NOTIFICATION

No. 120 /2023 Date : 17 /08/2023

Subject: Implementation of new Syllabus of Semester III & IV of Bachelor of Engineering (Computer Science and Engineering) (Data Science) (CBCS) as per AICTE model Curriculum.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new Syllabus of Semester III & IV of Bachelor of Engineering (Computer Science and Engineering) (Data Science) (CBCS) as per AICTE Model Curriculum to be implemented from the academic session 2023-2024 onwards as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

Syllabus Prescribed for Semester III & IV of Computer Science and Engineering (Data Science) (CBCS)

SEMESTER III

3KD01/3KS01 ENGINEERING MATHEMATICS - III [L-3 , T-1, C-4]

Course Objectives:

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Apply Laplace transform to find solution of linear differential equations. And solve problems related to Fourier Transform
- Compute and interpret the correlation coefficient.
- Compute the Analytic function and Complex Analysis.
- Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and linear differential equations.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Demonstrate the basic concepts of probability and statistics.
5. Apply the knowledge of Complex Analysis.
6. Apply the knowledge of vector calculus to solve physical problems.

SYLLABUS:

UNIT-I: Ordinary differential equations: **(Hours: 07)**

Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variation of parameters, Cauchy's and Legendre's linear differential equations.

UNIT-II: Laplace Transform: **(Hours: 07)**

Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function.

UNIT-III: **(Hours: 07)**

a) Applications of Laplace Transform: Solution of Linear differential equations, Simultaneous differential equation by Laplace transform method

b) Fourier Transform: Definition, standard forms, Fourier transforms, properties of Fourier transforms, Convolution theorem, Fourier sine and Fourier cosine transforms and integrals, inverse Fourier transforms.

UNIT-IV: **(Hours: 07)**

a) Partial differential equation of first order of following form:- (i)f (p,q) = 0; (ii) f (p,q,z) = 0; (iii) f (x, p) = g (y,q); (iv) P p + Qq = R (Lagranges Form); (v) z = px + qy + f(p,q) (Clairauts form)

b) Statistics Curve fitting: Least Square Method, Coefficient of Correlations, Lines of Regression.

UNIT-V: Complex Analysis: **(Hours: 07)**

Functions of complex variables, Analytic function, Cauchy- conditions, Harmonic function, Harmonic conjugate functions, Milne's Method, conformal mappings (translation, rotation, magnification and bilinear transformation), Expansion of function in Taylor's and Laurent's series.

UNIT–VI: Vector calculus: **(Hours: 07)**

Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion Formulae (without proof), line, surface, volume integrals, ir-rotational Solenoidal Vector fields.

Text Books:

1. Elements of Applied Mathematics Vol. II by P. N. Wartikar and J.N. Wartikar,
2. Higher Engg. Mathematics by B.S. Grewal.

Reference Books:

1. Advancing Engg. Mathematics by E.K.Kreyzig.
2. A text book of Differential Calculus by Gorakh Prasad.
3. A Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
4. Engineering Mathematics by Ravish R Singh, Mukul Bhatt.

3KD02 / 3KS02 DISCRETE STRUCTURE AND GRAPH THEORY [L-3 , T-0, C-3]

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3.. Apply logical reasoning to solve a variety of problem

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Perform operation on trees data structures.
6. Develop the given problem as graph networks and solve with techniques of graph theory

Unit I: The Foundations: Logic and Proofs **(Hours: 8)**

Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments.

Unit II: Sets, Functions and Relation **(Hours: 8)**

Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations ,Functions, Inverse Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations.

Unit III: Algebraic Structures **(Hours: 8)**

Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.

Unit IV: Boolean Algebra **(Hours: 7)**

Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.

Unit V: Tree **(Hours: 7)**

Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, Inorder Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree

Unit VI: Graph **(Hours: 7)**

Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings;

Text Books:

[1] Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.
[2] J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.

Reference Books:

[1] Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
[2] Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
[3] C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill

3KD03/3AD03 - PROGRAMMING METHODOLOGYUSING PYTHON [L-3 , T-0, C-3]

Course Prerequisite: Programming fundamentals

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Programming Methodology using Python by being able to do each of the following:

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Indicate the use of modules, packages and built-in functions to navigate the file system.
- Infer the Object-oriented Programming concepts in Python.
- To develop the ability to write database applications in Python.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:

1. Apply various fundamentals for problem solving using python
2. Develop proficiency in creating applications using the Python programming Language.
3. Understand the various data structures available in Python programming language and apply them in solving computational problems.
4. Draw various kinds of plots.

Unit I: Introduction: (08 Hrs)
Basic concepts of Python-Variables-Data types- Operators-Conditional Statements Looping-Control Statements If-If else-Nested If else-Looping Statements- for-while nested loop-Control Statements.

Unit II :Strings and Functions: (08 Hrs)
String Manipulation-Accessing Strings- Basic Operations-String slices- Function and Methods- Functions Defining a function- Calling a function- Types of functions Function Arguments-Anonymous functions- Global and local variables.

Unit III: Data Structures in Python: (08 Hrs)
Lists-Introduction -Accessing list-Operations-Working with lists -Function and Method Tuple-Introduction Accessing-Tuples-Operations- Working-Functions and Methods Dictionaries-Introduction- Accessing values in dictionaries- Working with dictionaries Properties-Functions.

Unit IV : Classes and objects: (08 Hrs)
Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Built-in Class Attributes, Inheritance- Overloading- Overriding- Data hiding

Unit V :Modules and Packages: (08 Hrs)
Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages.

Unit VI : Working with Data in Python: (08 Hrs)
Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions Loading Data with Pandas-Numpy.

Text Book: Martin C Brown, "Python: The Complete Reference", Mc-Graw Hill.

Reference Books:

1. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, ISBN- 1717410588, 9781717410580, 2018
2. Nicholas Ayden, "Python Programming", Independently Published, First Edition, ISBN- 1707051933, 9781707051939, 2019.
3. MichałJaworski, Tarek Ziadé, "Expert Python Programming", Packt Publishing Ltd., Third Edition, ISBN-9781789808896, 2019.

3KD04/ 3KS04DATA STRUCTURES [L-3 , T-0, C-3]

Course Pre-requisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:
- To understand the linear and nonlinear data Structures and its memory representations.
- To perform different operations on data structures such as insertion, deletion, searching and traversing.
- To understand various data searching and sorting methods with its complexity.
- To introduce various techniques for representation of the data in the real world.

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

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

Unit I: Introduction to Data Structures: (Hours 7)
Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity ofalgorithms. String processing: storing strings, character data type, string operations, wordprocessing, and pattern matching algorithms.

Unit II: Array& Record Structure: (Hours 7)
Linear arrays: Memory Representation of arrays, traversing linear arrays, insertion & deletionoperations, Bubble sort, Linear search and Binary search algorithms. Multi-dimensional arrays,Pointer arrays. Record structures.

Unit III: Linked lists: (Hours 7)
Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linkedlist. Memory allocation & garbage collection. Insertion & deletion operations on linked lists.Header linked lists, Two- way linked lists.

Unit IV: Stack & Queue: (Hours 7)
Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation.Quick sort, Recursion, Tower of Hanoi. Queues: Sequential Memory Representation of Queue,DeQueue, Priority queues.

Unit V: Trees: (Hours 7)
Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binarytrees, Header nodes, Binary Search Tree, Heap and heap sort, Path length & Huffman'salgorithm.

Unit VI: Graphs & Sorting Algorithms: (Hours 7)
Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations onGraphs, Breadth First Search, Depth First Search. Sorting : Insertion Sort, Selection Sort, Radixsort, Merge Sort.

Text Books:
1. Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:
1. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.
2. Data Structure Using C, Balagurusamy
3. Standish: Data Structures in Java, Pearson Education.

3KD05 / 3KS05 ANALOG& DIGITAL ELECTRONICS [L-3 , T-0, C-3]

Course Prerequisite: Basic Physics.

Course Objectives:
- To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
- To understand number systems and conversion between different number systems.
- To get basics knowledge about digital ICs and digital systems.
- To study the design of combinational circuits and sequential circuits

Course Outcomes:
At the end of course students will able to:
1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: Diode and Characteristics: **(Hours 7)**
PN-Junction Diode, Characteristics and Parameters, Zener Diode, Zener Diode as voltageregulator, Light Emitting Diode characteristics, Seven Segment Display, Photo Diode, PIN Diode

Unit II: Transistors and Characteristics: **(Hours 7)**
Transistors and their Types (PNP, NPN), Transistor as an amplifier, BJT operation, BJT Voltagesand Currents, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics,Common- Collector Characteristics, Transistor testing.

Unit III: Number System: **(Hours 7)**
Binary Number System, Signed and unsigned Number, Octal Number System, HexadecimalNumber System, Conversions between Number Systems, r's and (r-1)'s ComplementsRepresentation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code andAlpha numeric codes.

Unit IV: Minimization Techniques: **(Hours 7)**
Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, ReducingBoolean Expression, Boolean Functions and their representation, SOP Form, POS Form,Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey MinimizationTechnique (up to 5 variable).

Unit V: Combinational Circuits: **(Hours 7)**
Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits: **(Hours 7)**
Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: A synchronousand Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:
1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:
1. Millman &Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra& Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004

3KD06 / 3AD06 PROGRAMMING METHODOLOGY USING PYTHON LAB [P-2 , C-1]

Course Prerequisite: Basics of programming Language

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Programming Methodology using Python Lab by being able to do each of the following:

- Interpret the use of procedural statements like assignments, conditional statements, loops and function calls. Learn the syntax and semantics and create the functions in Python.
- Infer the supported data structures like lists, dictionaries and tuples in Python.
- Illustrate the application of matrices and regular expressions in building the Python programs.
- Discover the use of external modules in creating excel files and navigating the file systems.
- Describe the need for Object-oriented programming concepts in Python.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:

1. Apply the Python language syntax including control statements, loops and functions.
2. Understand the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.
3. Interpret the concepts of Object-oriented programming as used in Python
4. Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems.

List of Experiments:
Minimum **12** Experiments based on each concepts are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi:

1. Write a program to understand basic Python interpreter
2. Write a program to perform String Manipulation and Functions
3. Write a program to implement Python Data structures
4. Implement Classes and Objects using Python
5. Design a program to understand Overloading in Python
6. Design a program to understand Overriding in Python
7. Implement Inheritance using Python
8. Develop a Python code for Information hiding
9. Implement Python's Modules and Packages
10. Writ a program to illustrate concept of File handling
11. Write a code to load Data with library such as Pandas-Numpy.

Text Book: Martin C Brown, "Python: The Complete Reference", McGraw Hill

Reference Books:

1. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, ISBN- 1717410588, 9781717410580, 2018
2. Nicholas Ayden, "Python Programming", Independently Published, First Edition, ISBN- 1707051933, 9781707051939, 2019.
3. Michał Jaworski, Tarek Ziadé, "Expert Python Programming", Packt Publishing Ltd., Third Edition, ISBN- 9781789808896, 2019.

3KD07 / 3KS07 DATA STRUCTURE LAB [P-2 , C-1]

Course Pre-requisite: Basics of programming Language & Logic Building Skills

Course Objectives:

- To understand the linear and nonlinear data Structures and its memory representations.
- To perform different operations on data structures such as insertion, deletion, searching and traversing.
- To understand various data searching and sorting methods with its complexity.
- To introduce various techniques for representation of the data in the real world.

Course Outcomes:

On completion of the course, the students will be able to:

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures.
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi.

1. Write a program to find out largest number from the array and also find it's location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b) delete an element from an array.
4. To study and execute the Linear search method.
5. To study and execute the Binary Search method.
6. To study and execute the Pattern matching Algorithms (Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list.
    a. Traversing the linked list.
    b. Insert a node at the front of the linked list.
    c. Delete a last node of the linked list.
    d. Searching a Linked list.
9. To study and implement following operations on the doubly linked list.
    a. Insert a node at the front of the linked list.
    b. Insert a node at the end of the linked list.
    c. Delete a last node of the linked list.
    d. Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
    a. Insert a node at the end of the linked list.
    b. Insert a node before specified position.
    c. Delete a first node of the linked list.
    d. Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversing operations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a number using Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.
20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KD08 / 3KS08 ANALOG & DIGITAL ELECTRONICS LAB [P-2 , C-1]

Course Pre-requisite: Students should have the knowledge of Basic Physics.

Course Objectives:
- To impart the concepts of analog and digital electronics practically.
- To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
- To learn the operation of various logic gates and their implementation using digital IC's.
- To learn the realization of various combinational and sequential circuits.

Course Outcomes:
After successfully completing the lab, the students will be able to:
1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:
This is a sample list of Experiments; **minimum 10 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m , r and μ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, d 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.
13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiments beyond syllabus:
1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of A stable multi-vibrator using IC 555.

3KD09 / 3KS09 C SKILL - LAB - I [P-2 , C-1]

(Based on technology like -Python/Django etc. to be decided by Individual Dept. of respective College)

Course Prerequisite: Basic knowledge of any Programming Language

Course Objectives:
- To be able to program design with functions using Python.
- To understand data and information processing techniques.
- To understand to Design a program to solve the problems.
- To be able to access database using python programming.
- To be able to design web applications using python programming.

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

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017".
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function (with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.
23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books:

1. "Core Python Programming", R. NageswaraRao, dreamtech press.
2. "Python Programming A Modular Approach With Graphics, Database, Mobile and WebApplications", SheetalTaneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition,
6. Shroff/O'Reilly Publishers
7. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
8. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley
9. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

SEMESTER IV

4KD01 / 4KS01 ARTIFICIAL INTELLIGENCE [L-3, T-0 , C-3]

Course Pre-requisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:

- To present an overview of Artificial Intelligence (AI) principles and approaches.
- To understand the historical evolution of Artificial Intelligence.
- To learn various searching techniques and identify to address a particular problem.

Course Outcomes:

On completion of the course, the students will be able to:

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.
4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI **(Hours: 07)**
Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI, **Intelligent Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI: **(Hours: 07)**
Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies: **(Hours: 06)**
Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies: **(Hours: 07)**
Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis.

Unit V: Adversarial Search & Games: **(Hours: 07)**
Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge: **(Hours: 06)**
Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering.

Text Books:
1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:
1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by Rajendra Akerkar (PHI Learning Pvt. Ltd.)

4KD02 / 4KS02 DATA COMMUNICATION AND NETWORKING [L-3, T-0 , C-3]

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Data Communication and Networking by being able to do each of the following:

- Study the basic taxonomy and terminology of the digital communication system & computer networking and enumerate the layers of OSI model and TCP/IP model.
- Acquire knowledge of Application layer paradigms and protocols.
- Study Transport layer design issues, Transport layer services, and protocols.
- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study data link layer concepts, design issues, and protocols.
- Study various network security issues and firewalls.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:

1. Describe the functions of each layer in OSI and TCP/IP model.
2. Describe the Transport layer and Transport layer services.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Explain the functions of Application layer and Presentation layer paradigms and Protocols.
5. Describe the functions of data link layer and explain the protocols.
6. Explain the types of transmission media with real time applications.

Unit I :Introduction to Data Communication **(Hours:7)**
Introduction Data Communication Components, Networks, Network types: Local Area Network,Wide Area Network, Switching. The Internet, Accessing the Internet, Standards andAdministration: Internet Standard Internet Administration, Network Models TCP/IP Protocol Suite,The OSI Model.

Unit II: Guided &Unguided Media, Switching and Data Link Layer **(Hours: 7)**

Transmission media introduction, Guided median & Unguided media-Wireless. SwitchingIntroduction, Circuit Switch Networks Packet Switching Data Link Layer: Introduction, Nodes &Links, Services, Two categories of link, Two sub-layers, Error detection and correction:Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control:DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control(MAC) Random Access, Controlled Access, Channelization.

Unit III: Network Layer **(Hours: 7)**

Introduction to Network layer Network Layer Services: Packetizing. Routing and Forwarding,Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-CircuitApproach: Connection-Oriented Service, Network Layer performance: Delay, Throughput, PacketLoss, Congestion Control, IPV4 Address: Address Space, Classful Addressing. ClasslessAddressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT),Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label,Routers as packet Switches.

Unit IV: Network Layer Protocol **(Hours: 7)**

Network Layer Protocols: Internet Protocol (IP), Datagram Format, Fragmentation, Security of IPv4Datagrams, ICMPV4: Messages, Debugging Tools, ICMP Checksum Mobile IP: Addressing.Agents, Three Phases, Inefficiency in Mobile IP Routing algorithms: Distance Vector routing, LinkState Routing, IPV6 Addressing Representation, Address Space, Address Space Allocation, Autoconfiguration. Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses.

Unit V: Transport Layer **(Hours: 7)**

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless andConnection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-WaitProtocol, Go-Back-N Protocol (GBN). Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking. User Datagram Protocols: User Datagram, UDP Services, UDP Applications,Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, StateTransition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCPTimers, Options, SCTP: SCTP Services, SCTP Features.

Unit VI: Application layer **(Hours: 7)**

Introduction to Application layer: Providing Services. Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication,World wide web and HTTP World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: TwoConnections, Control Connection, Data Connection, Security for FTP, Electronic Mail:Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS) Name Space, DNSin the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security ofDNS.

Text Books:

1. Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH)
2. James F. Kurose & K W Ross: Computer Networking, Pearson Education (LPE)

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. Douglas E. Comer: Computer Network & Internet, Addison Wesley.
4. Andrew S. Tanenbaum: Computer Networks, PHI (5E)
5. Leon Garcia & Widjaja: Communication Networks, TMH

4KD03 / 4KS03 OPERATING SYSTEM [L-3, T-0 , C-3]

Course Pre-requisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:

- To make students aware of the kernel and shell structure of the operating systems.
- To make students aware of the purpose, structure and functions of operating systems
- To equip students with understanding of the various scheduling algorithms in OS.
- To make students aware of understanding of memory management in different OS.

Course Outcomes:

On completion of the course, the students will be able to:

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS: **(Hours: 07)**

Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling: **(Hours: 07)**
Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization: **(Hours: 06)**
Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management: **(Hours: 07)**
Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System: **(Hours: 07)**
File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System: **(Hours: 06)**
I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book : Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:
1. A.S.Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt. Ltd.

4KD04 - PROBABILITY & STATISTICAL MODELLING

Course pre-requisite: Basics Mathematics and Statistics

Course Objective:
- Understand and apply probability concept.
- Learn foundational concepts and applications of probability theory and common probability distributions.
- Understand and apply measures of central tendency, dispersion, correlation, and regression analysis in statistical analysis.
- Compute and interpret the correlation coefficient.
- Understand the computational details behind certain numerical methods.
- Gain proficiency in interpolation methods and numerical techniques for solving first-order differential equations.

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

1. Understand the collection of the data, condensation, and summarization into a compact form.
2. Apply probability axioms, analyze distributions, calculate conditional probabilities, and understand the central limit theorem.
3. Understand and compute measures of central tendency, dispersion, correlation, and regression for data analysis.
4. Apply numerical methods for curve fitting using least squares, including fitting straight lines and higher-degree curves.
5. Utilize numerical methods such as Newton-Raphson, false position, Gauss elimination, Gauss-Jordan, Gauss-Seidel, and matrix operations for solving equations and eigenvalue computations.
6. Apply interpolation techniques and numerical methods to solve differential equations accurately and efficiently.

Unit: I (Sample Space and Events): Meaning of experiment, random experiment, deterministic and non-deterministic models. Definition of the term: Outcome, sample space (finite and infinite), discrete sample space, Elementary event, Compound event, Complementary event, Favorable event, Equality-likely events, Sure event, Impossible event. Concept of Occurrence of an event, Union, and Intersection of two or more events, Exhaustive events, mutually exclusive events, Representation of sample space and events by Venn diagram, Occurrence of (i) at least one of the given events (ii) all of the events (iii) none of the given events, Example and problem.

Unit: II: Axioms of Probability, centre limit theorem, conditional probability, Bayes' rule, Bernoulli trials, probability mass function, continuous random variable, probability density function, probability distributions: Binomial distribution, Poisson distribution, normal distribution.

Unit: III: Measure of central tendency: Moments, Expectation, dispersion, skewness, kurtosis, expected value of two-dimensional random variable, Linear Correlation, correlation coefficient, rank correlation coefficient, Regression, Line of Regression.

Unit: IV: Curve fitting by the numerical method: Curve fitting by of method of least squares, fitting of straight lines, second degree parabola and more general curves.

Unit: V : Solution of Equation and Eigen value problem: Newton Raphson method, false position method, Gauss elimination, Gauss Jordan, Gauss Seidel, Matrix Inversion by Gauss Jordan method, Eigen value of a matrix by power method.

Unit: VI: Interpolation: Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation.

Numerical Solution of First order differential equation: Picard's method, Taylor series, Euler's Method, Modified Euler's Method, Runge-Kutta Method of fourth order.

Text Books:

1. Programmed Statistics, by Agarwal, B. I., 3rd Edition, New Age International Publisher, New Delhi.
2. Introductory Methods of Numerical Methods, by S. S. Shastri, PHI, Vol 2.

Reference Books:

1. Fundamental of Mathematical Statistics by Gupta S. C. and Kapoor V. K. (2019)
2. Numerical Methods for Scientific and Engineering Computation' by M. K. Jain, S. R., K. Iyengar, R. K. Jain
3. Introductory Probability and Statistical Application, by Myer P. I. (1970), Oxford & amp; IBH Publishing, New Delhi.

4KD05 / 4KS05 THEORY OF COMPUTATION [L-3, T-1 , C-4]

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:

- To understand different automata theory and its operation.
- To understand mathematical expressions for the formal languages
- To study computing machines and comparing different types of computational models
- To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes:

On completion of the course, the students will be able to:

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler.
4. To construct and analyze Push Down, Turing Machine for formal languages.
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines: (Hours: 8)

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA(Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFAand DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA,Minimization Of DFA, Minimization of Finite Automata (Construction of Minimum Automaton).

Unit II: Finite Automata with output and Regular Expression: (Hours: 8)

Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore andMealy Machines. Definition and Identities of Regular Expressions, Construction of RegularExpression of the given Language, Construction of Language from the RE.

Unit III: Regular Language and Regular Grammar: (Hours: 8)

Conversion of FA to RE using Arden‟s Theorem, Inter-conversion RE to FA, Pumping Lemmafor RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG(RLG and LLG) and FA.

Unit IV: Context Free Grammar and Languages: (Hours: 8)

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages,Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit V: Pushdown Automata: (Hours: 8)

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit VI: Turing Machines and Decidability and Un-Decidability: (Hours: 8)
Formal definition of a Turing Machine, Design of TM, Variants of Turing Machines: Multi-tapeTuring machines, Universal Turing Machine. Decidability of Problems, Halting Problem of TM,Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursivee numerable languages.

Text Books:
1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation.
2. Peter Linz: An Introduction to Formal Languages and Automata.

Reference Books:
1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013.

4KD06 / 4KS06 DATA COMMUNICATION & NETWORKING LAB [P-2, C-1]

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:
- To understand the working principle of various communication protocols
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To evaluate the errors using various error detection & correction techniques.
- To understand network-based protocols in data communication and networking.

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

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks.

List of Experiments:
This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi.

1. To study various LAN topologies and their creation using network devices, cables and computers.
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum.
7. Write a program to implement Sliding window.
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LA and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN(TCP/IP Configuration)

4KD07 / 4KS07 OPERATING SYSTEM LAB [P-2, C-1]

Course Pre-requisite: Basic computer programming

Course Objectives:
- To make students aware of the kernel and shell structure of the operating systems.
- To make students aware of the purpose, structure and functions of operating systems
- To equip students with understanding of the various scheduling algorithms in OS.
- To make students aware of understanding of memory management in different OS.

Course Outcomes:
On completion of the course, the students will be able to:
1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems.

List of Experiments:
This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi:

1. To study Linux Operating System along with its installation.
2. To Study and Execute basic file commands and process related open source Ubuntu commands
    a. Commands to view all executing, block and suspended process.
    b. Command to check and change the priority of process CPU utilization for executing processes.
    c. Commands to check for child process, sub-processes, process tree, abort & end process and all other basics commands related to processes.
3. Write a program for multithreading using C.
4. To simulate First Come First Serve & Shortest Job First process scheduling algorithm.
5. To simulate Shortest Job First process scheduling algorithm
6. To simulate Pre-emptive Shortest Job First process scheduling algorithm
7. To implement Round Robin Process scheduling Algorithm
8. To implement Priority Based Process scheduling Algorithm
9. To implement and analyze multi-level queue scheduling algorithm
10. To implement the following file allocation strategies.
11. To simulate paging technique of memory management.
12. To implement the FIFO page replacement policy
13. To implement the LRU page replacement policy
14. To implement the optimal page replacement policy
15. To simulate producer-consumer problem using semaphores.
16. To implement Dining-Philosophers problem to deal with concurrency control mechanism.
17. To implement contiguous memory allocation strategies to detect fragmentation using: First Fit, Best Fit and Worst Fit.
18. To implement FCFS Disk Scheduling algorithm
19. To implement SCAN Disk Scheduling algorithm
20. To implement C-SCAN Disk Scheduling algorithm
21. To simulate Banker's algorithm for deadlock avoidance
22. To implement following memory management techniques
23. Implement MVT and MFT where memory block size is 100 for 5 processes. Enter no. of blocks for each process and calculate internal fragmentation.
24. To simulate LFU page replacement algorithms
25. To simulate the Single level directory file organization techniques.
26. To Simulate bankers algorithm for Dead Lock Avoidance (Banker's Algorithm)

4KD08 PROBABILITY & STATISTICAL MODELLING- LAB

Practicals based on subject 4KD04Probability &Statistical Modelling using ADaMSoft, ADMB,Fityk, GNU Octave, jamovi, JASP, JMulTi, KNIME ,MondrianOpenEpi, OpenNN, Pandas &Simfit tools.

4KD09 / 4KS09 C-SKILL-LAB II [P-2, C-1]

(Based on technology like -PHP, Web Technology, Raspberry Pi/Ardino, etc. to be decided by Individual Dept. of respective College)

Course Pre-requisite:
Basic knowledge of scripting language, Programming language. Basic understanding of Electronic concepts.

Course Objectives:
To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes:
On completion of the course, a student will be able to:
1. Develop client server program and web applications.
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:
This is a sample list of experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi:

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)

5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find
13. the transpose of a matrix.
14. Write a PHP program to sort the student records which are stored in the database using selection sort.
15. Study and Install IDE of Arduino and different types of Arduino.
16. Write program using Arduino IDE for Blink LED.
17. Write Program for RGB LED using Arduino.
18. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
19. Study and Implement RFID, NFC using Arduino. Study and implement MQTT protocol using Arduino.
20. Study and Configure Raspberry Pi.
21. WAP for LED blink using Raspberry Pi.
22. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
23. Create Smart Plugs with Arduino and Raspberry Pi.
24. Interfacing digital sensors with raspberry pi.
25. Creating a webpage to control I-O devices, reading data from sensor and passing to web page.
26. Implement a program to access Analog sensor via wifi with HTML Web server.

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