engineering Mathematics, Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).
3. T Veerarajan, Engg Mathematics McGraw-Hill Education (India) Pvt Limited, 2007
4. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education)

English-I

Course Objectives:

The course focuses on familiarizing the students with the English language's basics and its grammar.

Course Outcomes:

- Develop one's ability to use English Language in day-to-day and real-life situations
- Interpret isolated vocabulary words and phrases in familiar contexts
- Express ideas through written, oral and visual communication
- Compose meaningful sentences and paragraphs as a prominent life-long skill
- Demonstrate excellent reading and comprehension skills

Unit 1: **Everyday conversations** **9 Hours**

- Introducing self/others
- Weather
- Classroom
- Asking about facilities around
- Asking for help, suggestions, ideas, directions and advice
- Describing a person/thing

Points to cover: Vocabulary, grammar, Construction of sentences, listening.

Unit 2: **Meeting people, expressing, and talking about** **9 Hours**

- Greetings, Starting the Conversation, Small Talks, Closing the Conversation
- Happiness/Displeasure, Preference, Doubts, Views.
- Interests, Different Cultures, Clothes, Cars, Institutes, Situations, Schedules, Prices Points to cover: Vocabulary, grammar, Construction of sentences, listening.

Unit 3: **Comprehension** **9 Hours**

- Comprehension passage 1
- Comprehension passage 2
- Comprehension passage 3
- Comprehension passage 4
- Comprehension passage 5

Points to cover: Vocabulary, grammar, Construction of sentences.

Unit 4: **Short Paragraph Writing** **9 Hours**

- Punctuality
- Nutrition
- Exercise
- Global Warming
- Disciple Inflation
- Demonetization

Points to cover: Vocabulary, grammar, Construction of sentences.

Unit 5: **Review Writing** **9 Hours**

- Topic 1- Book [can be a story review for average students]
- Topic 2 - Movie review [different kinds of movies can be suggested too for practice]
- Topic 3- Another Movie review
- Topic 4- Hotel / Café / Recreations Centre Review
- Topic 5- Electronic Gadget Review (Laptop/smartphone / speakers/ PSP/ etc.)
- What is a review? How to write a review? Different types of reviews.
- Writing for social media: Facebook, Inked-in
- Points to remember while writing on social media. How to write a profile summary.

- What is a blog? How to write a blog?

Points to cover: Vocabulary, grammar, Construction of sentences.

Reference:

- Speak Now Level I & II, Oxford Press
- Business Benchmark, Level- Upper Intermediate by Cambridge University Press.
- Practical English Usage by Michel Swan, Oxford University Press
- Cambridge Grammar for English: A comprehensive Guide for spoken & written English (South Asian edition),
- Cambridge University Press.
- How English Works by Michael Swan & Catherine Walter, Oxford University.

Environmental Science

Course Objectives:

- To make students realize the importance and their role in the protection and maintenance of a healthy environment for sustainable development.
- To enable students to grasp the significance and issues related to ecosystems, biodiversity and natural resources, and ways of managing/ protecting them.
- To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.
- To make students aware of the environmental policies and movements, and the role of individuals and communities in environmental protection for educating and inspiring the young minds.

Course Outcome:

- Describe the main environmental issues, their causes, and their impacts on ecosystems and human well-being.
- Explain the interrelationships between ecosystems, biodiversity, and environmental health.
- Apply critical thinking skills to analyze environmental problems and propose potential solutions.
- Analyze the causes and consequences of climate change and global warming.
- Evaluate the ethical and social implications of environmental decisions and actions.

Unit I: Introduction to Environmental Science **9 Hours**

Definition and scope of environmental science: The importance of interdisciplinary approaches, Overview of key environmental issues and their impact on ecosystems and human well-being

Ecosystems and Biodiversity: Understanding ecosystems: structure, function, and services, Biodiversity and its significance; Threats to biodiversity: habitat loss, invasive species, pollution, and climate change, Conservation strategies and initiatives

Unit II: Environmental Pollution **9 Hours**

Types and sources of environmental pollution (air, water, soil, noise, and light), Impacts of pollution on ecosystems and human health, Pollution prevention and mitigation strategies, Environmental policies and regulations

Climate Change and Global Warming: Causes and consequences of climate change, Greenhouse gases and their effects, Mitigation and adaptation strategies, international agreements and efforts to combat climate change

Unit III: Sustainability and Social Responsibility **7 Hours**

Understanding natural resources: renewable and non-renewable resources, Resource depletion and overexploitation, Sustainable management of resources: conservation, recycling, and sustainable agriculture, Sustainable development principles and practices

Environmental Ethics and Social Responsibility: Ethics and Values in environmental decision-making, Environmental justice and equity issues, Individual and collective responsibility for environmental stewardship, Promoting sustainable lifestyles

Unit IV: Environmental Impact Assessment and Advocacy **5 Hours**

Introduction to environmental impact assessment (EIA): process and methods; Evaluating and mitigating environmental impacts of development projects, Case studies of successful and unsuccessful EIA processes

Environmental Education and Advocacy: Importance of environmental education for raising awareness and fostering action, Strategies for effective environmental communication, Engaging in environmental advocacy and community initiatives, Reflection and action planning for personal environmental commitments

Reference Material

1. Wright, R. T., & Boorse, D. F. (2021). Environmental Science: Toward a Sustainable Future.
2. Carson, R. (2002). Silent Spring.
3. Kolbert, E. (2015). The Sixth Extinction: An Unnatural History.

4. McDonough, W., & Braungart, M. (2002). Cradle to Cradle: Remaking the Way We Make Things.

Health and Wellness

COURSE OBJECTIVE:

- Understanding the importance of holistic well-being: We will examine the concept of holistic health and why it is essential to consider all aspects of our lives when it comes to our health.
- Building resilience and coping skills: We will discuss the importance of resilience in maintaining mental health and explore different strategies for building resilience and coping skills.
- Recognizing environmental hazards and their impact: We will discuss common environmental hazards and their potential impact on our health and well-being.
- Strategies for maintaining long-term health: We will discuss different strategies for maintaining long-term health, including healthy eating, physical activity, and stress management techniques.

COURSE OUTCOME:

- Define key concepts related to health and wellness, such as physical well-being, mental health, and social connections.
- Interpret the effects of lifestyle choices on individual well-being, such as nutrition, exercise, and stress management.
- Apply strategies for promoting physical well-being, including developing balanced diet plans and designing exercise routines.
- Analyze the impact of environmental factors on personal health and develop strategies for promoting environmental well-being.
- Develop a personalized action plan for long-term health promotion and disease prevention, considering individual needs and goals.

Unit I: Introduction to Health and Wellness **8 Hours**

Defining health and wellness, the importance of holistic well-being, Determinants of Health, Understanding the mind-body connection, Nutrition and balanced diet, Physical activity and exercise, Sleep hygiene and its impact on health, Stress management techniques

Unit II: Mental and Emotional Well-being **9 Hours**

Understanding mental health and common disorders, building resilience and coping skills, Strategies for managing stress and anxiety, Emotional intelligence and self-awareness, the importance of social connections, Effective communication and active listening, Boundaries and healthy relationships, Building a support network

Unit III: Environmental and Occupational Health **8 Hours**

Promoting a sustainable lifestyle, recognizing environmental hazards and their impact, Work-life Balance and stress management in the Workplace, creating a healthy work environment, Hygiene and personal care practices, Time management and goal setting, Mindfulness and relaxation techniques, Practising self-compassion and self-care routines

Unit IV: Health Promotion and Disease Prevention **5 Hours**

Understanding preventive healthcare, Health screenings and immunizations, recognizing common health risks and preventive measures, Strategies for maintaining long-term health, reflecting on personal health and wellness journey, setting goals for continued self-improvement, Developing an action plan for sustainable lifestyle changes

Reference Material

1. Donatelle, R. J. (2020). Health: The Basics.
2. Procter, N., Hamer, H., McGarry, D., & Wilson, R. (2019). Mental Health: A Person-Centred Approach.
3. Buettner, D. (2012). The Blue Zones: Lessons for Living Longer From the People Who've Lived the Longest.
4. Tolle, E. (2004). The Power of Now: A Guide to Spiritual Enlightenment.
5. Carnegie, D. (1998). How to Win Friends and Influence People.
6. Benson, H., & Stuart, E. M. (1992). The Wellness Book: The Comprehensive Guide to Maintaining Health and Treating Stress-Related Illness.

Coding and Computational Thinking-1

COURSE OBJECTIVE:

Programming is both an art and science of telling the computer what to do, when to do, and how to do something by providing coding instructions to it. It involves programmers trying to solve and code a set of logical or mathematical problems in order to automate a process or task. And it requires creative problem-solving skills, logical thinking and debugging skills. Hacker rank, Code chef, Leetcode and many more offer platforms with complete environments for practicing, mastering and even taking up competitive programming. Most of these platforms are free and support all programming languages like C, C++, JAVA, Python etc.

COURSE OUTCOME:

1. Practice the basic programming constructs of Python to develop applications.
2. Solve coding challenges using technical skills and creativity.
3. Develop better problem-solving skills and efficient algorithms.
4. Demonstrate advanced Python programming skills to automate real-world problems.

Course content

Coding and Computational Thinking- I in the first semester, can help students take up Python programming practice on the platform HackerRank @www.hackerrank.com, register themselves and start practicing various challenges on the platform. For Python beginners, suggestive coding challenges as available on the platform can be taken up by students as follows:

Sl no	**Concept**	**Challenge**	**Max score**	**Difficulty levels**
1	Introduction	Hello World!	5	Easy
2	Basic data types	List comprehension	10	Medium
3	Operators	Arithmetic operators	5	Easy

4	Conditional statements	Condition statements	5	Easy
5	Loops	For-loop	10	Medium
6	Functions	Function to check leap year or not	10	Medium
7	Strings	Word order	10	Medium
8	Strings and functions	Capitalize!	20	Easy
9	Classes and objects	Find the Torsional angle	20	Medium
10	Collections	Collection.OrderedDict()	20	Easy

Text Books:

1. Fundamentals of Python Programming by Richard L. Halterman.
2. Python Cookbook by David Beazley and Brian K. Jones.

References Books :

1. Guido Van Rossum, Fred. L. Drake 'Introduction to Python'- Network Theory Limited- March 2011.

Problem Solving Using Programming-Lab

1.Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (d=8cm).

2.Write a program to take input of name, roll no and marks obtained by a student in 4 subjects of 100 marks each and display the name, roll no with percentage score secured.

3.Write a program to print whether a given number is even or odd.

4. Write a program to find whether a character is consonant or vowel using switch statement.

5.Write a program to print positive integers from 1 to 10.

6.Write a program to insert 5 elements into an array and print the elements of the array.

7.Write a program to calculate factorial of a number using recursion.

8.Write a program to find the biggest among three numbers using pointer.

9.Write a C program to create, declare and initialize structure.

10.Write a program to create a file called emp.rec and store information about a person, in terms of his name, age and salary.

11.Write a C program to add two matrices A and B of size 3x3 and store the result in matrix C.

12.Multiplication of two matrices

13.Check whether the given string is a palindrome or not.

14.Converting a hexadecimal number into its binary equivalent.

15.Arranging N numbers in ascending and in descending order using bubble sort.

16.Write a C function that takes two integer parameters and swaps their values using call by reference and call by value.

SEMESTER- II

Data Structures and Algorithms

Course Objectives:

A data structure is a named location that can be used to store and organize data. And, an algorithm is a collection of steps to solve a particular problem. Learning data structures and algorithms allow us to write efficient and optimized computer programs.

Course Outcomes:

- Recognize basic data structures such as arrays, linked lists, stacks and queues.
- Identify different parameters to analyze the performance of an algorithm.
- Apply Algorithms for solving problems like sorting, searching, insertion and deletion of data.
- Outline appropriate data structure while designing the algorithms.
- Compare the Trees, Graphs and its functionalities

UNIT-I

Fundamentals of Algorithms **9 Hours**

Algorithm definitions, Asymptotic notations, O-notation, Omega notation and theta notation. Time complexity and space complexity, Average and worst case analysis, Analysing control statements, Recursion

UNIT-II

Types of algorithms: **9 Hours**

Sorting and searching algorithms, Divide and conquer algorithms, Greedy algorithms, Dynamic programming, Graph Algorithms, String matching, The class P and NP problems.

UNIT-III

Linear Data Structures: **9 Hours**

Arrays and operations. Stacks: LIFO structure, create, POP, PUSH, delete stack. Queues: FIFO structure Priority Queues, Circular Queues, operations on Queues. Linked Lists: Nodes, Linked List operations: Create List, Insert Node (empty list, beginning, Middle, end), Delete node (First, general case), Search list, Retrieve Node, add node, Remove node, Print List.

UNIT-IV

Trees: 9 Hours

Introduction to Trees, Binary Trees :Travesals (breadth-first, depth-first), Expression Trees: Infix, Prefix, Postfix Traversals. Search Trees, Binary Search Trees, B Trees, AVL trees. Heaps: Structure, Basic algorithms- Reheap Up, Reheap Down, Build heap, Insert, Delete.

UNIT-V

Graphs: 9 Hours

Terminology, Operations: Add vertex, Delete vertex, Add Edge, Delete Edge, Find vertex, Traverse Graph: Depth-First, Breadth-First. Graph Storage Structures :Adjacency Matrix, Adjacency List.

TEXT BOOKS:

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, "Data structures using
   C and C++", Pearson Education.
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill

REFERENCES:

1. Bandyopadhyay, Data Structures Using C Pearson Education, 1999
2. Introduction to Algorithms, TH Cormen, CE Leiserson, RL Rivest, C Stein, Third Ed, 2009, PHI
3. Data Structures - A Pseudocode Approach with C, Richard.F.Gilberg and Behrouz.A.Forouzan, Second Edition, Thomson Course Technology, 2007
4. Fundamentals of Data Structures, Ellis Horowitz and Sartaz Sahni

Database Management Systems

Course Objectives:

The Database Management Systems course is intended to deliver students the elementary concepts of a database management system and equips them to design and implement a database application built on those concepts. It also introduces advanced level areas like transaction processing, concurrency control, and recovery management.

Course Outcomes:

- Demonstrate the basic elements of a relational database management system
- Identify the data models for relevant problems
- Design entity relationships and convert entity-relationship diagrams into RDBMS and formulate SQL queries with the respective data
- Illustrate normalization for the development of application software
- Analyze the basic issues of transaction processing and concurrency control

Unit 1

Introduction: 6 Hours

Purpose of Database System -– Views of data- Data Models- Database Languages-– Database System Architecture- Database users and Administrator- Entity– Relationship model (E-R model)- E-R Diagrams -- Introduction to relational databases.

Unit 2

Relational Model-I: 6 Hours

The relational Model- The catalog- Types– Keys - Relational Algebra- Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations- Additional Operations- SQL fundamentals. Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables. Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL

Unit 3

Relational Model-II: 6 Hours

Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User Integrity- Triggers - Security- Advanced SQL features-Embedded SQL– Dynamic SQL- Missing Information– Views- Introduction to Distributed Databases and Client/Server Databases.

Unit 4

Database Design: 6 Hours

Functional Dependencies- Non-loss Decomposition- Functional Dependencies- First, Second, Third Normal Forms, Dependency Preservation- Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form- Join Dependencies and Fifth Normal Form

Unit 5

Transactions: 6 Hours

Transaction Concepts - Transaction Recovery- ACID Properties- System Recovery- Media Recovery- Two Phase Commit - Save Points- SQL Facilities for recovery-Concurrency- Need for Concurrency- Locking Protocols- Two Phase Locking- Intent Locking- Deadlock- Serializability- Recovery Isolation Levels- SQL Facilities for Concurrency

TEXT BOOK

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fifth Edition, Tata McGraw Hill, 2006
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley, 2007.

REFERENCE

1. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.

Operating Systems

Course Objectives:

- Understand Operating System Structure and Operations
- Discuss Process management
- Illustrate Process Synchronization in Operating System
- Analyze different Memory Management Strategies and File System
- Apply the concepts learnt to Windows-10 as a case study.

Course Outcomes:

- Explain Operating System Structure and Operations
- Describe Process management
- Identify Process Synchronization in Operating System
- Compare different Memory Management Strategies and File System
- Implement the concepts learnt in Windows-10 as a case study.

UNIT-I

Introduction to Operating Systems **6 Hours**

Computer System organization, Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and security, Special-purpose systems, Computing environments, Operating System Services, User interface, System calls, System programs, Operating System design and implementation, Operating System structure, Operating System generation, System boot- Case Study.

Unit- II

Process Management **6 Hours**

Process concept, Process scheduling, Operations on processes, Inter-process communication, Multi-Threaded Programming Overview, Multithreading models, Thread Libraries, Threading issues, Process Scheduling Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling, Thread scheduling- Case Study.

Unit- III

Process Synchronization and Deadlocks **6 Hours**

Process Synchronization, The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors, Deadlocks System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock- Case Study.

Unit- IV

Memory Management and File System **6 Hours**

Memory Management Strategies, Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation, Virtual Memory Management Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing, File System: File concept, Access methods, Directory structure, File system mounting, File sharing, Protection. Implementing File System: File system structure, File system implementation, Directory implementation, Allocation methods, Free space management- Case Study.

Unit -V

Introduction to Windows 10 -A case study. 6 Hours

Introduction: Introduction to windows 10 operating system. New features in Windows 10, the important changes since Windows 8.1.Navigation and customization of the new enhanced user interface. Installing, Upgrading and Managing Windows 10,File Access, Printers and Network Connectivity with Windows 10,Securing, Optimizing and Maintaining Windows 10 Client ,Configuring Mobile Computing and Remote Access in Windows 10:

Understanding different editions of Windows 10, the differences between Upgrade and Migration: Installing Windows 10 and upgrading to it, Points to consider when deciding between an upgrade or migration, the supported upgrade paths. Support authentication and authorization: Support user authentication, Support workgroup, home group, and domain membership, Configure local accounts and Microsoft accounts, Configure Workplace Join.

Text books:

1. "Operating System Concepts" by Abraham Silberschatz, Greg Gagne, and Peter B. Galvin - Tenth edition published in 2018
2. "Operating Systems: Principles and Practice" by Thomas Anderson and Michael Dahlin - Second edition published in 2014.
3. "Windows Internals, Part 2: Covering Windows Server 2016 and Windows 10" by Mark E. Russinovich, David A. Solomon, and Alex Ionescu - Seventh edition published in 2017

Reference Books:

1. "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos - Fourth edition published in 2014
2. "Operating Systems: Three Easy Pieces" by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau - First edition published in 2015

Knowledge Representation and Reasoning

Course Objectives:

- Enhancing the basic understanding of intelligent agents and their role in problem-solving and decision-making.
- Describe different problem-solving techniques and search algorithms to find optimal solutions.
- Explain about the gaming concept in AI.
- Develop knowledge and reasoning skills to represent, manipulate, and reason with knowledge.
- Explore different learning approaches and techniques to build adaptive and intelligent agents.

Course Outcomes:

Upon completion of this course, students will be able to:

- Understand the foundations, history and the role of intelligent agents in solving complex problems.
- Analyze and compare different search algorithms to find optimal solutions for well-defined problems.
- Design and implement knowledge-based systems using logical and rule-based representations.
- Develop planning agents capable of generating and executing plans in complex environments.
- Use the concept of gaming and know the decision making in checker, go, etc. games.

Unit 1: 6 hours

Intelligent System and Intelligent Agent

What is intelligence? Structure of intelligent system, Biological brain and Basic neural model. Intelligent Agents, How Agents Should Act, Structure of Intelligent Agents, Simple reflex agents, Goal-based agents, Utility-based agents, Environments, Environment programs.

Unit 2: 6 hours

Problem Solving by Searching

Problem-Solving Agents, Toy problems, Real-world problems, Searching for Solutions, Uniformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Beyond Classical Search

Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

Unit 3: 6 hours

Adversarial Search

Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs, Alternative Approaches.

Unit 4: **6 hours**

Constraint Satisfaction Problems

Introduction to Constraint Satisfaction Problems, Constaint Propagation, Backtracking Search for Constraint Satisfaction Problems, Local Search for Constraint Satisfaction Problems, The Structure of Problems.

Unit 5: **6 hours**

Knowledge and Reasoning

Logical Agents: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic.

First-Order Logic: Syntax and Semantics, Extensions and Notational Variations, Using First-Order Logic.

Inference in First-Order Logic: Proposition vs First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Text Books:

1. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, Second Edition, Pearson Education, Inc., Upper Saddle River; New Jersey 07458.
2. Artificial Intelligence: The Basics by Kevin Warwick, Professor of Cybernetics Kevin, 1st published 2012 by Routledge.
3. "Artificial intelligence A systems approach" by M. Tim Jones, INFINITY SCIENCE PRESS LLC, 2008.

Reference Books:

1. "Artificial Intelligence: Foundations of Computational Agents", by D. Poole, Cambridge University Press, 2010.
2. "Artificial Intelligence and Intelligent Systems", by Padhy N.P, 4th impression, Oxford University Press, 2007.
3. "Super Intelligence Paths, Dangers and Strategies", by Nick Bostrom, Oxford University Press.

Mathematics-II

Course Objective

To develop the capability among students for handling abstract concepts and to provide the students with experience in axiomatic mathematics while keeping in close touch with the computational aspects of the subject.

Course outcome:

- Execute fundamental mathematical proofs and ability to verify.
- Apply basic counting techniques to solve combinatorial problems.
- Comprehend formal logical arguments and expression of mathematical properties formally via the formal language of propositional logic and predicate logic.
- Analyse and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to verify simple mathematical properties that these objects possess.
- Formulate computer programs (e.g. recursive functions) using mathematical principle.

CONTENTS

Unit 1: Hypothesis Testing **9 Hours**

Introduction to testing of hypothesis, Statistical assumptions for parametric test, Level of significance, confidence level, Type I Error, Type II error, Critical value, power of the test, sampling distribution, small sample test- t test for one sample and two sample mean, F test to test the equality of two sample variance, Large Sample test- Z test for equality of single mean with population mean, equality of two sample mean, equality of single proportion with population proportion and equality of two sample proportions.

Unit-2: Correlation and Regression Analysis **9 Hours**

Correlation analysis, properties of correlation coefficients, significance of single correlation coefficient, significance of multiple correlation coefficients, concepts of multiple correlation and partial correlation, Introduction to linear model, concepts of factor, effect, residuals, dependency, independency, assumptions of linear model, difference between linear and nonlinear model, estimation of parameters of regression coefficients for simple and multiple linear regression model, properties of regression coefficients, significance of regression coefficients, diagnostic testing: auto correlation, multi collinearity, heteroscedasticity, normality, significance of estimated parameters in multiple linear regression,.

Unit 3: Differential Equations **9 Hours**

Ordinary differential equations of the first order of the form y'=f(x,y), Bernoulli's equation, exact differential equations, integrating factor, orthogonal trajectories, homogeneous differential equations, variable separable equations, linear differential equations of second order with constant coefficients, Method of variation of parameters, Cauchy-Euler equation

Unit-4: Limits and PDE **9 Hours**

Evaluation of limits & Expansion of functions: Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits Taylor's Series and Maclaurin's Series, Convergence Tests for positive term series- Comparison.

Partial differentiation & Application of PDE: Partial Derivatives, Euler's Theorem on homogeneous functions, Total Derivatives & Implicit functions. Errors and Approximations, Maxima & Minima for two and several variables, Jacobians and their applications.

Unit-5: Integral Calculus **9 Hours**

Integration as the inverse process of differentiation, definite integrals, and their properties, fundamental theorem of calculus. Double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, calculating volumes using triple integrals.

Text Books

1. Discrete Mathematics for New Technology, Second Edition - Rowan Garnier, John Taylor, Institute of Physics Publishing Bristol and Philadelphia.
2. Theory and Problems of Discrete Mathematics, Third Edition - SEYMOUR LIPSCHUTZ, MARC LARS LIPSON, Schaum's Outline Series, McGRAW-HILL

Reference Books

1. Hand book of Discrete and Combinatorial Mathematics - KENNETH H. ROSEN, JOHN G. MICHAELS, JONATHAN L. GROSS, JERROLD W. GROSSMAN, DOUGLAS R SHIER, CRC Press.
2. Linear Algebra and Matrix Analysis for Statistics- Sudipto Banerjee, Anindya Roy, CRC Press.
3. Linear Algebra concepts and methods- Martin Anthony, Michele Harvey, Cambridge University Press.

English-II

Course Objective

To familiarize the students with the broad areas of communicative English

Course outcome:

- To know the working principles of a computer.
- To understand the basic terminology used in computer programming
- To write, compile and debug programs in C language.
- To design programs using decision structures, loops and functions.
- To understand the dynamics of memory by the use of pointers and Structures.

CONTENTS

Unit 1: Communication in Business 9 Hours

Introduction, Communication Process, Essentials of Business Communication, Barriers to Business Communication.

Unit-2: Types of Communication 9 Hours

Verbal Communication, Nonverbal Communication, Types of Communication Based on Style and Purpose

Unit 3: Reading Skills-I 9 Hours

Parts of Speech (Nouns, Pronouns, Adjectives, Verbs, Adverbs, Prepositions, Conjunctions, and Interjections)

Unit-4: Reading Skills-II 9 Hours

Sentences, Subject-Verb Agreement, Active and Passive Voice, Direct and Indirect Speech

Unit-5 : Communication in Organisation 9 Hours

Types of Communication, Meetings, Memo, Circulars and Notices. Business Correspondence: General Rules for All Business Correspondence, Guidelines for the Basic Cover Letter, Guidelines for Information Interviewing, Networking Letters, Guidelines for Thank You Letters, Guidelines for Job Offer, Acceptance Letters, Guidelines for Letters Declining a Job Offer, Style in Business Correspondence Business Report Writing: Cover Letters, Business Report Writing, The purpose of statistical studies, a sample of business correspondence

Recommended Readings:

1. Bhatia, R.C., Business Communication, New Delhi: Ane Books Pvt Ltd
2. Scot, O., Contemporary Business Communication, New Delhi: Biztnatra

3. Parikh, J.P. et al, Business Communication: Basic Concepts and Skills, Hyderabad: Orient Blackswan

Understanding India

Course Objective

- Overview of India's states and union territories: We will provide an overview of India's states and union territories, their geography, languages, and cultures, and the different historical events that have shaped them.
- Learners will gain an understanding of Hindu practices, including puja and yoga.
- Explore the changing roles and status of women in Indian society, the challenges they face, and initiatives for women's empowerment.

Course Outcome:

- Recognize the diversity of India's geography, languages, and religions.
- Explain the significance of major historical periods, empires, and movements in India.
- Apply cultural understanding to analyze and interpret the influence of Indian arts, literature, and festivals on society.
- Analyze the impact of colonization and the struggle for independence on Indian society and politics.
- Evaluate the socio-economic challenges and development initiatives in modern India.

CONTENTS

Unit I: Introduction to India and its History 9 Hours

Geographical Features and Diversity of India, Overview of India's states and union territories, Key historical periods and empires in India, Introduction to major religions and languages in India

Indus Valley Civilization and its Significance, The Maurya and Gupta empires, Islamic invasions and the Mughal Empire, British colonial rule and the struggle for independence

Unit II: Indian Philosophy and Culture 9 Hours

Hinduism: Concepts, deities, and practices; Buddhism: Origins, teachings, and spread; Jainism: Principles and influence; Sikhism: Beliefs and contributions

Indian Arts and Culture: Traditional Indian music, dance, and performing arts, Indian literature and languages; Visual arts: Painting, sculpture, and architecture; Festivals and celebrations across different regions

Unit III: Social Structure and Modern India 8 Hours

Caste system: Origins, impact, and contemporary issues, Gender roles and women's empowerment, Ethnic and linguistic diversity in India, Tribal communities and their cultural significance

Indian democracy and the Constitution, Socio-economic challenges and development initiatives, Contemporary social issues: Poverty, education, healthcare, and rural development; India's role in the global arena

Unit IV: Indian Cuisine and Cultural Exchange 4 Hours

Regional culinary traditions and flavours, Spices, Popular dishes and street food culture, reflecting on the learning journey and insights gained, sharing personal experiences and connections to Indian culture, Cultural exchange activities, such as food tasting or traditional art demonstrations

Reference Material

1. Keay, J. (2010). India: A History.
2. Guha, R. (2007). India After Gandhi: The History of the World's Largest Democracy.
3. Sen, A. (2006). The Argumentative Indian: Writings on Indian History, Culture, and Identity.
4. French, P. (2011). India: A Portrait.
5. Das, G. (2002). India Unbound: The Social and Economic Revolution from Independence to the Global Information Age.
6. Nehru, J. (1989). The Discovery of India.

Coding and Computational Thinking-II

COURSE OBJECTIVE:

Coding and Computational Thinking- II, students can take up coding practice and challenges on the platform Hackerrank @www.hackerrank.com suitable on:

1. Databases (https://www.hackerrank.com/domains/databases) and
2. SQL (https://www.hackerrank.com/domains/sql).

COURSE OUTCOME:

1. Discuss the applicability of mathematical concepts of sets, relations to database management systems.
2. Use SQL commands to query databases for relevant results.
3. Apply normalization techniques to create standardized relations.
4. Demonstrate SQL and relational databases skills to develop database management systems.

COURSE CONTENT

Students' understanding of the subject Database management systems can be supported by practicing and taking challenges for both on the Hackerrank platform. Following is a list of suggestive exercises that can be completed on the platform.

Sl no	Concept	Challenge	Max score	Difficulty levels
1	Basics of Sets and relations	Challenges 1,2,3 and 4	5	Easy
2	Relational Algebra	Challenges 3 and 4	2	Medium
3	Database Query Languages and procedural Languages	MCQ's	2	Easy
4	Normalization	Challenges for 1/2/3NF	5	Hard
5	Databases	Keys	5	Medium
6	SQL	Select All	10	Easy

7	SQL- DDL,DML	Weather observation station 5	30	Easy
8	SQL	New Companies	30	Medium
9	SQL	Top Competitors	30	Medium
10	SQL	Contest LeaderBoard	30	Medium

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Fifth Edition, Tata McGraw Hill, 2006
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addision Wesley.

Data Structures and Algorithms-Lab

Practical List on Data Structures Using C++

1. Write a program in C to count the frequency of each element of an array.
2. Write a program in C to count a total number of duplicate elements in an array.
3. Write a program in C to insert New value in the array (sorted list).
4. Write an algorithm and find the efficiency of the same for following problems:
    a. Finding Factorial- Iterative Approach and Recursive Approach
    b. Printing Fibonacci Series- Iterative Approach and recursive approach
5. Design an algorithm and implement programs for any 3 of the below:
    a. Insertion Sort
    b. Selection Sort
    c. Bubble Sort
    d. Count Sort
    e. Linear Search
6. Design an algorithm and implement a program for:
    a. Merge Sort
    b. Binary Search
7. Design an algorithm and implement a program to solve Knapsack Problem
8. C Program to Reverse a Stack using Recursion.
9. C Program to Implement Two Stacks using a Single Array & Check for Overflow & Underflow.
10. C Program to Check String is Palindrome using Stack.
11. C Program to Identify whether the String is Palindrome or not using Stack.
12. C Program to Implement Queues using Stacks.
13. Write a program to implement a linked list and traverse the list. Print all the elements traversed.
14. Write a program to illustrate insertion in linked list as per following:
    . Insertion in the beginning.
    a. insertion at the end
    b. insertion in the intermediate position given by user.
15. Write a program to illustrate deletion in linked list as per following:
    . deletion in the beginning.
    a. deletion at the end

b. deletion in the intermediate position given by user.

16. Write a program to reverse the linked list.
17. Write a program to sort the elements in linked list.
18. Write a program to illustrate insertion in circular linked list as per following:
    . Insertion in the beginning.
    a. insertion at the end
    b. insertion in the intermediate position given by user.
19. Write a program to implement binary tree.
20. Write a program to implement AVL tree.
21. Write a program to implement binary max heap.
22. Write a program to implement breadth first search using necessary data structure.
23. Write a program to find minimum spanning tree in graph using prims algorithm.
24. Write a program to find minimum spanning tree in graph using kruskals algorithm.

Database Management System-Lab

1. Perform following actions using SQL statements
    a) Create a new user with name “shiva” and password “kumar@1”
    b) Assign the following privileges
        i. Create and drop tables
        ii. Create and drop users
        iii. Allow to assign above privileges to new users
    a) List all tables in the database
    b) List all users in the database
    c) Logout from current user and log in as “shiva”
2. Create following tables and insert minimum 10 rows in to each table
    a. Department table with following columns with appropriate data types
        i. DeptId
        ii. DeptName
        iii. DeptLoc
    b. Employee table with following columns with appropriate data types
        i. EmpId
        ii. EmpName
        iii. DOB
        iv. DOJ
        v. Job
        vi. Salary
    c. Product table with following columns with appropriate data types
        i. ProdId
        ii. ProdName
        iii. Price
    d. Sales table with following columns with appropriate data types
        i. SalesId
        ii. Date
        iii. Quantity

3. Update above tables with following features using SQL statements
    a. Make DeptId in Department table as Primary Key
    b. Make EmpId in Employee table as Primary Key
    c. Add DeptId column to the Employee table and make it foreign key from Department table and update the values
    d. Add EmpId and ProdId to the Sales table and make them foreign key from Employee and Product table and update the values
    e. Update all columns in all tables with appropriate constraint such as not null, check and so on
4. Perform the following SQL statements
    a. Create a view “EmpDeptView” from Employee and Department table which contains following columns
        i. EmpName
        ii. DOB
        iii. Salary
        iv. DeptId
        v. DeptName
        vi. Loc

a. Retrieve all employees whose salary between 25,000 to 30,000
b. Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
c. Retrieve all employees who is working other than Accounts department
d. Retrieve all employee who is working in Sales department and Bangalore location
e. Retrieve all employees who completed minimum 5 years
f. Retrieve all employees who completed minimum 5 years and salary less than 30,000

5. Perform the following SQL statements
    a. Retrieve all employees whose salary more than 30,000
    b. Retrieve employee details who is getting maximum salary
    c. Retrieve employee details who is getting minimum salary
    d. Retrieve employee details who is getting 3rd maximum salary
    e. Retrieve employee details who is getting 5th minimum salary
    f. Retrieve total number of employees in each department in Bangalore location
    g. Retrieve total number of employees in each location
    h. Retrieve total number of employees in each location in Accounts department
    i. Retrieve total number of employees who complete more than 10 years in each department
6. Write a PL/SQL Procedure to find prime number from 1 to n, n is a user input or parameter
7. Write a PL/SQL Functions to return number of days an employee working using EmpId
8. Write a PL/SQL Procedure to find sum of salaries of all employee working in a particular location
9. Write a PL/SQL Function to return sum of sales by ProdId
10. Write a PL/SQL Function to return sum of sales by EmpId
11. Write a PL/SQL Procedure to generate Employee Report department wise as follows
    DeptName
    EmpName Job Location Salary Cumulative_Salary
12. Write a PL/SQL Trigger to insert row into OldEmployee table when a employee deleted from Employee table (Create OldEmployee table)
13. Write a PL/SQL Trigger not to delete more than 2 employees at a time
14. Write a PL/SQL Trigger not to update employee salary if it cross 67000
15. Write a PL/SQL Package with following procedures and functions
    a. Procedures
        i. Print Total Quantity Sales Summary Report(SalesId, Date, Quantity and Total Quantity)
        ii. Print Total Quantity Sales Summary Report by Date wise
    b. Functions
        i. Return employee name who made maximum sales till date
        ii. Return product name soled maximum quantity till date

Semester- III

Course Code	BCAAIML301	Programming in Python	L	T	P	C
Core/elective/Supportive			3	1	0	4
Pre - Requisite		• Knowledge in Basics of Object Oriented Programming			I	

Course Objectives

To introduce the concepts of the various programming constructs of Python programming

Expected Course Outcomes

1	Apply the various basic programming constructs like operators, expressions, decision making statements and Looping statements	**K2**
2	Summarize the concept of lists, tuples , functions and error handling	**K2**
3	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	**K3**
4	Analyze the concepts of Lists, tuples and error handling mechanisms	**K4**
5	Evaluate a program incorporating all the python language constructs	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**BASICS**	**18**

Python - Variables - Executing Python from the Command Line - Editing Python Files -Python Reserved Words - Basic Syntax-Comments - Standard Data Types – Relational Operators -Logical Operators - Bit Wise Operators - Simple Input and Output.

UNIT II	**CONTROL STATEMENTS, LISTS, TUPLES**	**18**

CONTROL STATEMENTS: Control Flow and Syntax - Indenting - if Statement - statements and expressions- string operations- Boolean Expressions -while Loop - break and continue - for Loop.
LISTS: List-list slices - list methods - list loop–mutability–aliasing - cloning lists - list parameters**.**
TUPLES: Tuple assignment, tuple as return value -Sets–Dictionaries.

UNIT III	**FUNCTIONS:**	**17**

Definition - Passing parameters to a Function - Built-in functions- Variable Number of Arguments - Scope – Type conVersion-Type coercion-Passing Functions to a Function – Mapping Functions in a Dictionary – Lambda - Modules - Standard Modules – sys – math – time - dir. – help Function.

UNIT IV	**ERROR HANDLING:**	**19**

Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.

UNIT V	**OBJECT ORIENTED FEATURES**:	**18**

Classes Principles of Object Orientation - Creating Classes -Instance Methods - File Organization - Special Methods - Class Variables – Inheritance – Polymorphism - Type Identification - Simple Character Matches - Special Characters – Character Classes – Quantifiers - Dot Character - Greedy Matches – Grouping - Matching at Beginning or End - Match Objects – Substituting - Splitting a String - Compiling Regular Expressions.

Total Lecture Hours	**90 Hours**

Text Book(s)	
1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001
Reference Book(s)	
1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist__, 2nd edition, Updated for Python 3, Shroff/O_Reilly Publishers, 2016
2	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
Course Designed by :	

Course Code	BCAAIML302	Fuzzy Logic and Neural Networks	L	T	P	C
Core/elective/Supportive			3	1	0	4
Pre - Requisite		• Knowledge in Basics of Object Oriented Programming				I

Course Objectives

- To introduce the concepts of neural networks and fuzzy systems
- To explain the basic mathematical elements of the theory of fuzzy sets.

1	Explain the basic concepts of fuzzy sets and fuzzy logic	**K2**
2	Understanding of the basic mathematical elements of the theory of fuzzy sets.	**K2**
3	Explain the fundamentals and history of neural networks	**K2**
4	Outline about the mapping and recurrent networks	**K2**
5	Analyze the applications of fuzzy logic and neural network for various applications	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Fuzzy Set Theory and Fuzzy Logic Control:**	**18**

Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control Fuzzification –Defuzzificatiuon- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT II	**Adaptive Fuzzy Systems**	**18**

Performance index- Modification of rule base0- Modification of membership functions- Simultaneous modification of rule base and membership functions- Genetic algorithms-Adaptive fuzzy system Neuro fuzzy systems.

UNIT III	**Artificial Neural Networks:**	**18**

Introduction- History of neural networks- multilayer perceptions- Back propagation algorithm and its Variants- Different types of learning, examples.

UNIT IV	**Mapping and Recurrent Networks:**	**18**

Counter propagation –Self organization Map- Cognition and Neocognitron- Hopfield Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning

UNIT V	**Case Studies**	**18**

Application of fuzzy logic and neural networks to Measurement- Control- Adaptive Neural Controllers – Signal Processing and Image Processing

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Vallum B.R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

Reference Book(s)

1	Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2	Neural Networks for control, Millon W. T, Sutton R.S and Warbots P. J, MIT Press 1992
3	Fuzzy sets Fuzzy logic, Klir, G. J and Yuan B.B Prentice Hall oif India Pvt. Ltd.,, New Delhi
4	Neural Networks and Fuzzy systems, Kosko. Prentice hall of India Pvt. Ltd.,, New Delhi 1994
5	Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996
6	Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New Delhi 1994

Graph Theory and its Applications 3 1 0 4

(BCAAIML303)

Course Objective:

To understand fundamentals of graph theory, techniques related to various concepts in graphs andexplore modern applications of graph theory.

Course Outcomes:

CO-1: Understand the basic concepts of graphs, and different types of graphs and illustrate fundamentals of cut edges and cut vertices..

CO-2: Identify special graphs like Euler graphs and Hamiltonian graphs.

CO-3: Model problems in different types of basic graphs like trees, bipartite graphs and planarGraphs.

CO-4: Understand the properties, theorems and be able to prove theorems and apply graph model for solving applications.

CO-5: Make use of theoretical knowledge and independent mathematical thinking in graph theory.

CO-6: Able to identify various forms of connectedness in a graph and Matching. **CO-7**: Learn about connectivity and paths, explore about Ford-Fulkerson algorithm.**CO-8**: Able to solve Network flow problems and learn about line graphs.

CO-9: Discuss about chromatic characteristics and planar graph.

CO-10: Apply different graph-coloring theorems for coloring problems get their solutions.

UNIT I Fundamental Concepts 12

Definitions, examples of problems in graph theory, adjacency and incidence matrices, isomorphism, paths, walks, cycles, components, cut-edges, cut-vertices, bipartite graphs, Eulerian graphs, vertex degrees, reconstruction conjecture, external problems, degree sequences, directed graphs, de Bruijncycles, Orientations and tournaments.

UNIT II Trees 12

Trees and forests, characterizations of trees, spanning trees, radius and diameter, enumeration of trees, Cayley's formula, Prüfer code, counting spanning trees, deletion-contraction, matrix tree theorem, graceful labeling, minimum spanning trees (Kruskal's algorithm), shortest paths (Dijkstra's algorithm).

UNIT III Matching and Covers 12

Matchings, maximal and maximum matchings, M-augmenting paths, Hall's theorem and consequences,

Min-max theorems, maximum matchings and vertex covers, independent sets and edge covers, Connectivity, vertex cuts, Edge-connectivity.

UNIT IV Connectivity and Paths 12

Blocks, k-connected graphs, Menger's theorem, line graphs, network flow problems, flows and source/sink cuts, Ford-Fulkerson algorithm, and Max-flow min-cut theorem.

UNIT V Graph Coloring and Case Study 12

Vertex colorings, bounds on chromatic numbers, Chromatic numbers of graphs constructed from smaller graphs, chromatic polynomials, properties of the chromatic polynomial, the deletion-contraction recurrence. Planar Graphs: Planar graphs, Euler's formula, Kuratowski's theorem, five and four color theorems. Case Study- Core Network Design using Graph Theory Method, Feasible Sanitary SewerNetwork Generation Using Graph Theory.

Books for References:

1. Douglas B West, “Introduction to Graph Theory”, II Edition, Pearson, 2017.
2. Gary Chartrand and Ping Zhang, “Introduction to Graph Theory”, Tata McGraw Hill 2017.
3. Jonathan L. .Gross and Jay Yellen, “Graph Theory and Its Applications”, 2nd Edition,Chapman Hall (CRC), 2005.

Course Code	BCAAIML304	Internet of Things (IoT)	L	T	P	C
Core/elective/Supportive			3	0	0	3

Course Objectives

- To explain about the definition and usage of Internet of things
- To explain the key components of IoT system

Expected Course Outcomes

1	Explain the definition and usage of the term ―Internet of Things‖ in different contexts	**K2**
2	Understand the key components that make up an IoT system	**K2**
3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack	**K3**
4	Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis	**K3**
5	Discover where the IoT concept fits within the broader ICT industry and possible future trends	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction to IoT**	**16**

Introduction – Definition and Characteristics of IoT, Physical Design of IoT; Things in IOT, Logical Design of IoT; IoT Functional Blocks, IoT Communication APIs, IoT Enabling Technologies; WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems

UNIT II	**IoT Hardware**	**15**

IoT Hardware, Devices and Platforms – Basics of Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi; Introduction to Raspberry pi, Programming with Raspberry pi, CDAC IoT devices: Ubimote, Wi-Fi mote, BLE Mote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators

UNIT III	**IoT Protocols**	**16**

IoT Protocols – IoT Data link Protocols, Network Layer Routing Protocols, Network Layer Encapsulation Protocols, Session Layer Protocols, IoT Security Protocols, Service Discovery Protocols, Infrastructure Protocols.

UNIT IV	**IoT Programming**	**14**

IoT Programming – Arduino Programming: Serial Communications – Getting Input from Sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication, Programming with Raspberry pi: Basics of python Programming, Python Packages of IoT, IoT Programming with CADC IoT devices.

UNIT V	**Domain Specific IoT**	**14**

Domain Specific IoT – Home automation, smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, industry and Health & Life style sensors, Case Studies: A Case Study of Internet of Things Using Wireless Sensor Networks and Smart Phones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, Open IoT Platform.

Total Lecture Hours	**75 Hours**

Text Book(s)		
1	Vijay Madisetti and ArshdeepBahga, –Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.	
Reference Book(s)		
1	Margolis, Michael. –Arduino Coo Kbook: Receipestobegin, Expand and Enhance Your Projects‖. O'Reilly Media Inc.2011.	
2	Monk, Simon. Raspberry Pi Cookbook: Software and hardware problems and Solutions. O'Reilly Media,Inc. 2016.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Web Development with PHP

(BCAAIML305)

Course Objective:

This course is aimed to provide a fundamental understanding of dynamic web site creation. PHP is the language used for development of most common web sites. Syllabus includes basic and advancedfeatures of PHP which includes detailed introduction of PHP and MYSQL, Arrays, Loops andvariables etc. It also gives an overview open source framework like JOOMLA, ZEND etc.

Course Outcomes:

- Develop programs using HTML and PHP.
- Develop PHP Program using Character set, variables, data types, conditional and iterative statements, functions etc.
- Develop WebPages using built-in functions related to string manipulation, mathematical, date and time etc.
- Develop Web pages using Arrays, Web forms, files, and databases with PHP

UNIT - I Introduction to HTML

HTML INTRODUCTION: History of HTML – HTML Document – Anchor Tags – Hyper Links-Sample HTML Documents.HEAD AND BODY SECTIONS: Header Section – Title – Prologue – Links – Comment – Heading – Horizontal Rule – Paragraph – Images and Pictures - Ordered and Unordered List.TABLES: Table Creation – ColSpan, RowSpan – Cell Spacing, Cell Padding – Nested Tables. FRAMES: Frameset Definition – Frame Definition – Nested Frames.FORMS: Action Attribute – Method Attribute – Drop Down List – Sample Forms.

UNIT - II Introduction to Open Source and PHP programming

Introduction to Open Sources Technologies, Introduction to PHP, installation and configuration, Advantages and Disadvantages of PHP, Client Side Scripting, Server Side Scripting, Variables, data types, various types of function, creating your own function, Strings in PHP, String Functions.Operator, Loops, Array, Exception and Error Handling Operators, Conditions, Loops, Using for each, Creating and Using Arrays, Multidimensional Array, Associative array. Error Handling in PHP, Errors and Exceptions, Exception class, try/catch block, throwing an exception, defining your own Exception subclass.

UNIT - III

Classes, File system, Passing Information between pages Object oriented programming with PHP, Working with Date time, code re-use, require (), include(), and the include path; Understanding PHP file permissions, File reading and writing functions, File system functions, File uploads, Sending mail & use of email server. HTTP, GET arguments, POST arguments, Using Session in PHP, cookies, The setcookie() function, Deleting Cookies and Reading Cookies.

UNIT - IV Working with Database

HTML Tables and Database tables, Databasemanipulation(Select, Insert, Update, Delete), validating User Input usingJavascript.MYSQL, Introducing MySQL; database design concepts;

the Structured Query, Language (SQL); communicating with a MySQL backend via the PHP, MySQL API Building Database Applications.

UNIT - V Working with Frameworks

Working with Mambo, Working with Joomla, Working with framework.Use of Joomla in rapid development of website.Developing of simple website using joomla.

References/Text Books:

- Beginning PHP, Apache, MySQL Web Development
- Michael K. Glass, Yann Le Scouarnec, Elizabeth Naramore, Gary Mailer, Jeremy Stolz, Jason Gerner
- PHP Manual.
- The Complete Reference PHP, by Steven Holzner, TAYA McGraw-Hill Publication
- Beginning PHP and MYSQL, by W. Jason Gilmore, Apress Publication

Course Code	BCAAIML306P	Programming in Python-Lab	L	T	P	C
Core/elective/Supportive			0	0	2	1
Pre - Requisite		• Knowledge in basic Programming				

Course Objectives
To introduce the concepts of python programming constructs of C++

Expected Course Outcomes		
1	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	K3
2	Analyze the concepts of Lists, tuples and error handling mechanisms	K4
3	Evaluate a program incorporating all the python language constructs	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1		**5**
Write a python program that displays the following information: Your name, Full address Mobile number, Kalinga University, LOGO name, Course subjects.		
PROGRAM - 2		**5**
Write a python program to find the largest three integers using if-else and conditional operator.		
PROGRAM - 3		**9**
Write a python program that asks the user to enter a series of positive numbers (The user should enter a negative number to signal the end of the series) and the program should display the numbers in order and their sum.		
PROGRAM - 4		**9**
Write a python program to find the product of two matrices [A]mxp and [B]pxr		
PROGRAM - 5		**9**
Write recursive functions for GCD of two integers.		
PROGRAM -6		**5**
Write recursive functions for the factorial of positive integer.		
PROGRAM -7		**5**
Write recursive functions for Fibonacci Sequence up to given number n.		
PROGRAM -8		**5**
Write recursive functions to display prime number from 2 to n.		
PROGRAM -9		**5**
Write a python program that writes a series of random numbers to a file from 1 to n and display.		
PROGRAM -10		**6**
Write a python program to sort a given sequence: String, List and Tuple.		
PROGRAM -11		**6**
Write a python program to make a simple calculator.		
PROGRAM -12		**6**
Write a python program for Linear Search and Binary Search.		
	Total Hours	**75 Hours**

Text Book(s)

1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.

Reference Book(s)

2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001

Mini Project/Internship Assessment
(BCAAIML307P)

Semester-IV

Course Code	BCAAIML401	R Programming	L	T	P	C
Core/elective/Supportive			3	1	0	4

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	**K2**
2	Understand the use of R for Big Data analytics	**K2**
3	Apply R programming for Text processing	**K3**
4	Appreciate and apply the R programming from a statistical perspective	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introducing to R**	**18**

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names. (9).

UNIT II	**Matrices**	**18**

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III	**Data Frames**	**18**

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

UNIT IV	**Classes**	**18**

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

UNIT V	**Interfacing R**	**18**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Total Lecture Hours	**90Hours**

Text Book(s)

1	Norman Matloff, ―The Art of R Programming: A Tour of Statistical Software Design‖, No Starch Press, 2011.
2	Jared P. Lander, ―R for Everyone: Advanced Analytics and Graphics‖, Addison-Wesley Data & Analytics Series, 2013.

	Reference Book(s)	
1	Mark Gardner, ―Beginning R – The Statistical Programming Language‖, Wiley, 2013.	
2	Robert Knell, ―Introductory R: A Beginner‘s Guide to Data Visualisation, Statistical Analysis and programming in R‖, Amazon Digital South Asia Services Inc, 2013. Richard Cotton (2013). Learning R, O‘Reilly Media.	
3	Garret Grolemund (2014). Hands-on Programming with R. O‘Reilly Media, Inc.	
4	Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Cloud Computing and its Security 3 1 0 4

(BCAAIML402)

Course Objective:

The course introduces the fundamental concepts of cloud computing, its services and Tools. It concentrates the basic concepts of security systems and cryptographic protocols, which are widely used in the design of cloud security. The issues related multi tenancy operation, virtualized infrastructure security and methods to improve virtualization security are also dealt with in this course.

Course Outcomes:

CO-1: To provide students the knowledge of fundamentals and essentials of Cloud Computing.

CO-2: Understand the importance of virtualization in distributed computing and how this has enabledthe development of Cloud Computing

CO-3: Identify the appropriate cloud services for a given application.

CO-4: Analyze Cloud infrastructure including Google Cloud and Amazon Cloud **CO-5:** Compare modern security concepts as they are applied to cloud computing. **CO-6:** Assess the security of virtual systems.

CO-7: Evaluate the security issues related to multi-tenancy.

CO-8: Apprise compliance issues that arise from cloud computing.

CO-9: Analyze authentication, confidentiality and privacy issues in cloud computing.

CO-10: Identify security implications in cloud computing.

Unit ICloud Computing 12

History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.

Unit IIWeb-Based Application 12

Pros and Cons of Cloud Service Development – Types of Cloud Service Development– Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.

Unit III Security Concepts 12

Confidentiality – Privacy – Integrity – Authentication - Non-repudiation – Availability - Access control Defence in depth – Least privilege - How these concepts apply in the cloud - Importance in PaaS, IaaS and SaaS. - User authentication in the cloud- Cryptographic Systems: Symmetric cryptography - Stream

Ciphers - Block ciphers - Modes of operation - Public-key cryptography – Hashing - Digital signatures - Public-key infrastructures - Key management - X.509 certificates - OpenSSL.

Unit IV Multi-Tenancy Issues 12

Isolation of users/VMs from each other - Virtualization System Security Issues- ESX and ESXi Security

- ESX file system security - Storage considerations - Backup and Recovery - Virtualization System Vulnerabilities - Management console vulnerabilities - Management server vulnerabilities - Administrative VM vulnerabilities - Guest VM vulnerabilities - Hypervisor vulnerabilities - Hypervisor escape vulnerabilities - Configuration issues - Malware.

Unit V Legal, Compliance Issues And Case Studies 12

Responsibility - Ownership of data - Right to penetration test - Examination of modern Security Standards - How standards deal with cloud services and virtualization - C compliance for the cloud provider vs. compliance for the customer – Case Studies: Cryptography for Remote Access and Support - A Secure Network for a Private Cloud.

Total: 60 Hours

Books for References:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way YouWork and Collaborate Online", Que Publishing, August 2008.
2. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.
3. Tim Mather, Subra Kumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security", [ISBN: 0470589876], 2010.
5. John Rittinghouse, James Ransome, "Cloud Computing" ,CRC Press; 1st Edition [ISBN:1439806802], 2009.
6. J.R. ("Vic") Winkler, "Securing the Cloud" ,Syngress [ISBN: 1597495921] , 2011.

Computer Networks

(BCAAIML403)

Course Objectives:

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking.
- Preparing the student for entry in advanced courses of computer networking.
- To gain knowledge of various protocols for network design and maintenance.

Course Outcomes:

- Understand and explain Data Communications System and its components.
- Understand Computer Network basics and OSI and TCP/IP model.
- Understand Networks switching, error detection and error correction techniques.
- Identify the different types of network devices and their functions.
- Familiarity with the various protocols of computer networks.

UNIT-I

Basic concepts: network definition, components of data communication, distributed processing, topology, transmission mode, categories of networks. OSI and TCP/IP models: layers and their functions, comparison of models. Digital transmission: modems, modems, cable modems. Analog and digital signal; data-rate and limits; digital to digital line encoding schemes; parallel and serial transmission; modulation scheme, multiplexing techniques FDM, TDM, transmission media.

UNIT-II

Networks switching techniques and access mechanisms, circuit switching; packet switching, message switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber, data link layer functions and protocol, error detection and error correction techniques, data -link control framing and flow control, error recovery protocols - stop and wait ARQ, go-back-n ARQ; point to point protocol.

UNIT-III

Multiple access protocol and networks, ALOHA, SLOTTED ALOHA, CSMA/CD, protocols; Ethernet LANS, Token Ring, Token Bus, back-bone networks, network adapters cards, repeaters, hubs, switches, bridges, types of bridges, router and gateways.

UNIT-IV

Networks layer functions and protocols, routing: routing algorithms distance vector routing; shortest path routing, network layer protocol, IP protocol, internet control protocols, Unicasting, multicasting, broadcasting, ISDN: services, historical outline, PRI, BRI.

UNIT-V

Transport layer functions and protocols, overview of TCP and UDP, transport services error and flow control, connection establishment and release, three way handshake, overview of session layer and presentation layer, overview of application layer protocol overview of DNS

protocol, overview of internet, WWW,HTTP, FTP, SNMP protocol. Internet services, email services, www services, search service etc.

References:

- B. A. Forouzan: Data Communications and Networking, Fourth edition, THM,
- A.S. Tanenbaum: Computer Networks, Fourth edition PHI.
- Ames Chews Charles Perkins, Matthew Strebe "Networking Essentials: Study Guide "MCSE BPB Publications.
- K.Basandra& S. Jaiswal "Local Area Network" Galgotia Publications
- William Stalling "Data and Computer Communication" Pearson Prentice Hall
- Prakash C Gupta " Data Communication and Computer Network " PHI

Course Code	BCAAIML404	Machine Learning Basics	L	T	P	C
Core/elective/Supportive		Skill Enhancement Subject-II	3	0	0	3

Course Objectives

- To explain about the basics of machine learning

Expected Course Outcomes

1	Understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	**K2**
2	Understanding of the strengths and weaknesses of many popular machine learning Approaches.	**K2**
3	Explain about the concepts of computational learning theory and dimensionality reduction	**K2**
4	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	Introduction to Learning	18

Algorithmic models of learning, Learning classifiers, functions, relations, grammars, probabilistic Models, value functions, behaviors and programs for experience. Bayesian, maximum some posterior, and minimum description length frameworks.

UNIT II	ML- Models	18

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

UNIT III	Computational Learning	17

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

UNIT IV	Unsupervised Learning	18

Unsupervised Learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

UNIT V	Applications in Data Mining	19

Selected applications in data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human computer interaction, semantic web, and bioinformatics and computational biology.

Total Lecture Hours	90 Hours

1	Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.	
	reference Book(s)	
1	Russel, S. And Norving, P. (2003). Artificial Intelligence: A Modern Approach. 2nd Edition, New York: Prentice-Hall.	
2	Baldi, P., Frasconi, P., Smyth, P. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.	
3	Baldi, P., Frasconi, P., Smyth, P. (2003). Modeling the Internet and the Web – Probabilistic Methods and Algorithms. New York: Wiley.	
4	Bishop, C.M. Neural Networks for pattern recognition. New York: Oxford University press (1995).	
5	Hastie, T., Tibshirani, R., and Friedman, J. (2001). The elements of Statistical Learning – Data mining, Inference, and Prediction, Berlin: Springer- Verlag.	
6	Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.	
7	Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegelhalter. D.J. (1999). Graphical Models and Expert Syatems. Berlin: Springer.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc.)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Big Data and Iot Security 3 1 0 4
(BCAAIML405)

Course Objective:

To explore, design and implement basic concepts of big data & methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and its application to the business needs. To understand the fundamentals of Internet of Things with security and to apply the concept in Real World Scenario.

Course Outcomes:

CO-1: To understand the fundamental concepts of big data platform and know about the basicconcepts of nature and evolution of big data.

CO-2: To work with big data platform learn intelligent data analysis and compare old and moderndata tool.

CO-3: Understand the framework of Visual data analysis techniques and interaction techniques.

CO-4: To explore on Big Data real time analytics platform applications.

CO-5: To Learn the fundamental concepts like history and components of Hadoop.

CO-6: To extend the security and implement the data with internet.

CO-7: To assess the vision and introduction of IoT and IoT Security.

CO-8: To Implement Data, Knowledge Management and use of Devices in IoT technology.

CO-9: To classify Real World IoT Design Constraints, Industrial Automation in IoT.

CO-10: Able to understand the application areas of IoT Security.

CO-11: Apply effective techniques to create IoT based projects.

CO-12: Able to understand building blocks of Internet of Things and characteristics.

UNIT I INTRODUCTION TO BIG DATA 12

Big data - Introduction to Big Data Platform - Big Data Skills and Sources - Big Data Adoption - Characteristics of Big Data - Key aspects of a Big Data Platform - Challenges of Conventional Systems Nature of Data - Evolution Of Analytic Scalability Governance for Big Data - definition and taxonomy

- Big data value for the enterprise.

UNIT II BIG DATA COMPONENTS 12

Technical Details of Big Data Components - Text Analytics and Streams - Intelligent data analysis- Analytic Processes and Tools - Modern Data Analytic Tools - Cloud and Big Data - Overview of High Value BDUse Cases – Examples - The Big Data and Data Science - Big Data Exploration - Security and Intelligence - Operations Analysis

UNIT III BIG DATA STREAMS 12

First steps with the Hadoop "ecosystem" – Introduction to Hadoop - Exercises - Hadoop components – Map Reduce/Pig/Hive/HBase - Loading data into Hadoop - Handling files in Hadoop - Getting data from Hadoop - Introduction to the SQL Language - Querying big data with Hive - Big Data & Machine Learning.

UNIT IV OVERVIEW OF IoT AND IoT SECURITY 12

IoT - An Architectural Overview - Main design principles and needed capabilities Devices and gateways

-Data management - Business processes in IoT- Everything as a Service (XaaS) - IoT Security Requirements - IoT Privacy Preservation Issues - Cyber-Physical Object Security -Hardware Security

- Front-end System Privacy Protection - Networking Function Security.

UNIT V ATTACKS AND SECURITY AND CASE STUDY 12

Attack Models - Attacks to RFIDs in IoTs - Attacks to Network Functions - Attacks to Back-end Systems - Security in Front and back end Sensors and Equipment -Prevent Unauthorized Access to Sensor Data – Case Study - Setting up the demo Environment, IoT and the Industrial Sector, IoT and the Connected Home, IoT and Consumer Wearable.

Books for References:

1. Stephan Kudyba, "Big Data Mining and Analytics, Components of Strategic Decision Making",Auerbach Publications, March 12, 2014.
2. Eliot P. Reznor, "Big Data: A Beginner's Guide to using Data Science for Business", 2017.
3. Fei HU, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", CRC Press, 2016.
4. Dirk deRoos , "Hadoop for Dummies", 2014.
5. Prajapati, "Big Data Analytics with R and Hadoop", 2014.
6. Dawn E. Holmes, Big Data: A Very Short Introduction, 2017.
7. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internetof Things Devices and Beyond", NCC Group, 2014.

Course Code	BCAAIML406P	R Programming-Lab	L	T	P	C
Core/elective/Supportive			0	0	2	1

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	**K2**
2	Understand the use of R for Big Data analytics	**K2**
3	Apply R programming for Text processing	**K3**
4	Appreciate and apply the R programming from a statistical perspective	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

List of Programs

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

Total Lecture Hours	90 Hours

Text Book(s)

1	S. Russell and P. Norvig, –Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2	I. Bratko, - Prolog: Programming for Artificial Intelligence, Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011.

reference Book(s)

1	M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.
2	Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.

3	William F. Clocksin and Christopher S Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.	
4	Gerhard Welss, - Multi Agents Systems, Second Edition, 2013.	
5	David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.	
6	Implement an application that stores big data in Hbase/MongoDB/Pig Using Hadoop	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc.)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Course Code	BCAAIML501	Machine Learning Techniques	L	T	P	C
Core/elective/Supportive			3	1	0	4

Course Objectives

- To introduce students to the concepts and techniques of Machine Learning.

Expected Course Outcomes

1	Understand the basic concepts and techniques of Machine Learning.	K2
2	Explain the regression methods, classification methods, clustering methods.	K2
3	Understand the inference and learning algorithms for the hidden Markov model.	K2
4	Demonstrate Dimensionality reduction Techniques	K2
5	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	Introduction to Machine Learning	18

Introduction – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search- Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II	Machine Learning Models	19

Linear Models – Multi-Layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-Layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III	Tree & Probabilistic Model	19

Tree and Probabilistic Models – Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers - Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV	Dimensionality Reduction and Evolutionary Models	17

Dimensionality Reduction and Evolutionary Models - Dimensionality Reduction – Linear Discriminant Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic Algorithms – Genetic Offspring – Genetic Operators – Using Genetic Algorithms – Reinforcements Learning – Overview – Getting Lost Example–Markov Decision Process.

UNIT V	Graphical Model	17

Graphical Models – Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

Total Lecture Hours		**90Hours**
Text Book(s)		
1	EthemAlpaydin, - introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.	
	reference Book(s)	
1	Jason Bell, - Machine Learning – Hands on for Developers and Technical professionals, First Edition, Wiley, 2014.	
2	Peter Flach, - Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Course Code	BCAAIML502	Deep Learning	L	T	P	C
Core/elective/Supportive			3	1	0	4

Course Objectives

- To introduce students to the basic concepts and techniques of deep Learning.

Expected Course Outcomes

1	Understand the basic concepts and techniques of Deep Learning.	**K2**
2	To understand and apply the Machine learning principles	**K2**
3	To study the deep learning architectures	**K2**
4	Explore and create deep learning applications with tensor flow	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	**Introduction to Learning**	**18**
The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Softmax output layers		
UNIT II	**Deep Learning Models**	**18**
Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization		
UNIT III	**CNN**	**19**
Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications		
UNIT IV	**RNN**	**17**
Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM — Memory augmented Neural Networks – NTM—Application		
UNIT V	**Reinforcement Learning**	**18**
Reinforcement Learning – MDP – Q Learning – Applications		
	Total Lecture Hours	**90 Hours**

Text Book(s)

1	Nikhil Buduma, Nicholas Locascio, –Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms‖, O'ReillyMedia, 2017.
	ReferenceBook(s)
1	Ian Goodfellow, YoshuaBengio, Aaron Courville, ‖Deep Learning (Adaptive computation and Machine Learning series‖, MITPress, 2017.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Designed by :

SOFTWARE ENGINEERING AND TESTING

(BCAAIML503)

Course Objectives:

- Understand, learn and apply the theoretical and practical knowledge of software development such as software development paradigms, process, models, tools and techniques.
- Understand and learn the process of software requirements identification, analysis, review, and learn recording requirements in the standard format of the SRS document.
- Understand the various types and levels of software testing and basic approaches of test case designing.

Course Outcomes:

- To classify the various Software Process Models
- To understand the Software Testing Concepts.
- To implement the Software Quality and Control Concepts
- To Design the Test cases and to get familiarity over Automated Testing tools

UNIT I - THE PRODUCT AND THE PROCESS

The Evolving Role of Software– Software Characteristics– Software Applications– Software: A Crisis on the Horizon?- Software Myths- Software Engineering: A Layered Technology– The Software Process– Software Process Models– The Linear Sequential Model– The Prototyping Model- The RAD Model- Evolutionary Software Process Models- Component-Based Development.

UNIT II - SYSTEM ENGINEERING AND ANALYSIS CONCEPTS

Computer-Based Systems– The System Engineering Hierarchy – Business Process Engineering: An Overview– Product Engineering: An Overview– Requirements Engineering– System Modeling– Requirement Analysis- Requirements Elicitation for Software- Software Prototyping- Specification- Specification Review.

UNIT III PRINCIPLES OF TESTING

PRINCIPLES OF TESTING: Introduction - Phases of software – Quality assurance and Quality control - Testing verification and validation - TECHNIQUES: White box - static testing - structural testing - challenges in white box testing - Black box testing.

UNIT IV - TYPES OF TESTING

TYPES OF TESTING: Integration testing - Top-Down Integration – Bottomup integration-Bi-Directional Integration - System - Integration – SYSTEM ACCEPTANCE TESTING: Functional versus Non Functional Testing - Functional System Testing - Non Functional Testing Acceptance Testing.

UNIT V - PERFORMANCE TESTING

PERFORMANCE TESTING: Introduction - Factors of governing - performance testing - Methodology for performance testing - Tools for performance testing - Process for

performance Testing – REGRESSION TESTING: Introduction - Types regression testing - Best pratice in regression testing.

TEXT/REFERENCES BOOKS

- Roger S. Pressman, (2001), “Software Engineering “, Fifth edition, McGraw-Hill Higher Education - A Division of The McGraw-Hill Companies.
- Srinivasan Desikan and Gopalasamy Ramesh, "Software Testing for Principles and Practices", Person Education,.
- William E. Perry (2006), “Effective Methods of Software Testing”, 3rd Ed, Wiley
- India.
- RenuRajani, Pradeep Oak (2007), “Software Testing”, TMH.

Course Code	BCAAIML504	Design and Analysis of Algorithms	L	T	P	C
Core/elective/Supportive			3	0	0	3
Pre - requisite		• Foundation in designing algorithms • Basic knowledge on data structural concepts			I	

Course Objectives

- To emphasize the importance of analysis of algorithms and finding the time complexity.
- To explain various algorithm design techniques

Expected Course Outcomes

1	Explain the importance of algorithm analysis and the notation used	**K2**
2	Apply the various frameworks for analyzing recursive and non-recursive algorithms to find the time complexity	**K3**
3	Illustrate the various algorithm design techniques like divide and conquer, greedy algorithms, brute force and dynamic programming	**K4**
4	Illustrate the various iterative method like Simplex Method, Maximum-Flow Problem, Maximum Matching in Bipartite Graphs, Stable marriage Problem..	**K4**
5	Compare the P,NP, NP –Complete and NP-Hard type of problems	**K4**
6	Compare algorithms by calculating their time efficiency using the prescribed framework	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	INTRODUCTION	18

Notion of Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem types– Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms

UNIT II	BRUTE FORCE AND DIVIDE-AND-CONQUER	18

Brute Force – Computing an– String Matching – Closest Pair and Convex-Hull Problems -Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort -Multiplication of Large Integers – Closest-Pair and Convex – Hull Problems.

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	19

Dynamic programming – Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem – Primes algorithm and Kruskal's Algorithm.

UNIT IV	ITERATIVE IMPROVEMENT	17

The Simplex Method – The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

UNIT V	COPING WITH THE LIMITATIONS OF ALGORITHM POWER	18
Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – Assignment problem – Knapsack Problem – Travelling Salesman Problem – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.		
Total Lecture Hours		**90Hours**
Text Book(s)		
1	AnanyLevitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.	
Reference Book(s)		
1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012	
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.	
3	Donald E. Knuth, ―The Art of Computer Programming‖, Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, ―The Algorithm Design Manual‖, Second Edition, Springer, 2008.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc.)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Advance Neural Network & Deep Learning

(BCAAIML505)

Course Objectives:

- To understand the theoretical foundations, algorithms and methodologies of Neural Network
- To design and develop an application using specific deep learning models
- To provide the practical knowledge in handling and analysing real world applications.

Course Outcomes:

- Recognize the characteristics of deep learning models that are useful to solve real-world problems.
- Understand different methodologies to create application using deep nets.
- Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
- Implement different deep learning algorithms
- Design the test procedures to assess the efficacy of the developed model.
- Combine several models in to gain better results

UNIT - I

MACHINE LEARNING BASICS: Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality

UNIT - II

DEEP LEARNING ARCHITECTURES: Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

UNIT - III

CONVOLUTIONAL NEURAL NETWORKS: Architectural Overview,Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet - Applications.TRANSFER LEARNING:Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

SEQUENCE MODELLING – RECURRENT AND RECURSIVE NETS: Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

UNIT - IV

AUTO ENCODERS: Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders,Contractive Encoders.

UNIT - V

DEEP GENERATIVE: Deep Belief networks, Boltzmann Machines,Deep Boltzmann Machine, GenerativeAdversial Networks.

Text Book(s) and Journals

- Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
- Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
- Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books

- Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
- EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
- Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
- Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
- Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

Course Code	BCAAIML506P	Machine Learning-Lab	L	T	P	C
Core/elective/Supportive			0	0	2	1

Course Objectives

- To introduce students to the concepts and techniques of Machine Learning.

Expected Course Outcomes

1	Understand the basic concepts and techniques of Machine Learning.	**K2**
2	Explain the regression methods, classification methods, clustering methods.	**K2**
3	Understand the inference and learning algorithms for the hidden Markov model.	**K2**
4	Demonstrate Dimensionality reduction Techniques	**K2**
5	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

List of Programs

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Text Book(s)

1	EthemAlpaydin, - introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

reference Book(s)

1	Jason Bell, - Machine Learning – Hands on for Developers and Technical professionals, First Edition, Wiley, 2014.
2	Peter Flach, - Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Code	BCAAIML601	Natural Language Processing	L	T	P	C
Core/elective/Supportive		Core : 10	3	0	0	3
Pre - Requisite						

Course Objectives

- To introduce the fundamental concepts and techniques of natural language processing (NLP)

Expected Course Outcomes

1	Understand the fundamental concepts and techniques of natural language processing (NLP)	**K2**
2	Understanding of the models and algorithms in the field of NLP.	**K2**
3	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	**K2**
4	Understanding semantics and pragmatics of languages for processing	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction to NLP**	**13**

Introduction: application of NLP techniques and key issues- MT grammar checkers- dictation – document generation- NL interfaces- Natural language processing key issues- the different analysis level used for NLP: morpho-lexical-syntactic-semantic-pragmatic-markup(TEI, UNICODE)-finite state automata- Recursive and augmented transition networks- open problems

UNIT II	**Lexical Level**	**14**

Lexical level: error tolerant lexical processing (spelling error correction)-transducers for the design of morphologic analyzers features-towards syntax: part-of-speech tagging (BRILL, HMM) - efficient representations for linguistic resources(lexica, grammars,….) tries and finite state automata.

UNIT III	**Syntactic Level**	**16**

Syntactic level: grammars(eg.formal/Chomsky hierarchy, DCSGs,systematic case, unification, stochastic)- parsing (top-down ,bottom up,char(early algorithm),CYK algorithm)- automated estimation of probabilistic model parameters(inside-outside algorithm)- data oriented parsing- grammar formalisms and treebanks- efficient patsing for context-free grammars(CFGs)-statistcial Parsing and probabilistic CFGs(PCFGs)-lexicilizedPCFGse.

UNIT IV	**Semantic Level**	**15**

Semantic level: logical forms- ambiguity resolution- semantic network and parsers- procedural semantics- montague semantics- vector space approaches- distributional semantics-lexical semantics and word sense disambiguation-compositional semantics semantic role labeling and sematic parsing

UNIT V	**Pragmatic LEvel**	**17**

Pragmatic level: knowledge representation- reasoning- plan/goal recognition –speech acts/intentions – belief models- discourse- reference. Natural language generation:content determination – sentence planning- surfacerealization,subjectivity and sentiment analysis: information extraction – automatic summarization- information retriveval and question answering – named entity recognition and relation extraction – IE using sequence labeling-machine transilation: basic issues in MT-statisticaltranslation-word alignment- phrase-baseed translation and synchronous grammars.

Total Lecture Hours	**75 Hours**

Text Book(s)		
1	Daniel J and James H. Martin,‖speech and language processing‖ an introduction to natural Language processing, computational linguistcs& speech recognition‖prentice hall,2009.	
Reference Book(s)		
1	Lan H Written and Elbef,MarkA.Hall,‖data mining: practical machine learning tools and techiniques‖,Morgan Kaufmann,2013	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

Course Code	BCAAIML602	Ethical Hacking	L	T	P	C
Core/elective/Supportive		-	3	1	0	4
Pre - Requisite						

Course Objectives

- To introduce the concepts of security and carious kinds of attacks
- To explain about system hacking and penetration testing

Expected Course Outcomes

1	Explain the importance of security and various types of attacks	**K2**
2	Understand the concepts of scanning and system hacking	**K2**
3	Explain about penetration testing and its methodology	**K2**
4	Identify the various programming languages used by security professional	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction To Hacking**	**18**

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools– Locating the Network Range – Meta Search Engines.

UNIT II	**Scanning And Enumeration**	**18**

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction toEnumeration – Enumeration Techniques – Enumeration Procedure – Tools.

UNIT III	**System Hacking**	**18**

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing –Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Keyloggers and Spyware.

UNIT IV	**Programming For Security Professionals**	**18**

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Toolsfor Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for IdentifyingVulnerabilities – Countermeasures

UNIT V	**Penetration Testing**	**18**

Introduction – Security Assessments – Types of Penetration Testing- Phases of PenetrationTesting– Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools.

Total Lecture Hours	**90 Hours**

Text Book(s)

1	EC-Council, ―Ethical Hacking and Countermeasures: Attack Phases‖, Cengage Learning,2010.
2	Jon Erickson, ―Hacking, 2nd Edition: The Art of Exploitation‖, No Starch Press Inc., 2008.
3	Michael T. Simpson, Kent Backman, James E. Corley, ―Hands-On Ethical Hacking andNetwork Defense‖, Cengage Learning, 2013.

Reference Book(s)

1	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing – Ethical Hackingand Penetration Testing Made Easy‖, Second Edition, Elsevier, 2013.
2	RafayBoloch, ―Ethical Hacking and Penetration Testing Guide‖, CRC Press, 2014

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
Course Designed by :		

Course Code	BCAAIML603P	Natural Language Processing-Lab	L	T	P	C
Core/elective/Supportive			0	0	2	1
Pre - Requisite						

Course Objectives

- To introduce the fundamental concepts and techniques of natural language processing (NLP)

Expected Course Outcomes

1	Understand the fundamental concepts and techniques of natural language processing (NLP)	**K2**
2	Understanding of the models and algorithms in the field of NLP.	**K2**
3	Demonstrate the computational properties of natural languages and the commonly used Algorithms for processing linguistic information.	**K2**
4	Understanding semantics and pragmatics of languages for processing	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

LIST OF PROGRAMS

1. Implementing word similarity
2. Implementing simple problems related to word disambiguation
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic Analyzer.
6. Sentiment Analysis.

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Daniel J and James H. Martin,‖speech and language processing‖ an introduction to natural language processing, computational linguistcs& speech recognition‖prentice hall,2009

Reference Book(s)

1	Lan H Written and Elbef,MarkA.Hall,‖data mining: practical machine learning tools and techiniques‖,Morgan Kaufmann,2013
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
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Course Designed by :