Curriculum for Undergraduate Degree (B.Tech.) in Computer Science and Engineering (AI and ML) (w.e.f. AY: 2022-23)

Part III: Detailed Curriculum

Third Semester

Course Name:	**Digital Electronics**		
Course Code:	ES-EC302	**Category:**	Engineering Science Courses
Semester:	**3rd**	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Basic Electronics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To acquire the basic knowledge of digital logic gates and apply it to understand digital electronics circuits.
2	To prepare students to perform the analysis and design of various digital electronic circuits
3	To know different logic family, A/D Converter, D/A Converter.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Introduction to Number System and code:** Number System and Number Base Conversion, BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.	4
2	**Boolean algebra and Logic Gates:** Venn diagram, Boolean operations and functions, algebraic manipulation, minterms and maxterms, sum-of-products and product- of-sum representations, Digital Logic gates	4
3	**Simplification of Boolean functions:** K-map method, don't care conditions, prime implicants, Quine-McCluskey method	5
4	**Combinational logic circuits:** Adders and subtractors, comparator, multiplexer, demultiplexer, decoder, encoder, parity generator etc.	5

5	**Sequential Circuits:** Basic Flip-flop & Latch, Clocking and timing issues, Monostable and Astable Circuit using 555 Timer. Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counter, General counter design methodology.	12
6	**Logic families:** TTL, ECL, MOS and CMOS - basic concepts	2
7	**A/D and D/A conversion techniques:** Basic concepts D/A: R-2-R only A/D: Successive Approximation	4
Total		**36L**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Realize number systems, basic gate operations and laws of Boolean algebra.
2	Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
3	Perform different operations with sequential circuits.
4	Design A/D and D/A conversion techniques and articulate the basic concepts of Logic families.

Learning Resources:	
1	Morris Mano- Digital Logic and Computer Design- PHI
2	Leach & Malvino—Digital Principles & Application, 5/e, McGraw H
3	Floyed & Jain- Digital Fundamentals-Pearson.
4	S. Salivahanan, S. Arivazhagan – Digital Circuits and Design
5	D. Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publisher
6	Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

Course Name:	**Signals and Systems**		
Course Code:	ES-EC303	**Category:**	Engineering Science
Semester:	3rd	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Knowledge about basic signal and system modeling concept and definitions.
2	Knowledge about the application and use of mathematical transform in order to solve Electronics Engineering problems.
3	Knowledge in the use of a modern computation software tool for the analysis of Electronics engineering problems.

Course Contents:

Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction to signal:** Overview of Continuous and discrete time Signals, Introduction to elementary Signals: unit Impulse, unit Step, Ramp, Exponential, Sinusoidal etc., Classification of Signals: Even and Odd, Energy and Power, Periodic and Aperiodic etc., Mathematical Operations on Signals: Folding, Time Scaling, Time Shifting etc.	6
2	**Introduction to Systems & Signal Transformation:** Overview of System, Classification of Continuous and Discrete Time Systems, System properties: Linearity, Causality, Time Invariance and Stability, Overview of Impulse response and System Response in LTI System, Linear and Circular Convolution, Interconnections of Continuous and Discrete Time Systems.	6
3	**Laplace Transform:** Introduction to Laplace Transform, Region of Convergence (ROC), Properties of Laplace Transform, Representation ofPoles and Zeros in S Plane, Analysis of Continuous LTI system using Laplace Transform, Convolution & De-Convolution using Laplace Transform, Stability in S Domain, Structure Realization of Continuous LTI system in S Domain.	4
4	**Fourier Series:** Introduction to Fourier Series, Dirichlet's Conditions, Determination of Trigonometric and Exponential Fourier Series Coefficients of various Types of Periodic Signals.	4
5	**Fourier Transform:** Introduction to Fourier Transform, Properties of Fourier Transform, Discrete time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Overview of FFT algorithm, Gibbs Phenomenon, Parseval's Theorem, System Characterized by Linear Constant Co-efficient Differential Equations.	6
6	**Sampling Theorem:** Representation of Continuous Time Signals by its Sample –Types of Sampling, Sampling theorem. Reconstruction of a Signal from its Samples, Aliasing –Sampling of Band pass signals.	4

7	**Z-Transforms**: Introduction to Z- Transformation Technique, Properties of Z-transform, Relationship between Z- transform and Fourier Transform, Region of Convergence (ROC), Properties of ROC, Inverse Z-Transform, Structure realization of LTI discrete Time Systems in Z- Domain.	6
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Analyze different types of Signals.
2	Represent continuous and discrete systems in time and frequency domain using differenttransforms.
3	Investigate the stability of the systems.
4	Sampling and Reconstruction of Signals.

Learning Resources:	
1	A.Nagoor Kani- Signals and Systems- McGraw Hill
2	P.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
3	A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
4	S.Haykin & B.V.Veen, Signals and Systems- John Wiley

Course Name:	**Mathematics III**		
Course Code:	BS-M 305	**Category:**	Basic Science Course
Semester:	3rd	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	High school mathematics and BSM-101
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To understand probability theory and its applications.
2	To know about Bivariate distribution and Marginal distribution.
3	To learn Fourier series & transform.
4	To use the concept of generating function in solving recurrence relation.
5	To know about sampling distribution and hypothesis

Course Contents:

Module No.	**Description of Topic**	**Contact Hrs.**
1	**Module-1: Basic Probability:** • **Probability** (i) Definition of random experiment, sample space, events and probability. (ii) Basic theorems (Statement only) of probability and related problems. (iii) Conditional probability and independent events; Multiplication theorem; Baye's theorem (statement only) and related problems. • **Probability Distribution** (i) Definition of random variable; Discrete and continuous random variable; Probability mass function (p.m.f.) and probability density function (p.d.f.) of single random variable; Cumulative distribution function (c.d.f.); Applications. (ii) Expectation and variance of random variable; Properties and applications. (iii) **Some special types of distributions** ➢ **Discrete probability distribution:** Binomial and Poisson distributions; Mean and variance (no proof) and examples. ➢ **Continuous probability distribution:** Uniform, Exponential and Normal distributions; Mean and variance (no proof) and examples	8

2	**Module-2: Bivariate Probability Distribution:** • **Discrete bivariate distribution** (i) Joint probability distribution of two discrete random variables, marginal distribution. (ii) Expectation, variance, covariance; Independent random variables**.** • **Continuous bivariate distribution** (i) Joint probability distribution of two continuous random variables, marginal distribution. (ii) Expectation, variance, covariance; Independent random variables.	6
3	**Module-3: Statistics:** • **Sampling distribution** (i) Population and sampling distribution; statistic, standard error and confidence interval. (ii) Point and interval estimation; unbiased and consistent estimator; maximum likelihood estimate. (iii) Chebyshev's inequality. • **Test of hypothesis** (iv) Simple and composite hypothesis. Critical region. Level of significance. (v) Type I and Type II errors. **(vi)** One sample and two sample tests for means and proportions. $\chi 2$ - test for goodness of fit.	8
4	**Module-4: Fourier Series and Fourier Transforms:** • **Fourier Series** (i) Periodic function and periodic extension of a function; Odd and even functions. (ii) **Special wave forms:** square wave, half wave rectifier, full wave rectifier, saw-toothed wave, triangular wave (graphical illustration only). (iii) Euler's formulae for Fourier series; Fourier series of functions of period 2π ; Fourier series of functions of period $2l$; Dirichlet's conditions and related problems. (iv) Half range Sine and Cosine series and related problems. (v) Parseval's identity (statement only) and related problems. • **Fourier Transforms** (i) Definition of Fourier transforms; Properties of Fourier transforms: Linearity, Shifting, change of scale property; Fourier transforms of some elementary functions; Fourier transforms of derivatives. (ii) Fourier sine and cosine transforms and related problems. (iii) Inverse Fourier transforms and convolution theorem; related problems.	10

5	**Module-5: Vector Space** I. Linear combination of vectors, Linear dependence and independence of vectors II. Linear span of subset of a vector space. III. Basis and dimension of a vector space. IV. Subspaces: Definition and examples including lines in **V.** Diagonalizations and Orthogonality	8
Total		**40**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment
2	Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.
3	Apply statistical tools for analysing data samples.
4	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
5	To solve engineering problems using z transform and probability theory.

Learning Resources:	
1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2	Michael Greenberg, Advanced Engineering Mathematics, Pearson.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4	Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning
5	Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
6	N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill
7	S. Ross, A First Course in Probability, Pearson Education India
8	W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley

Course Name:	**Introduction to Industrial Management**		
Course Code:	HM-HU 301	**Category:**	Management Science and Humanities Courses
Semester:	3rd	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	Nil
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Contribute to the success of companies through effective problem solving.
2	Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Introduction** System- concept, definition, types, parameters, variables and behavior. Management – definition and functions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. Organizational culture and climate – meaning, differences and factors affecting them. Moral-factors affecting moral. Relationship between moral and productivity. Job satisfaction- factors influencing job satisfaction. Important provisions of factory act and labor laws.	4
2	**Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):** CPM & PERT-meaning, features, difference, applications. Understand different terms used in network diagram. Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications	6
3	**Materials Management:** Material management-definition, functions, importance, relationship with other departments. Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping-functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice.	4

	Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). Material Requirement Planning (MRP)-concept, applications and brief details about software packages available in market.	
4	**Production planning and Control (PPC):** Types and examples of production. PPC :i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling- meaning and need for productivity and utilisation. Gantt chart- Format and method to prepare. Critical ratio scheduling-method and numeric examples. Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. Bottlenecking- meaning, effect and ways to reduce.	6
5	**Value Analysis (VA) and Cost Control:** VA-definition, terms used, process and importance. VA flow diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	3
6	**Recent Trends in IM:** ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits	3
Total		**26**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Interpret given organization structure, culture, climate and major provisions offactory acts and laws.
2	Explain material requirement planning and store keeping procedure.
3	Plot and analyze inventory control models and techniques.
4	Prepare and analyze CPM and PERT for given activities.
5	List and explain PPC functions.

Learning Resources:	
1	*L.S. Srinath– "CPM & PERT principles and Applications".*
2	*Buffa – "Modern Production Management".*
3	*N. Nair – "Materials Management".*
4	*O. P. Khanna – "Industrial Engineering & Management".*
5	*Mikes – "Value Analysis".*
6	*S.C. Sharma, "Engineering Management – Industrial Engineering & Management", Khanna Book Publishing Company, New Delhi*

Course Name:	**Data Structures and Algorithms**		
Course Code:	PC-CS301	**Category:**	Professional Core Courses
Semester:	3rd	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Programming Concept, Basic Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To familiarize the students with the basic concepts of linear data structures and operations on it.
2	To acquaint the students with nonlinear data structures and its application areas.
3	To develop the ability to compare complexity of different sorting and searching algorithms.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Basic Terminologies: Elementary Data Organizations, Array, Data Structure Operations: insertion, deletion, traversal etc. Analysis of an Algorithm: Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search algorithms and their complexity analysis, Interpolation Search algorithm. Recursion: Definition and Types with examples of each types, Tower of Hanoi problem and its complexity analysis.	6
2	Stacks and Queues: Stack as an ADT and its operations, Applications of Stacks: Expression Conversion and Evaluation – corresponding algorithms. Queue as an ADT: Types of Queue: Linear Queue, Circular Queue, Priority Queue; Operations on each types and their algorithms. Dequeue: Basic concept and associated algorithms.	6
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Application of Linked list: representation of Polynomial and addition of two polynomials. Doubly linked list and Circular Linked List: Basic Concept and Operations.	6
4	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, its properties, Complete and Strictly Binary Tree, Threaded Binary Tree, Binary Search Tree: insertion, deletion & traversal algorithms, AVL tree, Applications of Binary Trees. B Tree, B+ Tree: definitions and construction algorithms. Graph: Basic terminologies and Representations, Graph traversal algorithms (BFS and DFS), Minimal Spanning Tree algorithms (Prim's and Kruskal's).	12
5	Sorting and Hashing: Objective and properties of different sorting algorithms: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance analysis and comparison among all the methods; Hashing: Definition, Hash functions, Collision resolution techniques.	6
Total		**36L**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Understand the basic concepts of Data structures and complexity of algorithms.
2	Comprehend the concepts of linear and nonlinear data structures and operations on them.
3	Apply the knowledge of linear and nonlinear data structures in solving problems.
4	Analyze complexity of different Sorting and Searching algorithms.

Learning Resources:	
1	"Data Structures with C" by Seymour Lipschutz, McGrawHill
2	"Data Structures Using C" by Reema Thareja, Oxford
3	"Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni
4	"Data Structures using C" by A N Tenenbaum, Y Langsam, M J Augenstein, Pearson

Course Name:	**Biology**		
Course Code:	BS-BIO301	**Category:**	Basic Science Course
Semester:	3rd	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	Basic knowledge of Physics, Chemistry and Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Bring out the fundamental differences between science and engineering
2	Discuss how biological observations of 18th Century that lead to major discoveries

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Module 1- Introduction to Biology:** To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2
2	**Module2-Classification System in Biology:** The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. *E. coli, S. cerevisiae, D. melanogaster, C. elegance, A. thaliana, M. musculus.*	2
3	**Module 3: Genetics:** To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be given not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Importance of stem cell research.	2
4	**Module 4: Biomolecules**: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.	4

5	**Module 5: Enzymes:** To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Discuss at least two examples.	2
6	**Module 6: Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	4
7	**Module 7: Macromolecular analysis:** How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	4
8	**Module 8: Metabolism:** ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	2
9	**Module 9: Microbiology:** Concept of microscopic organisms. Concept of species and strains. Identification and classification of microorganisms. Sterilization and media compositions. Growth kinetics. Microscopy: simple, compound, phase-contrast, SEM, TEM, Confocal: principle and applications.	2
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	State different engineering applications from biological perspective.
2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
6	Describe energy transformation processes in biological systems.

Learning Resources:	
1	Biology for Engineers. Arthur T. Johnson. CRC Press.
2	Biology and Engineering of Stem Cell Niches. A K Vishwakarma and Jefferey Karp, Elsevier.
3	Environmental Biology for Engineers and Scientists. David A. Vaccari, P. P. Storm and J. F Alleman. ELBS
4	Biology for Engineers. G. K. Suraishkumar. Oxford

Course Name:	**Digital Electronics Lab**		
Course Code:	ES-EC392	**Category:**	Engineering Science Courses
Semester:	3rd	**Credit:**	1.5
L-T-P:	0-0-3	**Pre-Requisites:**	Basic Electronics
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To acquire the basic knowledge of digital logic gates and application it to understand digital electronics circuits.
2	To prepare students to design various combinational and sequential circuits.
3	To know the working principle of A/D and D/A Converter.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Realization of Basic gates (AND,OR,NOT) from Universal Gates(NAND & NOR).	3
2	Implementation of the given Boolean function using logic gates in both sop and pos forms.	3
3	Design and Verify adder, subtractor Circuit	3
4	Implementation and Verification of Decoder, Encoder, Multiplexer, Demultiplexer Circuit	6
5	Verification of state tables of RS, JK, T and D flip-flops	3
6	Design of Shift Register	3
7	Design of Asynchronous Counter	3
8	Design of Synchronous Counter	3
9	Design of Ring/Johnson Counter	3
10.	Study of D/A Converter and A/D Converter Circuit	6
Total		**36P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Realize basic gate operations and laws of Boolean algebra.
2	Design different combinational circuits.
3	Design different sequential circuits.
4	Study A/D converter and D/A converter circuits.

Learning Resources:	
1	Morris Mano- Digital Logic and Computer Design- PHI
2	Leach & Malvino—Digital Principles & Application, 5/e, McGraw H
3	Floyed & Jain- Digital Fundamentals-Pearson.
4	S. Salivahanan, S. Arivazhagan – Digital Circuits and Design
5	D. Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publisher
6	Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

Course Name:	**Data Structures and Algorithms Lab**		
Course Code:	PC-CS391	**Category:**	Professional Core Courses
Semester:	3rd	**Credit:**	1.5
L-T-P:	0-0-3	**Pre-Requisites:**	Programming knowledge
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To familiarize the students with programming concepts required for implementing linear data structures and operations on it.
2	To acquaint the students with dynamic memory allocation concepts required for implementing linear & nonlinear data structures.
3	To develop the ability to write menu driven programs that compares different sorting and searching techniques.

Course Contents: The course should cover (but may not limited to) C program implementation of the following topics

Module No.	**Description of Topic**	**Contact Hrs.**
1	**Linear Data Structure:** a) Basic data structure operations using Array b) Implementation of Stack operations using array c) Implementation of Linear Queue operations using array d) Implementation of Circular Queue operations using array	4×3
2	**Application of Stack:** a) Program to convert an infix expression to Postfix Expression b) Program for Evaluating a Postfix Expression. (optional)	1×3
3	**Programs using Dynamic Memory Allocation:** Implementation of Single Linked List and associated operations (menu driven) Application of Single Linked List : a) Implementation of Stack and Queue using Single Linked List. b) Program to add two Polynomials using Single Linked List (SLL).	3×3
4	Implementation of various Sorting algorithms (Menu driven) Implementation of various Searching algorithms (Menu driven)	3×3
5	**Implementation of Non-Linear Data Structure** a) Binary Search Tree: Construction and Traversal b) AVL tree: Construction and Traversal (optional)	1×3
Total		**36P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Write the basic codes on linear Data structures and operations performed on it
2	Apply dynamic memory allocation concept to implement linear and nonlinear data structures programs
3	Apply the knowledge of linear data structures to solve expression conversion programs.
4	Compare different Sorting and Searching techniques by writing menu driven programs.

Learning Resources:	
1	"Data Structures with C" by Seymour Lipschutz, McGrawHill
2	"Data Structures Using C" by Reema Thareja, Oxford
3	"Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni
4	"Data Structures using C" by A N Tenenbaum, Y Langsam, M J Augenstein, Pearson

Course Name:	**IT Workshop (Using Python) Lab**		
Course Code:	PC-CS392	**Category:**	Professional Core Course
Semester:	3rd	**Credit:**	1.5
L-T-P:	0-0-3	**Pre-Requisites:**	Familiar with any Basic computer language
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	a) Master the fundamentals of writing Python scripts b)Learn core Python scripting elements such as variables and flow control structures
2	a) Use Python to read and write files b) Make their code robust by handling errors and exceptions properly
3	a) Explore Python's object-oriented features b) Search text using regular expressions
4	Understand the Exception Handling and Object-oriented concept of Python.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Introduction** History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator	3
2	**Conditional Statements** If , If- else, Nested if-else, Looping, For, While, Nested loops	3
3	**Control Statements** Break, Continue, Pass **String Manipulation** Accessing Strings, Basic Operations, String slices, Function and Methods	3
4	**Lists** Introduction, Accessing list, Operations, Working with lists, Function and Methods **Tuple** Introduction, Accessing tuples, Operations, Working, Functions and Methods **Dictionaries** Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	6
5	**Functions** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables **Modules** Importing module, Math module, Implementation of Array using numpy module, Random module, Packages, Composition, Input-Output	6

6	**Exception Handling** Exception, Exception Handling, Except clause, Try- finally clause, User Defined Exceptions	3
7	**The Object-Oriented Approach: Classes, Methods, Objects** Basic concepts of object programming, Implementation of Properties of Object-oriented Programming, Inheritance.	
8	**File Handling** Introduction to File Handling, Data Files, Opening and Closing Files, Reading and Writing Files	3
9	**Data Visualization using Python** Concept of Data Visualization, Using Pyplot of Matplotlib library, Creating Line chart, Bar chart and Pie chart using pyplot interface, Customizing the Plot	3
Total		**36P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Understand and develop Computational Thinking concepts.
2	Express a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
3	Describe python programs that appropriately utilize built-in functions and control flow statements.
4	Use functions for structuring Python programs
5	Represent compound data using Python lists, tuples, dictionaries
6	Apply the knowledge of different Charts along with their comparison.

Learning Resources:	
1	"Core Python Programming" by R.Nageswar Rao
2	"Python:the complete reference" by Martin C.Brown
3	"Let us Python" by Yashvant Kanetkar
4	"Programming and Problem Solving With Python" by Ashok Namdev Kamthane and Amit Ashok Kamthane
5	"Python Programming" by Anurag Gupta and G. P. Biswas

Course Name:	**Environmental Science**		
Course Code:	MC371	**Category:**	Mandatory Course
Semester:	3rd	**Credit:**	0
L-T-P:	2-0-0	**Pre-Requisites:**	Basic concepts of Environmental Science
Full Marks:	100		
Examination Scheme:	Semester Examination of 100 marks		

Course Objectives:	
1	Purpose: We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects this ethos. There is a direct application of this wisdom even in modern times.
2	Idea of an activity-based course on environment protection is to sensitize the students on the above issues through following two type of activities.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**(a) Awareness Activities:** i) Small group meetings about any of the topic. ii) Slogan making event iii) Poster making event iv) Seminar on any of the topic. v) Preparation of a report on any of the topic regarding current scenario.	 4 2 5 4 4
2	**(b) Actual Activities:** i) Plantation ii) Gifting a tree to see its full growth iii) Cleanliness drive iv) Drive for segregation of waste v) Shutting down the fans and ACs of the campus for an hour or so	 1 1 1 1 1
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Course Outcomes:	
After completion of the course, students will be able to:	
1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
4	Study Elements of ecology and environmental management.

Learning Resources:	
1	M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House, New Delhi, 2019
2	Environmental science by Gillbert G. Master