IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Computer Science & Engineering Department

Semester IV (Second Year)
Course/Branch: Computer Science & Engineering

S.No.	Course Code	Course Title	Hrs./ week			Credits
			L	T	P	
1	ESC-CS401	Data Communication	3	0	2	4
2	PCC-CS401	Discrete Structure	3	1	0	4
3	PCC-CS402	Object Oriented Programming & Methodology	2	0	4	4
4	PCC-CS403	Analysis & Design of Algorithm	2	1	2	4
5	PCC-CS404	Programming in PYTHON	0	0	4	2
6	HSMC-CS401	Soft Skill & Interpersonal Communication-I	3	0	0	3
7	MC4	Constitution of India/ Essence of Indian Traditional Knowledge	2	–	–	0
Total credits			**13**	**2**	**14**	**21**
Total Academic Engagement and Credits			**29**			**21**

ESC- CS401	Data Communication	3L: 0T: 2P (5 Hrs.)	Credits:04

Prerequisite: - Communication System, Digital Communications

Course Objective: The course is designed to understand the basic technologies used in data communication like mode of communication, interfacing of devices, medium of communication and detection and correction of errors occurs during data transmission.

Module 1 **(08 Hrs.)**

Introduction to data communication: Components, data representation, data flow and basic model, data representation, Serial & Parallel transmission, Modes of data transmission, Encoding: Unipolar, Polar, Bipolar line & block codes, Data compression, Frequency dependent codes, Run length encoding, Relative encoding, LZ Compression, Image and multimedia compression. Review of analog & digital transmission methods

Module 2 **(08 Hrs.)**

Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM, North American digital multiplexing hierarchy, European TDM, Spread spectrum: Frequency Hopping & Direct Sequence spread spectrum. Terminal handling & polling. Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching, Soft switch Architecture with their comparative study, X.25, ISDN.

Module 3 (08 Hrs.)

Physical Layer: Introduction, Interface, Standards, EIA-232-D, RJ-45, RJ-11, BNC connector & EIA-449 digital Interface: Connection, specifications & configuration, X.21 Modem: Types, features, signal constellation, block schematic, limited distance, dial up, baseband, line driver, Group Band and Null modems etc., ITU-T V-series modem standards Connecting Devices: Active and Passive Hubs, Repeaters, Bridges, Two & Three layer switches & Gateway. Study of various types of topology and their comparative study Design of physical LAN Network using routers switches.

Module 4 **(6 Hrs.)**

Transmission Media: Transmission line characteristics, Guided Media: Unguided media, Telephone Network, Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL, Cable TV network for data transfer.

Module 5 **(10 Hrs.)**

Transmission Errors: Content Error , flow integrity error , methods of error control ,Error detection ,Error correction ,Bit error rate , Error detection methods: Parity checking , Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum .

Course Outcomes:

Students earned credits will develop ability to

1. Illustrate the different modes of data transmission, encoding techniques.
2. Illustrate the different types of multiplexing technique and switching techniques.
3. Illustrate the interfacing and connecting devices and standards used in communication.
4. Summarize the Different types of media of transmission and networks.
5. Analyze the problem of errors in communication and technique of error detection and corrections in transmission.

List of Text/Reference Book:

1. Behrouz A Forouzan, "Data communication and networking", 4th edition, McGrawHill Education, 2017.
2. Tanenbaum A. S., "Computer Networks", Pearson Education, 5th edition, 2011.
3. William Stallings, "Data & Computer Communication", Pearson Education, 8th edition, 2006.
4. Comer, "Internetworking with TCP/ IP Vol-1", Pearson education, 6th edition, 2015.

PCC-CS401	Discrete Structure	3L : 1T : 0P (4 hrs.)	Credits: 04

Prerequisite:

Course Objective:
This course introduces the applications of discrete mathematics in the field of computer science. It covers sets, logic, proving techniques, combinatory, functions, relations, Graph theory and algebraic structures.

Module 1: **(10 hrs.)**
Set Theory, Relation, Function, Theorem Proving Techniques : Set Theory: Definition of sets, countable and uncountable sets, Venn Diagrams, proofs of some general identities on sets Relation: Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Partial ordering relation, Job- Scheduling problem Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle. Theorem proving Techniques: Mathematical induction, Proof by contradiction.

Module 2: **(08 hrs.)**
Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.

Module 3: **(08 hrs.)**
Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers.

Module 4: **(08 hrs.)**
Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs.

Module 5: **(10 hrs.)**
Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices. Combinatorics: Introduction, Permutation and combination, Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Generating functions, Solution by method of generating functions.

Course Outcome:

1. Describe sets, relations, functions and mathematical induction.
2. Formulate and solve Groups and Rings problems
3. Apply Propositional logic and finite state automata to solve problems
4. Apply the Concepts of Graph theory to Solve real world problems.
5. Formulate and solve Poset and recurrence relations.

List of Text Books / Reference Books:

1. C.L.Liu, "Elements of Discrete Mathematics" Tata McGraw-Hill Edition.
2. J Trembley, R Manohar; "Discrete Mathematical Structure with Application CS", 2001 McGraw Hill.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications",7th Ed., McGraw Hill.
4. R K Bisht, H S Dhami, "Discrete Mathematics",2015, Oxford University Press
5. P C Biswal, "Discrete Mathematics & Graph Theory", 4th Ed. , PHI

PCC-CS402	Object Oriented Programming & Methodology	2L : 0T : 4P (6 hrs.)	Credits:04

Prerequisite:

Course Objective:

The course is designed to provide complete knowledge of Object Oriented Programming through and to enhance the programming skills of the students by giving practical assignments to be done in labs. Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm.

Module 1: **(08 hrs.)**
Introduction to Object Oriented Programming, Comparison with Procedural Programming, features of Object oriented paradigm, merits and demerits of OO methodology; Introduction to Java Development Kit (JDK) & Java virtual machine (JVM); Linker & Loader; Data Encapsulation: Concept of Classes & Objects; State, Behavior & Identity of an object.

Module 2: **(08 hrs.)**
Data Abstraction and Message Passing: Methods, Calling of constructors, Decision making constructs, Control loops, Keywords: this, static; Access modifiers, Arrays within a class, String Class.

Module 3: **(10 hrs.)**
Relationship between classes: Generalization- Inheritance, Types of Inheritance, Ambiguity in multiple inheritances, Concept of interfaces; Specialization- Association, Aggregation and Composition; Static and Dynamic Binding: Polymorphism, Method Overriding & Overloading; Keywords: super, abstract, final.

Module 4: **(08 hrs.)**
Concept of Packages, Need of package; Basic idea of exception handling, stack based execution and exception propagation, Exception types: Exception Handling Try, Catch, Finally, Throw statement, Assertions.

Module 5: **(08 hrs.)**
Overview of Simple threads, Basic idea of Multithreaded Programming, Thread synchronization: Locks, synchronized methods, synchronized block, thread scheduling, Producer-consumer relationship, Daemon thread, Case Study: Chabot implementation etc.

Course Outcome:

1. Understand object oriented programming concepts, core JAVA and apply them in solving Problems.
2. Develop skill in data abstraction and message passing
3. Understand fundamentals of relationship amongst objects
4. Learn about the need of exception and errors
5. Develop ability to write a computer program to solve specified problems

List of Text Books / Reference Books:

1. G. Booch, "Object Oriented Analysis & Design", Pearson.
2. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001
3. James Martin, "Principles of Object Oriented Analysis and Design", Prentice Hall/PTR.
4. Peter Coad and Edward Yourdon, "Object Oriented Design", Prentice Hall/PTR.
5. Herbert Schildt, "Java 2: The Complete Reference", 7th Edition, McGraw-Hill

List of Experiments:

1. A gardener plants a daisy flower and observes that on the first day the flower has 1 petal, on the second day the flower has 2 petals, on the third day it has 3 petals, on fourth day it has 5 petals, on fifth day it has 8 petals. Write a program to calculate how many petals will be there on the daisy flower on ninth day?
2. The Marks obtained by the class of 10 students are 45,50,66,32,80,77,59,63,71,85 respectively. Write a program for following
   - Arrange and print the marks in descending order
   - Calculate the average marks of the class
   - Find out whether any student got 95 marks(if yes print –"Student exist" and if no print – "Student doesn't exist")
3. WAP for the following calculating
   - Sum of square of given even numbers from 1 to 20
   - Sum of square of given odd numbers from 21 to 40
4. In the school while prayer assembly the 12 std boys and girls heights(in feet) are :
   Boys – 5.3, 5.6, 6.3, 5.9, 5.11
   Girls – 5.1, 5.9, 5.0, 5.5, 5.6
   Write a program for finding:
   - Tallest height in boys
   - Tallest height in girl
   - Tallest height in the class
   - Is there any student having height above 6.2 feet (o/p True or False)
   - How many boys have height between 5.5 and 5.9 feet
5. Create an abstract class Account. Inherit this class into two classes as CurrentAccount and SavingAccount. Identify the below attributes & methods and place them in suitable classes so as achieve best outcomes:
   - Attributes: Name_of_customer, Address, MobileNo, type_of_account, balanceAmt, etc.
   - Methods: withdrawal, deposit, displayInfo, viewBalance, calculateInterest

(saving 6% & current 1%).

6. Write a program which does following on a given String. Count the number of occurrence of a particular character. (e.g. "assassinations" here 's' had come 5 times)
7. Write a program that takes a string (e.g. "apple is a fruit"). Obtain a substring from this string but starting from a second occurrence of a particular character (suppose. 'a') then output should be ("a fruit").
8. WAP to check weather a given string is a substring of other string. (e.g. "drinking" and other string is "packages drinking water" so here first string a substring of second hence the result must be TRUE).
9. Write a java program showing the concept of keywords this in java.
10. Write a java program showing the concept of constructor in java.
11. Write a java program showing the concept of Inheritance, super keyword & Interfaces in java.
12. Write a java program showing the concept of file handling in java.
13. Write a java program showing the concept of multithreading in java.
14. Write a java program showing the concept of exception handling in java.

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PCC-CS403	**Analysis & Design of Algorithm**	**2L : 1T : 2P (5 hrs.)**	**Credits:04**

Prerequisite: Data Structure & Algorithm

Course Objective:
Its main objective is to teach the basic concepts and techniques to analysis and Design of Algorithm.

Module 1: **(08 hrs.)**
Algorithms, Designing algorithms, analyzing algorithms, asymptotic notations, heap and heap sort. Introduction to divide and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, merge sort, quick sort, strassen's matrix multiplication.

Module 2: **(10 hrs.)**
Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm

Module 3: **(08 hrs.)**
Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm.

Module 4: **(10 hrs.)**
Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph coloring problem etc. Introduction to branch & bound method, examples of branch and bound method like traveling salesman problem etc. Meaning of lower bound theory and its use in solving algebraic problem, introduction to parallel algorithms.

Module 5: **(08 hrs.)**
Binary search trees, height balanced trees, 2-3 trees, B-trees, basic search and traversal techniques for trees and graphs (In order, preorder, postorder, DFS, BFS), Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover. Introduction to approximate and randomized algorithms.

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Course Outcome:

1. Understand and analyze the performance of recursive and non recursive algorithms and use of asymptotic notations to measure the performance of algorithms.
2. Identify and analyze different algorithm design techniques for problem solving.
3. Exemplifying and checking algorithms using Dynamic programming algorithm design techniques.
4. Interpreting Backtracking, Branch and Bound strategy, and evaluate various algorithms including parallel algorithms.
5. Analyze nonlinear data structure and identify different NP, NP-Hard, NP-Complete problems.

List of Text Books / Reference Books:

1. Coremen Thomas, Leiserson CE, Rivest RL, "Introduction to Algorithms" 3rd Ed,2009 PHI.
2. Horowitz & Sahani, "Analysis & Design of Algorithm" Computer Science Press
3. Ullmann, "Design & Analysis of Computer Algorithms" Pearson
4. Michael T Goodrich, Robarto Tamassia, "Algorithm Design", Wiely India
5. Rajesh K Shukla, "Analysis and Design of Algorithms: A Beginner's Approach", Wiley

List of Experiments:

Write a Program For:

1. Iterative and Recursive Binary Search.
2. Merge Sort.
3. Quick Sort.
4. Strassen's Matrix Multiplication.
5. Optimal merge patterns.
6. Huffman coding.
7. Minimum spanning trees using Kruskal's algorithm.
8. Minimum spanning trees using Prim's algorithm.
9. Single sources shortest path algorithm.
10. Floye-Warshal algorithm.
11. Traveling salesman problem.
12. Hamiltonian cycle problem.

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PCC-CS404	Programming in PYTHON	0L : 0T : 4P (4 hrs.)	Credits:02

Prerequisite:

Course Objective:

The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language. Learning Outcomes: Problem solving and programming capability

Module 1: **(07 hrs.)**
Introduction, History,Features, Python –EnvironmentSetupLocal Environment Setup, Getting Python, Installation of Python, Use of IDE

Module 2: **(10 hrs.)**
Python –Basic SyntaxPythonIdentifiers, Reserved Words, Lines & Indentation, Multiline Statements, Quotation in Python, Comments & other useful constructs, Python –Variables Assigning Values to Variables, Multiple Assignment, Standard Data Types

Module 3: **(08 hrs.)**
Python –Variables, Assigning Values to Variables, Multiple Assignment, Standard Data Types; Python Numbers, Python Strings, Python Lists, Python Tuples, Dictionary, DataType Conversion

Module 4: **(08 hrs.)**
Python –Basic Operators, Types of Operators, Arithmetic Operators, Comparison Operators, Assignment Operators, Bitwise Operators, Logical Operators, Operator Precedence, Python – Decision Making & Loops, Flowchart, If statement Syntax

Module 5: **(08 hrs.)**
Python-Functions, Syntax for defining a function, Calling a Function, Function Arguments, Anonymous Functions Python-Applications & Further Extensions, Data analysis packages.

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Course Outcome:

1.Install Python and have knowledge of syntax ofPython.
2.Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries inPython.
3.Express different Decision Making statements andFunctions.
4.Develop code in Python using functions, loopsetc.
5.Design GUI Applications in Python and evaluate different databaseoperations.

List of Text Books / Reference Books:

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press.
2. ZedA. Shaw, "Learn Python the Hard Way" (3rdEdition), Addison Wesley.
3. Paul Barry, "Head-First Python", O'Reilly.
4. John Zelle, Franklin ,"Python Programming", Beedle & Associates Inc.

List of Experiments:

Write a Python program:

1. To find GCD of two numbers.
2. To find the square root of a number by Newton's Method.
3. To find the exponentiation of a number.
4. To find the maximum from a list of numbers.
5. To perform Linear Search
6. To perform binary search.
7. To perform selection sort.
8. To perform insertion sort.
9. To perform Merge sort.
10. To find first n prime numbers.
11. To multiply matrices.
12. For command line arguments.
13. To find the most frequent words in a text read from a file.
14. To simulate elliptical orbits in Pygame.
15. To bouncing ball in Pygame.
16. To demonstrate data analysis packages using python like Pandas, Filtering, etc.

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HSMC-CS401	**Soft Skills & Interpersonal Communication**	**3L : 0T : 0P (3hrs.)**	**Credits:03**

Prerequisite:

Course Objectives:
The course will help students to learn effective communication skills, group and team building skills. It will help them to learn the goal setting process and thus become more effective in achieving it.

Module-I

Introduction to Soft Skills

Importance of Soft Skills, Effective Communication Skills, Verbal: Oral and Written, Merits and Demerits. Non Verbal: Kinesics, Proxemics, Haptics, Chronemics, Paralanguage, Sign/Symbol, Meta Communication, and Cultural differences in Non-Verbal Communication

Module-II

Aspects of Communication

Process of Listening, Types of Listening, Barriers to Listening, Strategies to Develop Listening Skills, Listening Comprehension, Culture as Communication, Communicating across Cultures, Communication Breakdown and ways to overcome

Module-III

Interpersonal Skills

Introduction and Importance to Interpersonal Skills, Personal Attributes, Interpersonal Attributes, Decision making, Creative Problem Solving, Dealing with Glossophobia, , Logical Reasoning

Tony Buzan's Mind Mapping Techniques: Argumentation, Inductive, Deductive reasoning, Persuasion

Module-IV

Group Behavior

Leadership skills, Team Management, Group Dynamics, Negotiation, Assertiveness, Emotional Intelligence

Module-V

Practical Approach to Soft Skills and Interpersonal Skills

Case Studies, SWOC Analysis and Goal Setting, Mindfulness Training, Brain Storming, Group Discussion, Team Building Activities.

Course Outcomes:

The outcome of this course will be to make students aware about the different facets of self. It will also help them learn skills to strengthen their inner capacities so that they are able to understand themselves, think and act effectively to lead.

List of Text Books:

1. Soft Skills by G.S. Chouhan and Sangeeta Sharma, Wiley, New Delhi, 2016 Communication Skills by Sanjay Kumar and Pushplata, OUP, New Delhi, 2011
2. Communication Skill for Engineers and Scientist by Sangeeta Sharma and Vinod Mishra, PHI Learning, New Delhi, 2015
3. Developing Communication Skill by Krishna Mohan, Meera Banerji, McMillan India Limited,2018
4. Effective Listening Skills by Kratz, Abby Robinson. Toronto: ON: Irwin Professional Publishing, 1995.
5. Soft Skill for Everyone by Jeff Butterfield, Cengage Leaning, New Delhi, 2010

List of Reference Books:

1. Theories of Personality by Hall, Calvin S. et al. . New Delhi: Wiley. rpt. 2011.
2. Corporate Conversations by Holtz, Shel. New Delhi: PHI. 2007.
3. The Art of Public Speaking by Lucas, Stephen E. McGraw-Hill Book Co. International Edition, 11th Ed. 2014.
4. Winning at Interviews by Thorpe, Edgar and Showick Thorpe. Pearson Education. 2004.
5. Business Communication for Managers by Penrose, John M., et al. New Delhi: Thomson South Western. 2007

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MC-4	**Constitution of India/ Essence of Indian Traditional Knowledge**	**0L : 0T : 2P (2 hrs.)**	**Credits:00**

Course Objective:

The objective of this course is to focus on Indian traditional knowledge.

Module 1: Introduction to Traditional Knowledge **(08 hrs.)**
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.

Module 2: Protection of Traditional Knowledge **(08 hrs.)**
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.

Module 3: Legal Frame Work and TK **(08 hrs.)**
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act).
The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

Module 4: Traditional Knowledge and Intellectual Property **(08 hrs.)**
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.

Module 5: Traditional Knowledge in Different Sectors: **(08 hrs.)**
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. 139.

Course Outcome:

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.
5. Understand the traditional knowledge in different sectors.

List of Text Books / 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, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
"Knowledge Traditions and Practices of India" Kapil Kapoor, Michel