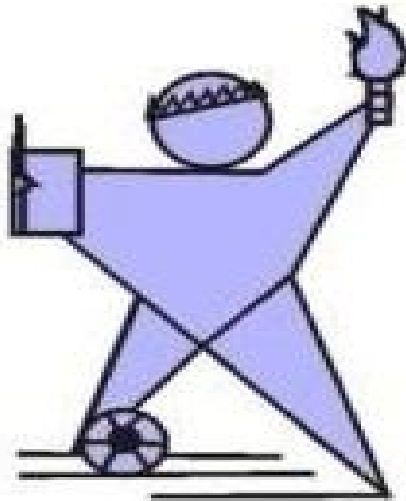


# **Proposed Scheme & Syllabus of UG Engineering Program**

**Bachelor of  
Technology  
(B.Tech.)**

**Computer Science & Engineering  
2020-21**



**IPS ACADEMY**  
**INSTITUTE OF ENGINEERING & SCIENCE, INDORE**  
*(A UGC Autonomous Institute affiliated to RGPV)*

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

S.No.	Course Code	Course Title	Hrs./ week			Credits
			L	T	P	
1	BSC-CS301	Numerical Methods, Statistics, Fourier & Fuzzy theory	3	1	0	4
2	ESC-CS301	Digital System	2	1	2	4
3	PCC-CS301	Data Structure & Algorithm	2	1	2	4
4	PCC-CS302	Computer Organization & Architecture	2	1	2	4
5	PCC-CS303	Programming Practices(C++)	1	0	4	3
6	HSMC-CS301	Principles of Mgt & Managerial Economics	3	0	0	3
7	MC-3	Energy, Environment, Ecology	–	–	2	0
<b>Total credits</b>						<b>22</b>

**IPS Academy**  
**Institute of Engineering & Science**  
**Department of Computer Science & Engineering**

**III-Semester**

<b>BSC-CS301</b>	<b>Numerical Methods, Statistics, Fourier &amp; Fuzzy theory</b>	<b>3L:1T:0P (4 Hrs)</b>	<b>4 Credits</b>
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**Course Objective:** Mathematics is the basic necessity for the foundation of engineering and technology. The main objective of this course is to teach mathematical method, develop mathematical skills and increase students' thinking power.

**Module- 1: Numerical Methods ( 10 Hours)**

Solution of algebraic and transcendental equations – Newton-Raphson method and Regula-Falsi method, Finite differences, Interpolation using Newton's forward and backward difference formulae, Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae, Inverse interpolation by Lagrange's method.

**Module- 2: Statistics (8 Hours)**

Mean, Median, Mode, Standard deviation, Variance, Correlation, Regression, Curve fitting: Fitting of straight line, Fitting of second degree parabola.

**Module-3 : Probability (8 Hours)**

Introduction to probability, Conditional probability, Baye's theorem, Probability mass function, Probability density function, Probability distribution: Binomial distribution, Poisson distribution, Normal distribution.

**Module-4: Fourier Transformations (9 Hours)**

Fourier transform: Definition and properties, Convolution of Fourier transformation, Fourier transformation on function spaces, Solution of ordinary and partial differential equation by Fourier transformation.

**Module-5: Fuzzy Set Theory (10 Hours)**

Definition of a fuzzy set, Classical sets vs. Fuzzy sets, Types of fuzzy sets, Operations on fuzzy sets, Fuzzy relations, Relations including operations: Reflexivity, Symmetry and Transitivity, Pattern classification based on fuzzy relations, Fuzzy analysis including metric spaces, Distances between fuzzy sets, Area, Perimeter, Height, Width of fuzzy subsets, Applications.

**Course Outcomes:**

CO1: To explain and apply the numerical methods in engineering problems.

CO2: To explain the basic concepts of statistics and apply in engineering fields.

CO3: To explain and apply the concepts of probability distribution in evaluation of engineering problems.

CO4: To define Fourier Transform and apply in different engineering problems.

CO5: To describe and apply the concepts of fuzzy sets.

**Textbooks/References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2018.
2. B. V. Ramanna, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2017.
3. Chandrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Co. (P) Ltd., Delhi, 2018.
4. Sudhir K. Kumar and Rimple Pundir, Fuzzy sets and their Applications, Pragati Prakashan, 9<sup>th</sup> Edition, 2018.
5. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
6. R. W. Hamming, Numerical Methods for Scientist and Engineers, Dover Publications, 2<sup>nd</sup> Edition, New York.
7. T. Veerarajan, Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2017.
8. D. C. Montgomery and G. C. Runjer, Applied Statistics & Probability for Engineers, Wiley Publication, 6<sup>th</sup> Edition.
9. T.T. Soong, Fundamental of Probability & Statistics for Engineers, John Wiley & Sons Ltd, 2004.
10. M. Ganesh, Introduction to Fuzzy Sets and Fuzzy Logic, PHI Learning, 2009.

<b>ESC-CS301</b>	<b>Digital Systems</b>	<b>2: 1: 2 (40 Hrs.)</b>	<b>4</b>
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**Recommended Prerequisite:** - Engineering Physics, Electronic Devices

**Course Objective:** The course is designed to acquire the basic knowledge of digital logic levels and application of digital electronics circuits and different types of memories. To impart how to design Digital Circuits. To understand the basic software tools for the design and implementation of digital circuits and systems.

**THEORY:**

**Module 1 (8 Hrs.)**

Review of Number Systems, Codes-BCD, Excess- 3, Gray Reflected ASCII,EBCDIC, review of Logic gates and binary operations, Implementations of Logic Functions using gates, NAND–NOR implementations. Boolean postulates and laws – De-Morgan’s Theorem - Principle of Duality, Boolean function, Canonical and standard forms,Minimization of Boolean functions, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization, Quine-McCluskey method of minimization.

**Module 2 (8 Hrs.)**

Combinational logic circuits: Adder, subtractor, Carry Look Ahead adder, BCD adder, Binary Multiplier, Multiplexer/De-multiplexer, decoder/encoder, code-converters, designing of combinational Circuits, Introduction to Races and Hazards.

**Module 3 (8 Hrs.)**

Sequential logic: flip flops, D, T, S-R, J-K, race around condition and its remedies, Edge & Level triggered circuits, Shift registers, Asynchronous and synchronous counters, their types and state diagrams.

**Module 4 (8 Hrs.)**

Logic Families and its Specifications: RTL, DTL, TTL, ECL, CMOS, Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices, PLDs, Semiconductor memories and classification of ROM, RAM and storage devices.

**Module 5 (8 Hrs.)**

Digital-to-analog conversion (DAC) - R-2R ladder Type, Weighted converter using Op-amp and transistor. Analog-to-digital Conversion (ADC) -Counter type, Successive Approximations Register, Flash type, Digital hardware description methodology, HDL, different modeling in VHDL, VHDL construct and codes for combinational circuit.

**Assessment:** Mid Term tests, Assignments, Tutorial, Quiz and End semester exams.

**Course Outcomes:-**

Students earned credits will develop ability to

1. Illustrate basic postulates of Boolean algebra. To design Boolean functions by applying the methods for simplifying Boolean expressions.
2. Illustrate fundamental concepts and design of digital combinational circuits.
3. Illustrate the basic methods for the design of sequential circuits.
4. Illustrate the operation of Logic families and Analyze and design of programmable logic devices.
5. Design and simulate the Logic circuits using HDL and appropriate EDA tool.

**DIGITAL SYSTEM DESIGN LAB**

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.
2. Design and Implement Half Adder and Half subtractor.
3. Design and Implement Multiplexer, De-multiplexer.
4. Design and Implement BCD to Gray Code Converters.
5. Design and Implement Encoder, Decoder.
6. Verify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates
7. Design and Implement a modulo-4 asynchronous counter.
8. Analysis of Analog to Digital Converter.
9. Design and simulate half adder and full adder using xilinx tool (VHDL)
10. Design and simulate Multiplexer using xilinx tool (VHDL)
11. Design and simulate D flip flop using xilinx tool (VHDL)
12. Design and simulate ALU using xilinx tool (VHDL)

**Assessment:** Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

**Text Books/ Reference Books**

1. R. P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4<sup>th</sup> edition, 2009.
2. W. H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2<sup>nd</sup> edition, 2006.
3. D. V. Hall, "Digital Circuit and System", Tata McGraw Hill, 1989.
4. S. Salivahanan & S. Arivazhagan, "Digital Circuits and Design", VikasPublishing.
5. M. Morris Mano, "Digital Logic and Computer Design", Pearson India Education, 1<sup>st</sup> edition, 2012
6. Douglas Perry, "VHDL Programming by example", McGraw Hill, 1<sup>st</sup> edition, 2002.
7. J. Bhaskar, "VHDL: Primer", P T R Prentice Hall, 3<sup>rd</sup> edition, 1999.

<b>PCC-CS301</b>	<b>Data Structure &amp; Algorithm</b>	<b>2L : 1T : 2P (5 hrs.)</b>	<b>4 credits</b>
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**Prerequisite:**

**Course Objective:**

The objective of this course is to understand different types of data structures and algorithms used in program.

**Course Contents: (46 hrs.)**

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

Review of C programming language. Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Abstract Data Types, Implementation aspects: Memory representation. Analysis of algorithm: Time Complexity and Space Complexity, Data structures operations and its cost estimation, Basic of Asymptotic notation. Introduction to linear data structures- Arrays, String, representation & Operations, Linked List: Representation of linked list in memory, different implementation of linked list. Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation using linked list, etc.

**Module 2: (10 hrs.)**

Stacks: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue, Queue simulation, Application of queues.

**Module 3: (10 hrs.)**

Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search, AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B\* tree and red-black tree.

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

Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST)- Kruskal, Prim's algorithms. Dijkstra's shortest path algorithm; Comparison between different graph algorithms. Application of graphs.

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

Sorting: Introduction, Classification of sorting method, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Case Study: Application of various data structures in operating system, DBMS etc.

## **Course Outcome:**

1. Understand basic data structures such as arrays, linked lists, stacks and queues
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. Understand the basic operations of trees and its types.
4. Understand the basic concept of graph and its operations.
5. Demonstrate and implement searching sorting algorithms.

## **List of Text / Reference Books:**

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures" Computer Science Press.
2. Mark Allen Weiss "Algorithms, Data Structures, and Problem Solving with C++", Pearson Education (US) 1996
3. R. G. Dromey "How to Solve it by Computer", 2nd Impression by, PHI
4. AM Tanenbaum, Y Langsam & MJ Augustein, "Data structure using C and C++", 2<sup>nd</sup> Ed., 2006, Prentice Hall India.
5. Robert Kruse, Bruce Leung, "Data structures & Program Design in C", 2<sup>nd</sup> Ed., 1997, Pearson Education.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Pearson Education.
7. Richard, Gilbert Behrouz, Forouzan, "Data structure – A Pseudocode Approach with C", 2<sup>nd</sup> Ed., Thomson press.

## **List of Experiments:**

### **Write a program:**

1. To perform insertion and deletion operations on array.
2. To perform multiplication operation on matrix
3. To calculate factorial of number using recursion.
4. To demonstrate static implementation of stack.
5. To demonstrate dynamic implementation of stack.
6. To demonstrate static implementation of Linear queue.
7. To demonstrate dynamic implementation of Linear queue.
8. To implement circular queue.
9. To implement single linked list.
10. To implement doubly linked list.
11. To implement binary search tree.
12. To perform BFS and DFS operations on graph.
13. To perform binary search operation.
14. To perform sorting operation using bubble sort.
15. To perform sorting operation using insertion sort.



<b>PCC-CS302</b>	<b>Computer Organization &amp; Architecture</b>	<b>2L : 1T : 2P (5 hrs.)</b>	<b>4 credits</b>
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**Prerequisite:**

**Course Objective:**

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

**Course Contents: (42 hrs.)**

**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: (8 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: (8 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.

**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 ” 3<sup>rd</sup> 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” 10<sup>th</sup> 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”, 3<sup>rd</sup> Ed. PHI

## **List of Experiments:**

1. Study of Multiplexer and Demultiplexer.
2. Study of Half Adder and Subtractor.
3. Study of Full Adder and Subtractor.
4. WAP to add two 8 bit numbers and store the result at memory location 2000.
5. WAP to multiply two 8 bit numbers stored at memory location 2000 and 2001 and stores the result at memory location 2000 and 2001.
6. WAP to add two 16-bit numbers. Store the result at memory address starting from 2000.
7. WAP which tests if any bit is '0' in a data byte specified at an address 2000. If it is so, 00 would be stored at address 2001 and if not so then FF should be store at the same address.
8. Assume that 3 bytes of data are stored at consecutive memory addresses of the data memory starting at 2000. Write a program which loads register C with (2000), i.e. with data contained at memory address 2000, D with (2001), E with (2002) and A with (2001).
9. Sixteen bytes of data are specified at consecutive data-memory locations starting at 2000. Write a program which increments the value of all sixteen bytes by 01.
10. WAP to add t 10 bytes stored at memory location starting from 3000. Store the result at memory location 300A

<b>PCC-CS303</b>	<b>Programming Practices (C++)</b>	<b>1L : 0T : 4P (5 hrs.)</b>	<b>3 credits</b>
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**Prerequisite: C language**

**Course Objective:**

Interpret good knowledge in C++ programming language and enable them to build Programs.

**Course Contents: (42 hrs.)**

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

Introduction of C++, Programming paradigms, Language translator, Structure of C++ program. Declaration, Expression and statements: Data types, Variables, Constants, Operator and expression, Operator precedence and associativity & Control statements.

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

**Array:** Declaration & Initialization, 2-D Array & Multidimensional Array. **Function:** Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference.

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

**Class:** Class, Members, Constructor and destructor, Copy constructor, parameterized constructor, Static member, Scope of class names. Dynamic memory management: Operators new and delete.

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

Introduction, Polymorphism, Overloading, Parametric and inclusion polymorphism Inheritance: inheritance and Types of inheritance, Virtual base class, Virtual function, Abstract class, Overriding and hiding, Dynamic binding of functions.

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

Class template, Member function inclusion, Function template, Specialization, Inheritance, Namespace. Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception. Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes, Basics of file handling.

## **Course Outcome:**

1. Understand expression and statements and apply them in solving Problems.
2. Explain and be able to use array and function in writing programs.
3. Explain and be able to use class in writing programs.
4. Explain and be able to use Polymorphism and Inheritance in writing programs.
5. Explain and be able to use template and exception handling in writing programs

## **List of Text / Reference Books:**

1. B. Stroutstrup “The C++ Programming Language”, 3rd Edition, 2002, Pearson Education.
2. Josée Lajoie and Stanley B. Lippman “C++ Primer”, 3rd Edition, Addison Wesley
3. E.Balagurusamy “Object Oriented Programming with C++ “, 7e, TMH
4. Rajesh K.Shukla “Object Oriented Programming in C++”, Wiley India

## **List of Experiments:**

### **Write a C++ Program:**

1. To display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. To declare Struct. Initialize and display contents of member variables.
3. To declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. To read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
6. To illustrate the concepts of console I/O operations.
7. To use scope resolution operator. Display the various values of the same
8. To allocate memory using new operator.
9. To create multilevel inheritance. (Hint: Classes A1, A2, A3)
10. To create an array of pointers. Invoke functions using array objects.
11. To use pointer for both base and derived classes and call the member function. Use Virtual keyword.
12. To implement a file handling program for demonstration of database connectivity.
13. To make a small project using C++.

<b>HSMC-CS301</b>	<b>Principles of Management and Managerial Economics</b>	<b>3L: 0T: 0P (3 hrs.)</b>	<b>3 Credits</b>
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**Pre requisite(s):** Nil

**Course Objectives:**

- Explain management, organization and the roles of managers & Explain different theories of management.
- Describe the importance of planning and organization Structure.
- Discuss the control process and its elements
- Explain the term Managerial Economics & its importance.
- Explain productivity & factors that affect productivity.

**Module- 1**

**Introduction:**

Definition, Functions, Process, Scope and Significance of Management. Nature of Management, Managerial Roles, Managerial Skills and Activities, Difference between Management and Administration. Significance of Values and Ethics in Management.

**Evolution of Management:**

Thought Approaches of Management Thought, Functions of Management. Different theories of Management. (08 Hrs)

**Module- 2**

**Planning and Organizing:**

Nature, Scope, Objective and Significance of Planning, Elements and Steps of Planning, Decision Making Organizing Principles, Span of Control, Line and Staff Relationship, Authority, Delegation and Decentralization. Effective Organizing, Organizational Structures, Formal and Informal Organizations, Staffing. (10 Hrs)

**Module- 3**

**Directing:**

Effective Directing, Supervision, Motivation, Different Theories of Motivation, Concept of Leadership- Theories and Styles. Communication Process, Channels and Barriers, Effective Communication.

**Controlling and Coordinating:**

Elements of Managerial Control, Control Systems, Management Control Techniques, Effective Control Systems. Coordination Concept, Importance, Principles and Techniques of Coordination, Concept of Managerial Effectiveness (08 Hrs)

**Module- 4**

**Managerial Economics:**

Introduction, Factors Influencing Manager, Micro and Macro-economics, Theory of the Cost, Theory of the Firm, Theory of Production Function. (08 Hrs)

**Module- 5**

**Productivity:**

Input-Output Analysis, Micro-economics Applied to Plants and Industrial Undertakings, Production and Production system, Productivity, Factors affecting Productivity, Increasing Productivity of Resources. (10 Hrs)

**Case Studies.**

## **Course Outcomes:**

After completion of the course student will be able to:

- Understanding of basic concepts, principles and practices of management
- Understanding the planning and organizing & organization Structures.
- Importance of Management Control Techniques
- Understand the term Managerial Economics & its importance.
- Understand productivity & factors that affect productivity.

## **Text Books :**

- 1 Chhabra T.N., Principles and Practice of Management. 10<sup>th</sup> ed Year 2018.
- 2 Murton- Gulab, Management Today. 3<sup>th</sup> ed.1998
- 3 KoontzH. and O'DonnelH., Essential of Management, 8<sup>th</sup> ed., McGraw-Hill, New Delhi, 2009.
- 4 Robbins, S.Fundamentals of Management. 5th ed., Pearson Education, Canada, 2008.

## **Reference Book:**

- 1 Prasad L M, Principles and Practices of Management, S. Chand and Sons, New Delhi ,2018
- 2 Terry & Francklin, Principles of Management, Richard– Erwin.18<sup>th</sup> Ed. 1982

<b>MC-3</b>	<b>III</b>	<b>Energy &amp; Environmental Engineering</b>	<b>L-2, T-0, P-0</b>	<b>0 Credits</b>
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**Course objective-**To provide an introduction to energy resources and an emphasis on alternative energy sources and their application. To study the interrelationship between the living organism and environment. To understand the transformation and degradation of organic pollutants in the environment

**Course content-**

**MODULE 1:** **6 hrs**  
 Energy: Introduction, conventional and non-conventional energy resources - coal, oil, gas, solar energy, wind energy, geothermal energy, Hydropower, Bio-energy, Nuclear energy. Energy survey in India. Current and future energy requirements in India and across the world including associated environmental problems.

**MODULE 2:** **8 hrs**  
 Ecosystem and Biodiversity: Introduction of an ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, rivers, oceans), Biodiversity at global, national and local levels. Threats to biodiversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Endangered and endemic species of India. Conservation of biodiversity: In-Situ and Ex-Situ.

**MODULE 3:** **8 hrs**  
 Air pollution and Water Pollution: Definition, Cause, effects and control measures of Air pollution; Mobile and stationary sources of air pollutants, effective stack height concept, CO, CO<sub>2</sub>, H<sub>2</sub>S, SO<sub>x</sub>, NO<sub>x</sub> emissions, and its control. Definition, Classification, Cause, effects and control measures of water pollution, Measurement of levels of pollution such as DO, BOD, COD.

**MODULE 4:** **6 hrs**  
 E-Waste: Definition, Classification, Cause, effects and control measures of e-waste, global trade issues of e-waste, Recycling method of e-waste & its benefit.

**MODULE 5:** **8 hrs**  
 Environment Impact & Protection Act Environment: Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. Environmental Impact Assessment. Measuring environmental impacts and policies for the regulation of environmental impacts.

**Course outcome-**

- CO 1: Ability to understand basic concepts conventional and non-conventional energy resources.
- CO2: Ability to understand Ecosystem & Biodiversity.
- CO3: To provide knowledge about Air pollution & Water Pollution.
- CO4: To provide knowledge & reuse of E-Waste.
- CO5: Ability to understand basic concepts of Environment Impact & Protection Act.

**Text/Reference Book-**

1. Environmental Engineering - H.S. Peavy & D.R. Rowe-Mc Graw Hill Book Company, New Delhi
2. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R)