JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF CSE - COMPUTER SCIENCE & BUSINESS SYSTEMS

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. Tech - COMPUTER SCIENCE & ENGINEERING with Specialization

Common to

(i) CSE (COMPUTER SCIENCE & BUSINESS SYSTEMS) – Branch Code: 48
(ii) COMPUTER SCIENCE & BUSINESS SYSTEMS - Branch Code: 57

(Applicable for batches admitted from 2020-2021)

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II Year – I SEMESTER

S. No	Course Code	Course Title	L	T	P	C
1.	BSC2101	Mathematics – III	3	0	0	3
2.	PCC2101	Mathematical Foundations of Computer Science	3	0	0	3
3.	PCC2102	Data Structures	3	0	0	3
4.	PCC2103	Formal Languages & Automata Theory	3	0	0	3
5.	PCC2104	Computer Organization& Architecture	3	0	0	3
6.	PCC2105	Data Structures Lab	0	0	3	1.5
7.	PCC2106	Computer Organization& Architecture Lab	0	0	3	1.5
8.	PCC2107	R programming Lab	0	0	3	1.5
9.	SCC2101	Free and Open Source Software	0	0	4	2
10.	MC2101	Essence Of Indian Traditional Knowledge	2	0	0	0
TOTAL						**21.5**

II Year – II SEMESTER

S. No.	Course Code	Course Title	L	T	P	C
1.	ESC2201	Java Programming	3	0	0	3
2.	BSC2201	Probability and Statistics	3	0	0	3
3.	PCC2201	Operating Systems	3	0	0	3
4.	PCC2202	Database Management System	3	0	0	3
5.	HSMC2201	Fundamentals of Economics	3	0	0	3
6.	ESC2202	Java Programming Lab	0	0	3	1.5
7.	PCC2203	OS&UNIX Programming Lab	0	0	3	1.5
8.	PCC2204	Database Management System Lab	0	0	3	1.5
9.	SC2201	Android Application Development	0	0	4	2
TOTAL						**21.5**
	Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)		4	0	0	4
	Internship 2 Months (Mandatory) during summer vacation					

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II Year - I Semester		L	T	P	C
		3	0	0	3
MATHEMATICS - III (BSC2101)					

Course Objectives:

- To familiarize the techniques in partial differentialequations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real worldapplications.

Course Outcomes:

At the end of the course, the student will be able to

- Interpret the physical meaning of different operators such as gradient, curl and divergence(L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations(L3)
- Find or compute the Fourier series of periodic signals(L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms(L3)
- Identify solution methods for partial differential equations that model physical processes(L3)

UNIT I: Vector calculus:

Vector Differentiation: Gradient – Directional derivative – Divergence – Curl – Scalar Potential. Vector Integration: Line integral – Work done – Area – Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

UNIT II: Laplace Transforms:

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III: Fourier series andFourierTransforms:

Fourier Series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet'sconditions – Even and odd functions – Change of interval – Half-range sine andcosine series.Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties – inverse transforms – FiniteFourier transforms.

UNIT IV: PDE of first order:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

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UNIT V: Second order PDE and Applications:

Second order PDE: Solutions of linear partial differential equations with constantcoefficients –RHS term of the type e^{ax+by},sin(ax + by), cos(ax + by), $x^m y^n$.

Applications of PDE: Method of separation of Variables – Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, KhannaPublishers.
2) B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition,Wiley-India.
2) Dean. G. Duffy, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3) Peter O' Neil, Advanced Engineering Mathematics,Cengage.
4) Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

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II Year – I Semester		L	T	P	C
		3	0	0	3
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE(PCC2101)					

Course Objectives:

This course is designed to:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computerscience

Course Outcomes:

At the end of the course student will be able to

- Demonstrate skills in solving mathematical problems
- Comprehend mathematical principles and logic
- Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software
- Manipulate and analyze data numerically and/or graphically using appropriate Software
- Communicate effectively mathematical ideas/results verbally or in writing

UNIT I

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT II

Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

UNIT III

Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime

Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler'sTheorems

UNIT IV

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous RecurrenceRelations.

UNIT V

Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

Text Books:

1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGrawHill.
2) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGrawHill.

Reference Books:

1) Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall ofIndia.
2) Discrete Mathematical Structures, BernandKolman, Robert C. Busby and Sharon Cutler Ross,PHI.
3) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGrawHill.

e-Resources:

1) https://nptel.ac.in/courses/106/106/106106094/

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II Year – I Semester		L	T	P	C
		3	0	0	3
DATA STRUCTURES (PCC2102)					

Course Objectives:

The objective of the course is to

- Introduce the fundamental concept of data structures and abstract datatypes
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

Course Outcomes:

After completing this course a student will be able to:

- Summarize the properties, interfaces, and behaviors of basic abstract data types
- Discuss the computational efficiency of the principal algorithms for sorting &searching
- Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs

UNIT I

Data Structures - Definition, Classification of Data Structures, Operations on DataStructures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity.

Searching - Linear search, Binary search, Fibonacci search.

Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.

UNITII

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation ,Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.

UNIT III

Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues-Circular Queues, Deques, Priority Queues, Multiple Queues.

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.

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UNIT IV

Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion andRotations.

UNIT V

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims &Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.

Text Books:

1) Data Structures Using C. 2nd Edition.ReemaThareja,Oxford.
2) Data Structures and algorithm analysis in C, 2nd ed, Mark AllenWeiss.

Reference Books:

1) Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, UniversitiesPress.
2) Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, BehrouzA. Forouzon, Cengage.
3) Data Structures with C, Seymour LipschutzTMH

e-Resources:

1) http://algs4.cs.princeton.edu/home/
2) https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

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II Year – I Semester		L	T	P	C
		3	0	0	3
FORMAL LANGUAGES AND AUTOMATA THEORY (PCC2103)					

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars andLanguages
- To understand the relation between Regular Language and Finite Automata andmachines
- To learn how to design Automata's and machines as Acceptors, Verifiers and Translators
- To understand the relation between Contexts free Languages, PDA andTM
- To learn how to design PDA as acceptor and TM asCalculators

Course Outcomes:

By the end of the course students can

- Classify machines by their power to recognize languages.
- Summarize language classes & grammars relationship among them with the help of Chomsky hierarchy
- Employ finite state machines to solve problems incomputing
- Illustrate deterministic and non-deterministic machines
- Quote the hierarchy of problems arising in the computerscience

UNIT I

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT II

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, InterConversion.

UNIT III

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

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UNIT IV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of PushdownAutomata.

UNIT V

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

Text Books:

1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson,2008
2) Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishraand N. Chandrasekharan, 3rd Edition, PHI, 2007

Reference Books:

1)Elements of Theory of Computation, Lewis H.P. &Papadimition C.H., Pearson/PHI
2)Theory of Computation, V. Kulkarni, Oxford University Press,2013
3)Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill,2014

e-Resources:

1) https://nptel.ac.in/courses/106/104/106104028/

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II Year – I Semester		L	T	P	C
		3	0	0	3
COMPUTER ORGANIZATION & ARCHITECTURE(PCC2104)					

Course Objectives:

The course objectives of Computer Organization are to discuss and make student familiar with the

- Principles and the Implementation of ComputerArithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle andBusses
- FundamentalsofdifferentInstructionSetArchitecturesandtheirrelationshiptothe CPU Design
- Memory System and I/OOrganization
- Principles of Operation of Multiprocessor Systems andPipelining

Course Outcomes:

By the end of the course, the student will

- Develop a detailed understanding of computer systems
- Cite different number systems, binary addition and subtraction, standard, floating-point, and microoperations
- Develop a detailed understanding of architecture and functionality of central processing unit
- Exemplify in a better way the I/O and memory organization
- Illustrate concepts of parallel processing, pipe lining and inter processor communication

UNIT I

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

UNIT II

Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

UNIT III

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

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Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

UNIT IV

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

UNIT V

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipe lining, Instruction Pipeline, RISC Pipeline, Array Processor.

Text Books:

1) Computer System Architecture, M. Morris Mano, Third Edition, Pearson,2008.
2) Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5/e, McGraw Hill,2002.

Reference Books:

1) Computer Organization and Architecture, William Stallings, 6/e, Pearson,2006.
2) Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson,2005.
3) Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006.

e- Resources:

1) https://nptel.ac.in/courses/106/105/106105163/
2)http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf

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II Year – I Semester		L	T	P	C
		0	0	3	1.5
DATA STRUCTURES LAB(PCC2105)					

Course Objectives:

The objective of this lab is to

- Demonstrate procedural and object oriented paradigm with concepts of streams, classes, functions, data andobjects.
- Understand dynamic memory management techniques using pointers, constructors, destructors,etc
- Demonstrate the concept of function overloading, operator overloading, virtual functions and polymorphism,inheritance.
- Demonstrate the different data structuresimplementation.

Course Outcomes:

By the end of this lab the student is able to

- Use basic data structures such as arrays and linked list.
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
- Use various searching and sorting algorithms.

Exercise1:

Write recursive program which computes the n^{th}Fibonacci number, for appropriate values of n. Analyze behavior of the program Obtain the frequency count of the statement for various values of n.

Exercise 2:

Write recursive program for the following

a) Write recursive and non recursive C program for calculation of Factorial of an integer

b) Write recursive and non recursive C program for calculation of GCD (n,m)

c) Write recursive and non recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

Exercise 3:

a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a givenlist.

b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a givenlist.

c) Write C program that use both recursive and non recursive functions to perform Fibonacci search for a Key value in a givenlist.

Exercise 4:

a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order

b) Write C program that implement Quick sort, to sort a given list of integers in ascending order

c) Write C program that implement Insertion sort,to sort a given list of integers in ascending order

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Exercise 5:

a) Write C program that implement heap sort, to sort a given list of integers in ascending order
b) Write C program that implement radix sort, to sort a given list of integers in ascending order
c) Write C program that implement merge sort, to sort a given list of integers in ascending order

Exercise 6:

a) Write C program that implement stack (its operations) usingarrays
b) Write C program that implement stack (its operations) using Linkedlist

Exercise 7:

a) Write a C program that uses Stack operations to Convert infix expression into postfix expression
b) Write C program that implement Queue (its operations) usingarrays.
c) Write C program that implement Queue (its operations) using linkedlists

Exercise 8:

a) Write a C program that uses functions to create a singly linkedlist
b) Write a C program that uses functions to perform insertion operation on a singly linkedlist
c) Write a C program that uses functions to perform deletion operation on a singly linkedlist

Exercise 9:

a) Adding two large integers which are represented in linked listfashion.
b) Write a C program to reverse elements of a single linkedlist.
c) Write a C program to store a polynomial expression in memory using linkedlist
d) Write a C program to representation the given Sparse matrix usingarrays.
e) Write a C program to representation the given Sparse matrix using linkedlist

Exercise10:

a) Write a C program to Create a Binary Tree ofintegers
b) Write a recursive C program for Traversing a binary tree in preorder, inorder andpostorder.
c) Write a non recursive C program for Traversing a binary tree in preorder, inorder andpostorder.
d) Program to check balance property of atree.

Exercise 11:

a) Write a C program to Create aBST
b) Write a C program to insert a node into aBST.
c) Write a C program to delete a node from aBST.

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II Year – I Semester		L	T	P	C
		0	0	3	1.5
COMPUTER ORGANIZATION & ARCHITECTURE LAB (PCC2106)					

Course Objectives:

Upon completion of the Course, the students will be able to:

- Know the characteristics of various components.
- Understand the utilization of components

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Solve elementary problems by assembly language programming
- Implement assembly language program for given task for 8086 microprocessor.

List of Experiments:

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Design a JK Flip-Flop, Edge triggered J-K NAND Flip Flop and show its functionality Handle race condition and clock gating in your circuit.
4. Design a 4 – bit Adder / Subtractor
5. Combinational logic circuits: Implementation of Boolean functions using logic gates
6. Arithmetic operations using logic gates; Implementation of Multiplexers, Demultiplexers, Encoders, Decoders; Implementation of Boolean functions using Multiplexers/Decoders
7. Study of sequential logic circuits: Implementation of flip flops, Verify the excitation tables of various FLIP-FLOPS.
8. Design and realization a Synchronous and Asynchronous counter using flip-flops
9. Design and realization of an 8-bit parallel load and serial out shift register using flipflops
10. Implementation of counters, Design and realization a Synchronous and Asynchronous counter using flip-flops
11. Design and realization of 4x1 mux, 8x1mux using 2x1 mux

Write assembly language programs in 8086 for the following: (MASAM can also beused)

1. To add two 8 bit number (A+B=RESULT with a carry and without a carry).
2. To subtract one 8 bit number from another (A-B=RESULT with a borrow and without a borrow).
3. To find out AND, OR, NOT, XOR, NAND, NOR, XNOR of two 8 bitnumber.
4. To find out addition of two 16 bit numbers.
5. To find out subtraction of two 16 bit numbers.
6. To evaluate the expression a = b + c –d * eConsidering 8-bit, 16 bit and 32-bit binary numbers as b, c, d, e.Take the input in consecutive memory locations and

results also Display the results by using "int xx" of 8086. Validate program for the boundary conditions.

7. To take N numbers as input. Perform the following operations on them.
    a. Arrange in ascending and descending order.
    b. Find max and minimum
    c. Find averageConsidering 8-bit, 16-bit binary numbers and 2-digit, 4 digit and 8-digit BCD numbers. Display the results by using "int xx" of 8086. Validate program for the boundary conditions.
8. To implement the above operations as procedures and call from the main procedure.
9. To find the factorial of a given number as a Procedure and call from the main program which display the result.

Note: Experiments can be done using Logic board, EasyCPU, RTSlim, Little Man Computer (LMC), Assemblers for 8085 programming, 8086 based trainer kits, MIPS simulator PCSpim, Xilinx schematic editor and simulation tools or any other choice

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II Year – I Semester		L	T	P	C
		0	0	3	1.5
R PROGRAMMING LAB (PCC2107)					

Course Objective:

In this course student will learn about the fundamentals of R programming, standard R libraries,solid understanding of R functions,write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R.

Course Outcomes:

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

1. Implement basic concepts of R programming, and its different module that includes conditional, looping, lists, Strings, Functions, Frames, Arrays, and File programming.
2. Implement the concepts of R Script to extract the data from data frames and file operations.
3. Implement the various statistical techniques using R.
4. Extend the functionality of R by using add-on packages
5. Use R Graphics and Tables to visualize results of various statistical operations on data

LIST OF LAB PROGRAMS:

Week 1:

a) Installing R and R-Studio
b) Basic functionality of R, variable, data types in R

Week 2:

a) Implement R script to show the usage of various operators available in R-language.
b) Implement R script to read person‘s age from keyboard and display whether he is eligible or voting ornot.
c) Implement R script to find biggest number between two numbers.
d) Implement R script to check the given year is leap year ornot.

Week 3:

a) Implement R Script to generate first N naturalnumbers.
b) Implement R Script to check given number is palindrome ornot.
c) Implement R script to print factorial of anumber.
d) Implement R Script to check given number is Armstrong ornot.

Week 4:

a) Implement R Script to perform various operations on string using stringlibraries.
b) Implement R Script to check given string is palindrome ornot.
c) Implement R script to accept line of text and find the number of characters,
d) number of vowels and number of blank spaces init.
e) Implement R script for Call-by-value and Call-by-reference

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Week 5:

a) Implement R Script to create a list.
b) Implement R Script to access elements in the list.
c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation

Week 6:

Implement R script to perform following operations:

a) various operations on vectors
b) Finding the sum and average of given numbers using arrays.
c) To display elements of list in reverse order.
d) Finding the minimum and maximum elements in the array.

Week 7:

a) Implement R Script to perform various operations on matrices
b) Implement R Script to extract the data from dataframes.
c) Write R script to display file contents.
d) Write R script to copy file contents from one file to another

Week 8:

a) Implement R Script to create a Pie chart, Bar Chart, scatter plot andHistogram.
b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.

Introduction to ggplot2 graphics

Week 9:

a) Implement R Script to perform Normal, Binomial distributions.
b) Implement R Script to perform correlation, Linear and multiple regression.

Week 10:

Introduction to Non-Tabular Data Types: Time series, spatial data, Network data.
Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

Week 11:

Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates, outliers, spelling

Week 12:

Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Excel and Google Spreadsheets, API and web scraping examples

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REFERENCES:

1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
3. R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Statistical Programming in R by KG Srinivas G.M. Siddesh, Chetan Shetty &Sowmya B.J. - 2017 edition
6. R Fundamentals and Programming Techniques, ThomasLumely.
7. R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison WesleySeries
8. The Art of R Programming, Norman Matloff, CengageLearning
9. Maria DoloresUgarte,AnaF.Militino,AlanT.Arnholt–ProbabilityandStatisticswithR2nd Edition on, CRC Press,2016.
10. R-programming for Data science, RogerD.Peng.
11. An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani.

Web Links

1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf (Online Resources)
2. http://nptel.ac.in/courses/106104135/48
3. http://nptel.ac.in/courses/110106064/

SOFTWARE requirements:

1. The R statistical software program. Available from: https://www.r-project.org/

RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

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II Year - I Semester		L	T	P	C
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FREE AND OPEN SOURCE SOFTWARE (SC2101)					

Course Objectives:

The student should be made to:

- Be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects.
- Be familiar with participating in a FOSS project
- Learn scripting language like Python or Perl
- Learn programming language like Ruby
- Learn some important FOSS tools and techniques

1. Getting started with Linux basic commands and directory structure, execute file, directory operations.
2. Linux commands for redirection, pipes, filters, job control, file ownership, file permissions, linksand file system hierarchy.
3. Shell Programming : Write shell script to show various system configuration like
   a) Currently logged user and his logname
   b) Your current shell
   c) Your home directory
   d) Your operating system type
   e) Your current path setting
   f) Your current working directory
   g) Show Currently logged number of users
4. Write shell script to show various system configuration like
   a) About your OS and version, release number, kernel version
   b) Show all available shells
   c) Show mouse settings
   d) Show computer CPU information like processor type, speed etc
   e) Show memory information
   f) Show hard disk information like size of hard-disk, cache memory, model etc
   g) File system (Mounted)
5. Shell script program for scientific calculator.
6. Version Control System setup and usage using GIT.
   a) Creating a repository
   b) Checking out a repository
   c) Adding content to the repository
   d) Committing the data to a repository

7. Shell script to implement a script which kills every process which uses more than a specifiedvalue of memory or CPU and is run upon system start.
8. Running PHP : simple applications like login forms after
9. Advanced linux commands curl, wget, ftp, ssh and grep
10. Application deployment on a cloud-based LAMP stack/server with PHP eg: Openshift,Linode etc.
11. Virtualization environment (e.g., xen, kqemu, virtualbox or lguest) to test anapplications, new kernels and isolate applications. It could also be used to exposestudents to otheralternate OSs like *BSD
12. Introduction to packet management system : Given a set of RPM or DEB, how to Buildand maintain, serve packages over http or ftp. and also how do youconfigure clientsystems toaccess the package repository.
12. Installing various software packages. Either the package is yet to be installed or anolderversion is existing. The student can practice installing the latest version. of course,this mightneed Internet access.
    a. Install samba and share files to windows
    b. Install Common Unix Printing System(CUPS)

TEXT BOOK:

Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.

REFERENCES:

Philosophy of GNU URL: http://www.gnu.org/philosophy/.
Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.
The Python Tutorial available at http://docs.python.org/2/tutorial/.

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II Year - I Semester		L	T	P	C
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ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE(MC2101)					

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledgesystem
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge andprotection

Course Outcomes:

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

- Understand the concept of Traditional knowledge and itimportance
- Know the need and importance of protecting traditionalknowledge
- Know the various enactments related to the protection of traditionalknowledge
- Understand the concepts of Intellectual property to protect the traditionalknowledge

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

UNIT II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act,2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing

protection of Indian Traditional Knowledge.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Reference Books:

1) Traditional Knowledge System in India, by Amit Jha,2009.
2) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan2012.
3) Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002
4) "Knowledge Traditions and Practices of India" Kapil Kapoor, MichelDanino

e-Resources:

1) https://www.youtube.com/watch?v=LZP1StpYEPM
2) http://nptel.ac.in/courses/121106003/