IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

[Computer Science & Engineering (AIML)]

IV Semester

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1.	ESC	ESC-CSCL401	Computer Organization & Architecture	2	1	-	3
2.	PCC	PCC-CSCL401	Object Oriented Programming & Methodology	2	1	2	4
3.	PCC	PCC-CSCL402	Analysis & Design of Algorithm	2	1	2	4
4.	PCC	PCC-CSCL403	Operating System	3	-	2	4
5.	PCC	PCC-CSCL404	Discrete Structure	3	-	-	3
6.	PCC	PCC-CSCL405	Python	-	-	4	2
7.	HSMC	HSMC-CSCL 401	Soft Skill & Interpersonal Communication-I	3	–	–	3
8.	MC	MC-II	Constitution of India	1	-	-	Audit
Total Academic Engagement and Credits				16	3	10	23
				29			

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IV Semester

ESC-CSCL401	**Computer Organization & Architecture**	**2L: 1T: 0P (3 hrs.)**	**3 credits**

Prerequisite:

Course Objective:

Students to be familiarize the basic principles of computer architecture, Design and Multiprocessing, Types of data transfer, Concept of semiconductor memories which is useful for research work in field Computer System.

Course Contents:

Module 1: **(10 hrs.)**

Basic Structure of Computer: Structure of Desktop Computers, CPU: General Register Organization-Memory Register, Instruction Register, Control Word, Stack Organization, Instruction Format, ALU, I/O System, bus, CPU and Memory Program Counter, Bus Structure, Register Transfer Language-Bus and Memory Transfer, addressing modes. Control Unit Organization: Basic Concept of Instruction, Instruction Types, Micro Instruction Formats, Fetch and Execution cycle, Hardwired control unit, Micro- programmed Control unit micro program sequencer Control Memory, Sequencing and Execution of Micro Instruction.

Module 2: **(08 hrs.)**

Computer Arithmetic: Addition and Subtraction, Tools Compliment Representation, Signed Addition and Subtraction, Multiplication and division, Booths Algorithm, Division Operation, Floating Point Arithmetic Operation, Number concept 1's and 2's complement representation, addition and subtraction using 2's complement.

Module 3: **(08 hrs.)**

I/O Organization: I/O Interface–PCI Bus, SCSI Bus, USB, Data Transfer: Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, Direct Memory Access (DMA), I/O Processor.

Module 4: **(08 hrs.)**

Memory Organization: Main memory-RAM, ROM, Secondary Memory –Magnetic Tape, Disk, Optical Storage, Cache Memory: Cache Structure and Design, Mapping Scheme, Replacement Algorithm, Improving Cache Performance, Virtual Memory, memory management hardware.

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Module 5: **(08 hrs.)**

Multiprocessors: Characteristics of Multiprocessor, Inter-Processor Communication and Synchronization. Memory in Multiprocessor System, Concept of Pipelining, Vector Processing, Array Processing, RISC And CISC, Study of Multicore Processor –Intel, AMD.

Course Outcome:

1. Explain the basic structure & components of the computer system, Microprogrammed Control Unit.
2. Demonstrate the concepts of computer arithmetic.
3. Explain the input output organization of the computer system.
4. Illustrate memory organization and memory management techniques.
5. State the core concepts of multiprocessor and pipelining.

List of Text / Reference Books:

1. Morris Mano , "Computer System Architecture " 3rd Ed., 2007, PHI
2. Alan Clements: "Computer Organization and Architecture", 2012, Cengage Learning
3. Subrata Ghosal: "Computer Architecture and Organization", 2011, Pearson Education
4. William stalling ,"Computer Organization and Architecture" 10th Ed., 2016, Pearson Education
5. M. Usha, T.S. Shrikant: "Computer System Architecture & Organization", 2019, Willey India
6. Chaudhuri, P.Pal: "Computer Organization and Design", 3rd Ed. PHI

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PCC-CSCL401	**Object Oriented Programming & Methodology**	**2L: 1T: 2P (5 hrs.)**	**Credits:04**

Prerequisite: Programming for Problem Solving

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.

Course Content:

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.

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Course Outcomes:

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. Write a program to show Concept of CLASS in JAVA. (CO1)
2. Write a program to show Concept of Constructor in JAVA. (CO2)
3. Write a program to show Concept of Arrays in JAVA. (CO2)
4. Write a Program to show Inheritance. (CO3)
5. Write a program to show Polymorphism (method overloading and overriding) (CO3)
6. Write a program to show Interfacing between two classes. (CO4)
7. Write a program to show Exception handling. (CO4)
8. Write a program to Add a Class to a Package (CO4)
9. Write a program to show Life Cycle of a Thread (CO5)
10. Write a program to demonstrate multithreading using Java. (CO5)

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PCC-CSCL402	**Analysis & Design of Algorithm**	**2L: 1T : 2P (5 hrs.)**	**Credits:04**

Prerequisite: Data Structure & Algorithm

Course Objective:

To understand different algorithm design techniques and analyze the asymptotic performance of algorithms.

Course Contents:

Module 1: **(10 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: **(12 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, 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.

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, Sum of subset problem, Matrix Chain Multiplication, Longest common subsequence.

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: **(06 hrs)**

Hashing: Hash Function, Address calculation Technique , Common Hashing Function , Collision resolution, Linear probing, Quadratic Double Hashing , Bucket Hashing , Deletion and Rehashing.

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IV Semester

Course Outcomes:

1. Analyze the asymptotic performance of recursive and non-recursive algorithms.
2. Discuss different algorithm design techniques for deterministic and non-deterministic problems.
3. Solve problems using Greedy method & Dynamic programming techniques.
4. Demonstrate Backtracking, Branch and Bound strategy.
5. Describe different types hashing techniques.

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:

1. Write a program to perform Quick Sort for the given list of integer values. (CO1).
2. Write a Program to perform Merge Sort on the given lists of integer values. (CO1).
3. Write a program for finding the maximum and minimum value from list. (CO1).
4 Write a program for minimum spanning trees using Kruskal's algorithm. (CO2).
5. Write a program for minimum spanning trees using Prim's algorithm. (CO2).
6. Write a program for Single source shortest path. (CO2).
7. Write a program for 0/1 knapsack problem. (CO3).
8. Write a program for All Pair Shortest Path (CO3).
9. Write a program for Sum of subset problem (CO3).
10. Write a program to solve N-QUEENS problem (CO4).
11. Write a program to solve Hamiltonian cycle problem. (CO4).
12. Write a program to solve Traveling salesman problem. (CO4).
13. Write a program for Tree traversal (Inorder, Preorder, Postorder) (CO5).
14. Write a program for Depth First Search Graph Traversal (CO5).
15. Write a program for Breadth First Search Graph Traversal (CO5).

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PCC-CSCL 403	Operating System	3L:0T:2P (5hrs.)	Credits:04

Prerequisite:

Course Objective:

This Course provides a comprehensive introduction of Operating System, Process Management, Memory Management, File Management and I/O management.

Course Contents:

Module 1: **(06 hrs.)**

Introduction to Operating Systems: Function, Evolution, Different Types, Desirable Characteristics and features of an O/S, Operating Systems Services: Types of Services, Different ways of providing these Services – Utility Programs, System Calls, Operating System Structure, and Spooling & Buffering.

Module 2: **(11 hrs.)**

CPU Scheduling: Process Concept, Scheduling Concepts, Types of Schedulers, Scheduling Criteria, Process State Diagram, Scheduling Algorithms, Operation on Process, Algorithms Evaluation, System calls for Process Management; Multiple Processor Scheduling; Concept of Threads.

Module 3:

Concurrent Processes: Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Inter-Process Communication, Critical Section Problem, Solution to Critical Section Problem: Semaphores – Binary and Counting Semaphores, WAIT & SIGNAL Operations, and their implementation. Deadlocks: Deadlock Problems, Characterization, Prevention, Avoidance, Recovery.

Module 4: **(11 hrs.)**

Memory Management: Different Memory Management Techniques – Partitioning, Swapping, Segmentation, Paging, Paged Segmentation, Comparison of these techniques, Techniques for supporting the execution of large programs: Overlay, Dynamic Linking and Loading, Virtual Memory – Concept, Implementation by Demand Paging etc., Page replacement algorithms.

Module 5: **(06 hrs.)**

File Systems: File Concept, User's and System Programmer's view of File System, Disk Organization, Tape Organization, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked and Indexed. Directory Structures, File Protection, System Calls for File Management, Disk Scheduling Algorithms.

Introduction to Network, Distributed and Multiprocessor Operating Systems. Case Studies: Unix/Linux, WINDOWS, and other Contemporary Operating Systems.

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Course Outcomes:

1. State the core concepts of operating system, evolution and types of operating system.
2. Illustrate CPU & process scheduling concepts.
3. Illustrate various input output concepts, interprocess communication and deadlock
4. Describe the concept of memory management techniques.
5. State the core concepts of file, disk management and various types of operating system.

List of Text / Reference Books:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts Essentials", Wiley Asia Student Edition, 10th Edition, 2018.
2. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hall of India, 5th Edition, 2005.
3. Charles Crowley, "Operating System: A Design-oriented Approach", Irwin Publishing, 1st Edition.
4. Gary J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley, 2nd Edition.
5. Maurice Bach, "Design of the Unix Operating Systems", Prentice-Hall of India, 8th Edition.
6. Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel", O'Reilly and Associates, 3rd Edition.
7. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall, 3rd Edition, 2007.
8. Bovet &Cesati, "Understanding the Linux Kernel", O'Reily, 3rd Edition.

List of Experiment:

Write a program:

1. To implement FCFS CPU scheduling algorithm.
2. To implement SJF CPU scheduling algorithm.
3. To implement Priority CPU Scheduling algorithm.
4. To implement Round Robin CPU scheduling algorithm.
5. To compare various CPU Scheduling Algorithms over different Scheduling Criteria.
6. To implement classical inter process communication problem (producer consumer).
7. To implement classical inter process communication problem (Reader Writers).
8. To implement classical inter process communication problem (Dining Philosophers).
9. To implement & Compare various page replacement algorithms.
10. To implement & Compare various Disk & Drum scheduling Algorithms.
11. To implement Banker's algorithms.

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IV Semester

PCC-CSCL404	Discrete Structure	3L: 0T: 0P (3 hrs.)	Credits: 03

Prerequisite: Nil

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.

Course Content:

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.

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IV Semester

Course Outcomes:

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.

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IV Semester

PCC-CSCL405	Python	0L: 0T: 4P (4 hrs.)	Credit: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.

Course Contents:

Module 1:

Introduction, History, Features, Python –Environment Setup Local Environment Setup, Getting Python, Installation of Python, Use of IDE. Python– Basic Syntax Python Identifiers, Reserved Words, Lines & Indentation, Multiline Statements, Quotation in Python, Comments & other useful constructs.

Module 2:

Python– Variables, Assigning Values to Variables, Multiple Assignment, Standard Data Types; Python Numbers, Python Strings, Python Lists, Python Tuples, Dictionary, Data Type Conversion.

Module 3:

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. Python- Functions, Syntax for defining a function, Calling a Function, Function Arguments, Anonymous Functions Python- Applications & Further Extensions, Data analysis packages.

Module 4:

Python File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations. Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations.

Module 5:

Introduction to Python Libraries, uses Pandas, Numpy etc.

Course Outcomes:

1. Install Python and have knowledge of syntax of Python.
2. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
3. Express different Decision-Making statements, loops and Functions.
4. Make use of various file operations in python.
5. Make use of Pandas and Numpy Libraries.

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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:

1. Introduction to python programming and python datatypes.
2. Python program to find the union of two lists.
3. Python program to find the intersection of two lists.
4. Python program to remove the "i" th occurrence of the given word in a list where words repeat.
5. Python program to count the occurrences of each word in a given string sentence.
6. Python program to check if a substring is present in a given string.
7. Python program to map two lists into a dictionary.
8. Python program to count the frequency of words appearing in a string using a dictionary.
9. Python program to create a dictionary with key as first character and value as words starting with that character.
10. Python program to find the length of a list using recursion.
11. Python program to read a file and capitalize the first letter of every word in the file.
12. Python program to read the contents of a file in reverse order.
13. Create a numpy array from list, tuple with float type
14. Python program to demonstrate slicing, integer and boolean array indexing
15. Write a python program to find min, max, sum, cumulative sum of array.
16. Write a python program to demonstrate use of ndim, shape, size, dtype.
17. Write a python program to implement Pandas Series with labels.
18. Create a Pandas Series from a dictionary.
19. Creating a Pandas Data Frame.
20. Write a program which make use of following Pandas methods
    a. describe()
    b. head()
    c. tail()

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IV Semester

HSMC-CSCL401	**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.

Course Content:

Module 1:

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 2:

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 3:

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 4:

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

Module 5:

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.

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List of Text Books / Reference Books:

1. Soft Skills by G.S. Chouhan and Sangeeta Sharma, Wiley, New Delhi, 2016
2. Communication Skills by Sanjay Kumar and Pushplata, OUP, New Delhi, 2011
3. Communication Skill for Engineers and Scientist by Sangeeta Sharma and Vinod Mishra, PHI Learning, New Delhi, 2015
4. Developing Communication Skill by Krishna Mohan, Meera Banerji, McMillan India Limited,2018
5. Effective Listening Skills by Kratz, Abby Robinson. Toronto: ON: Irwin Professional Publishing, 1995.
6. Soft Skill for Everyone by Jeff Butterfield, Cengage Leaning, New Delhi, 2010
7. Theories of Personality by Hall, Calvin S. et al.. New Delhi: Wiley. rpt. 2011.
8. Corporate Conversations by Holtz, Shel. New Delhi: PHI. 2007.
9. The Art of Public Speaking by Lucas, Stephen E. McGraw-Hill Book Co. International Edition, 11th Ed. 2014.
10. Winning a t Interviews by Thorpe, Edgar and Showick Thorpe. Pearson Education. 2004.
11. Business Communication for Managers by Penrose, John M., et al. New Delhi: Thomson Southwestern. 2007

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MC-II	Constitution of India	1L : 0T : 0P	Credits:00

Prerequisite:

Course Objective:

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

Course Content:

Module 1: **(08 hrs.)**

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.

Module 2: **(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: **(08 hrs.)**

Legal Frame Work and TK: 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: **(08 hrs.)**

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.

Module 5: **(08 hrs.)**

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. 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.