Bachelor of Technology

in

Artificial Intelligence

B.Tech. (AI)

Curriculum

First Year

Curriculum implemented from Academic Year 2023-24 in accordance with National Education Policy 2020

B.Tech. I (AI) Semester – I **INTRODUCTION TO COMPUTER SCIENCE (CORE-1)** **AI101**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Acquire knowledge about computers and computational problem solving.
CO2	Design the solutions of computational problems using iterative and recursive methods using flowcharts and pseudo-codes.
CO3	Solve computational problems in different number systems.
CO4	Analyse the importance of different types of memory and evaluate the impact of different algorithms on memory.
CO5	Experiment with different operating systems such as Windows and Linux and write scripts to automate repetitive tasks.

2.	**Syllabus**	
	INTRODUCTION TO COMPUTER AND ITS ARCHITECTURE	**(04 Hours)**
	Introduction and Characteristics, Computer Architecture, Generations, Classifications, Applications, Central Processing Unit and Memory, Communication between various Units, Processor Speed, Multiprocessor System, Peripheral Buses, Motherboard Demonstration.	
	NUMBER SYSTEMS	**(06 Hours)**
	Introduction and type of Number System, Conversion between Number System, Arithmetic Operations in different Number System, Signed and Unsigned Number System.	
	COMPUTATIONAL PROBLEM SOLVING	**(08 Hours)**
	Program Development Cycle, Pseudocode, Flowchart, Representing Information as Bits, Binary System, Storing Integers, Storing Fractions, Examples of Computational Problems, Iterative and Recursive Approaches to Solve Computational Problems, Easy and Hard Computational Problems	
	MEMORY AND VARIOUS INPUT AND OUTPUT DEVICES	**(04 Hours)**
	Introduction to Memory, Input and Output Devices, Memory Hierarchy, Primary Memory and its Types, Secondary Memory, Classification of Secondary Memory, Various Secondary Storage Devices and their Functioning.	

	INTRODUCTION TO SYSTEM SOFTWARES AND PROGRAMMING LANGUAGES	**(03 Hours)**
	Classification of Computer Languages, Introduction of Operating System, Evolution, Type and Function of OS, Unix Commands, Evolution and Classification of programming Language, Feature and Selection of good Programming Language, Development of Program, Algorithm and Flowchart, Program Testing and Debugging, Program Documentation and Paradigms, Characteristics of good Program.	
	WINDOWS OPERATING SYSTEM AND ITS ENVIRONMENT	**(03 Hours)**
	Introduction to GUI based OS, Configuration, Setup, Services, Network Configuration.	
	LINUX OPERATING SYSTEM AND ITS ENVIRONMENT	**(06 Hours)**
	Introduction to Linux OS, Configuration, Setup, Commands – Navigating File System, File Permissions (R/W/X), Access control and super user (sudo) privileges, Scripting basics, Bash Shell and Scripting, Network Configuration.	
	DEBUGGING TOOLS AND COMPILER OPTION	**(03 Hours)**
	Different Debugging tools, Commands, Memory dump, Register and Variable Tracking, Instruction and Function level debugging, Compiler Options, Profile Generation.	
	DATA COMMUNICATION, COMPUTER NETWORK AND INTERNET BASICS	**(04 Hours)**
	Data Communication and Transmission media, Multiplexing and Switching, Computer Network and Network Topology, Communication Protocols and Network Devices, Evolution and Basic Internet Term, Getting Connected to Internet and Internet Application, Email and its working, Searching the Web, Languages of Internet, Internet and Viruses.	
	SYSTEM AND NETWORK SECURITY BASICS	**(04 Hours)**
	Security Services, Security Attacks, and Security Mechanisms, Authentication, Password Strengths and Entropy, Access Control Mechanisms, Read/Write/Execute Permissions and Super User/Administrator Privileges, Introduction of HTTPS and Digital Certificates	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Number System
2	Problem Solving using Algorithms

3	Problem Solving using Flowcharts
4	Linux Commands
5	Bash Shell Scripting

4.	**Books Recommended**
1.	Introduction to Computer Science", Fourth Impression, Pearson Education, ITL Education Solutions Limited, 2009.
2.	Nell Dale and John Lewis, "Computer Science Illuminated", Jones and Bartlett Publishers.
3.	Robert Sedgewick and Kevin Wayne, "Computer Science", Addison-Wesley.

B.Tech. I (AI) Semester – I **INTRODUCTION TO PROGRAMMING (CORE-2)** **AI103**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Acquire knowledge about fundamentals of C programming language.
CO2	Apply the knowledge of C Programming to solve computational problems.
CO3	Debug, test, and analyse C Programs to find and correct errors and improve the solutions.
CO4	Learn various programming techniques such as iteration and recursion, and apply them to solve computational problems.
CO5	Learn and apply the advanced programming concepts such as modularization, memory management, and file handling to improve the efficiency of computational problems.

2.	**Syllabus**	
	OVERVIEW OF C PROGRAMMING LANGUAGE	**(02 Hours)**
	History of C, Importance of C, Basic Structure of a C Program, How to Compile a C Program, How to Run a C Program, Sample Programs.	
	CONSTANTS, VARIABLES, AND DATA TYPES	**(03 Hours)**
	Character Set in C, Keywords, Identifiers, Constants, Strings, Operators, Special Symbols, Variables, Data Types: Primary Data Types and User Defined Data Types, Declaration of Variables, Assigning Values to Variables, Initialization of Variables, Defining Symbolic Constants, Declaring Variables as Constants.	
	OPERATORS AND EXPRESSIONS	**(03 Hours)**
	Operators: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Comma Operator, sizeof Operator, Operators used in Pointers and Structures, Arithmetic Expressions, How C programming Evaluates Arithmetic Expressions, Precedence of Arithmetic Operators and Associativity Rule, Type Conversion: Implicit and Explicit.	
	LIBRARY FUNCTIONS: INPUT, OUTPUT, MATHEMATICS, DATE AND TIME	**(03 Hours)**
	Reading Character from Keyboard, Printing Character on Screen, Reading String from Keyboard, Printing String on Screen, Formatting input and Output, difftime, clock, time, Math Functions: abs, fmod, reminder, log, log2, pow, sqrt, ceil, floor.	

	DECISION MAKING AND BRANCHING	**(04 Hours)**
	Decision Making in C Programming, If Statement, Nested If Statement, Else .. If Ladder, Switch Statement, Conditional Operator Statement, Goto Statement, Decision Making with Logical Operators, Sample Programs.	
	DECISION MAKING AND LOOPING	**(05 Hours)**
	Introduction to Loops, While Loop, Do While Loop, For Loop, Break Statement, Goto Statement, Continue Statement, Sample Programs.	
	ARRAYS AND CHARACTER ARRAYS	**(05 Hours)**
	Introduction to Arrays, One Dimensional Array, Declaration and Initialization of One Dimensional Array, Two Dimensional Array, Declaration and Initialization of Two Dimensional Array, Multi-Dimensional Array, Sample Programs, Declaration and Initialization of Strings, Arithmetic Operations on Characters, String Functions: Strlen(), Strcat(), Strcpy(), Strstr(), Strcmp(), etc.	
	FUNCTIONS	**(05 Hours)**
	Function Declaration, Function Definition, Function Calls, Functions with No Arguments and No Return Values, Functions with Arguments and No Return Values, Functions with No Arguments and Return Values, Functions with Arguments and Return Values, Recursive Functions, Passing Arrays to Functions, Call by Value, Call by Reference, Scope and Lifetime of Functions: Local, Global, Static, and Register Declaration.	
	STRUCTURES AND UNIONS	**(04 Hours)**
	Structure Template, Structure Variable Declaration and Initialization, Structure Variable Assignment, Accessing Structure Variables, Arrays as Structure, Arrays with Structures, Passing Structure Members to Functions, Unions, Difference Between Structures and Unions, Bit Fields.	
	POINTERS AND MEMORY MANAGEMENT	**(05 Hours)**
	Declaration and Initialization of Pointers, Accessing Memory through Pointers, Dynamic Memory Allocation, Memory Management Functions: Malloc, Calloc, and Free, Using Pointers to Access Dynamically Allocated Memory Locations, Pointers with Arrays, Use of Pointers to Return Multiple Values From Functions, Sample Program: Linked List.	
	FILE MANAGEMENT	**(04 Hours)**
	Opening and Closing a File, Modes in File Opening: Read, Write and Append, Input and Output Operations on Files, File Handling Functions such as fseek(), ftell(), rewind().	
	PREPROCESSOR DIRECTIVES	**(02 Hours)**
	Macro Substitution, Importing a File, Compiler Control Directives.	

	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	C Programming – How to write a program, compile a program, and execute a program
2	Read the input from a keyboard and write the output to computer screen
3	Variable declaration, initialization, and assignment, Constant declaration, Experiments with different data types
4	Experiments with different C Operators, Analysing the impact of precedence and associativity rules while evaluating expressions in C
5	Experiments with standard library functions related to math library, time library, standard input and output library etc.
6	Experiments with If, Else If, Switch, Goto statements
7	Experiments with While, Do…While, For Loops, and analysing the impact of Break, Goto and Continue statements on C Loops
8	Experiments with Arrays and Character Arrays
9	Experiments with Different Functions having Arguments/No Arguments and Return Values/No Return Values, Scope and Lifetime of Functions, and Understanding Local, Global, Static, and Register Declaration
10	Experiments with Structures and Unions, Analysing the difference between the structure and union with respect to memory
11	Experiments with Pointers with respect to Accessing Memory from the Stack and Heap Section of the RAM (i.e., Experiments with Static and Dynamic Memory Management)
12	Opening, Closing the Files using a C program, and accessing the files to get the input from the file and store the output to the file.
13	Experiments with pre-processor directives.

4.	**Books Recommended**
1.	E. Balagurusamy, “Programming in ANSI C”, Mc-Graw Hill.
2.	Brian W. Kernighan / Dennis Ritchie,“The C Programming Language”, Pearson.
3.	Yashavant Kanetkar, “Let us C”, BPB Publications.
4.	Harbison and Steele, “C: A Reference Manual”

B.Tech. I (AI) Semester – I **ENGLISH AND PROFESSIONAL COMMUNICATION** **HS110**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Show enhanced reception towards the use of English language.
CO2	Choose and employ appropriate words for professional communication.
CO3	Develop sentences and text in English coherently and formally.
CO4	Demonstrate overall improvement in oral communication.
CO5	Analyze and infer from written and oral messages.

2.	**Syllabus**	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different forms of Communication, Barriers to Communication and some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note taking practice, Practice and activities; Reading Comprehension (unseen passage- literary / scientific / technical) Skimming and scanning, fact vs opinion, Comprehension practice	
	SPEAKING SKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation and practice. Interviews- types, preparation and mock interview; Group Discussion- types, preparation and practice	
	WRITING SKILLS	**(10 Hours)**
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, Editing.	

	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Letter and Resume
2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi & Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rd Edition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley. *Basic Business Communication skills for Empowering the Internet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi. "Business Communication Today." Ninth Edition. Pearson, 2009.
5	Mike Markel. "Practical Strategies for Technical Communication," Bedford/ St. Martin's Second Edition, 2016

ADDITIONAL REFERENCE BOOKS	
1	Laura J. Gurak and John M. Lannon. "Strategies for Technical Communication in the Workplace," Pearson, 2013.

B.Tech. I (AI) Semester – I **ELECTRICAL NETWORK ANALYSIS** **EE103**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about AC circuits, electrical network basics, transforms, wave form representation.
CO2	apply the fundamentals of electrical network basics to analyse different networks.
CO3	analyse electrical network using different theorems and different wave forms.
CO4	evaluate network performance using different parameters.
CO5	design and analyse different types of systems using network principles and network theorems.

2.	**Syllabus**	
	AC FUNDAMENTALS AND CIRCUITS	**(10 Hours)**
	Alternating Voltages and Currents through Purely Resistive Inductive and Capacitive Circuits, R-L, R-C, R-L-C Series Circuits, Impedance and Admittance, Circuits in Parallel, Series and Parallel Resonance, Complex Algebra and its Application to Circuit Analysis, Circuit Transient, Initial and Final Value Theorem, DC and Induction Machines, Electrical Measurements, Power System.	
	POLYPHASE CIRCUITS AND TRANSFORMES	**(10 Hours)**
	Balanced Three Phase Systems, Star and Mesh Connections, Relation between Line and Phase Quantities, Measurement of Power, Principle of Transformer, Construction, Transformer on no-load and with load, Phasor Diagram for Transformer under No-Load and Loaded Condition (with unity, lagging power factor load) Equivalent Circuit, Open Circuit and Short Circuit Test, Efficiency, Voltage Regulation.	
	NETWORK CONCEPTS	**(04 Hours)**
	Network Element Symbols and Conventions, Active Element Conventions, Current and Voltage Conventions, Loops and Meshes, Nodes, Coupled circuits and Dot Conventions.	
	MESH CURRENT AND NODE VOLTAGE NETWORK ANALYSIS	**(04 Hours)**
	Kirchhoff's Voltage Law, Kirchhoff's Current Law, Definitions of Mesh Current and Nodal Voltage, Choice of Mesh Currents or Nodal Voltages for Network Analysis, Self and Mutual Inductances, Mesh Equation in the Impedance Matrix Form by Inspection, Solution of Linear Mesh Equations, Nodal Voltage Analysis Nodal Equations in the Form of Admittance Matrices by Inspection,	

	Solution of Linear Nodal Equations.	
	NETWORK THEOREMS AND GRAPH	**(06 Hours)**
	Linearity and Superposition, Independent and Dependent Source and their Transformations, Thevenin, Norton, Reciprocity and Maximum Power Transfer Theorems, Use of these Theorems in Circuit Analysis, Duality and Dual of a Planner Network, Fundamental Concepts, Definition of Graph and Various Related Terms, Paths and Circuits Connections, Tree of a Graph, Cut Sets and Tie Sets, Non-separable Planner and Dual Graphs, Matrices of Oriented Graphs, Properties and Inter-Relationship of Incidence, Tie Set and Cut Set Matrices, Complete Analysis Using Tie Set and Cut Set Matrices.	
	WAVE FORM ANALYSIS BY FOURIER SERIES	**(03 Hours)**
	Trigonometric and Complex Exponential Forms, Frequency Spectra of Periodic Wave Forms, Fourier Integral and Continuous Frequency Spectra, Fourier Transform and their Relationship with Laplace Transform.	
	NETWORK FUNCTIONS AND TWO PORT PARAMETERS	**(08 Hours)**
	Poles and Zeros of a Function, Physical and Analytical Concepts, Terminal and Terminal Pairs, Driving Point Immitances, Transfer Functions, Definitions, Calculations and Interrelationship of Impedance, and Admittance, Hybrid and Transmission Line Parameters for four Terminal Networks. Image Impedance and its Calculations for Symmetrical and Unsymmetrical π, T and Ladder Networks.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	To study Ammeter and Voltmeter for current and voltage measurement in circuit.
2	To study Energy meter.
3	Verification of superposition theorem for electric circuit.
4	To study Power measurement method for three phase circuits using watt meter method.
5	Verification of Thevenin's theorem of electric circuit.
6	Calculation and verification Norton's theorem.
7	Open circuit and short circuit test for the transformers for efficiency calculation.
8	Verification of Kirchhoff's current law and Kirchhoff's voltage law for electric circuit.
9	Capacitance measurement of parallel plates.
10	Calculation of efficiency of auto transformer.

4.	**Books Recommended**
1.	W.H.Hyat, J.E.Kemmerly, S.M.Durbin, "Engineering Circuit Analysis", 6th Edition, TMH, 2006.
2.	Van Valkenburg M E, "Network Analysis", 3rd Edition, PHI, 2002.
3.	Samarjit Ghosh, "Network Theory, Analysis & Synthesis",3rd Edition, PHI, 2005.
4.	C.L.Wadhwa, "Network Analysis & Synthesis", Revised 3rd Edition, New Age International Publishers, 2007.
5.	Kothari and Nagrath, "Basic Electrical Engineering", 2nd edition, Tata McGraw-Hill Education, 2007.

ADDITIONAL REFERENCE BOOKS	
1.	V. N. Mittle & Arvind Mittal, "Basic Electrical Engineering", 2nd edition, Tata McGraw-Hill Education, 2005.

B.Tech. I (AI) Semester – I **FUNDAMENTALS OF ENGINEERING MATHEMATICS** **MA105**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Accept the challenge to solve the problem with Mathematics.
CO2	Apply the knowledge of curve tracing to solve problem of engineering.
CO3	Identify, formulate and analyze complex engineering and affiliated field problems, specifically the differential equation concept in different engineering field.
CO4	Apply the knowledge of mathematics for model and analyze computational processes using analytic and combinatorial methods
CO5	Design solutions engineering industrial problems with effective mathematical skill.

2.	**Syllabus**	
	DIFFERENTIAL CALCULUS	**(09 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIAL CALCULUS	**(09 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(06 Hours)**
	Cartesian, polar and parametric form of standard curves.	
	ORDINARY DIFFERENTIAL EQUATION	**(09 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	

	APPLICATION OF DIFFERENTIAL EQUATION (Mathematical Modelling)	**(06 Hours)**
	Modelling of Realworld problems particularly Engineering System, Electrical network models (LCR), spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(06 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	**Books Recommended**
1	James Stewart, "Calculus", Thomson Asia, Singapore, 2003.
2	Kreyszing E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015.
3	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
4	F. B. Hilderband, "Methods of Applied mathematics", PHI, New Delhi, 1968
5	Ramana D. V., "Higher Engg. Mathematics", The McGraw-Hill Inc., New Delhi, 2007.

ADDITIONAL REFERENCE BOOKS	
1	Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.
2	Bali and Iyengar, "Engineering Mathematics", Laxmi Publications, New Delhi, 2004.
3	Mary L. Boas, "Mathematical Methods in the Physical Sciences", John Wiley & Sons, Ed.2005

B.Tech. I (AI) Semester – II **DATA STRUCTURES (CORE-3)** **AI102**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**2**	**05**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	recognize the need of different data structures and understand its characteristics.
CO2	apply different data structures for given problems.
CO3	design and analyse different data structures, sorting and searching techniques.
CO4	evaluate data structure operations theoretically and experimentally.
CO5	give solution for complex engineering problems.

2.	**Syllabus**	
	INTRODUCTION TO DATA STRUCTURES	**(03 Hours)**
	Review of Concepts: Information and Meaning, Abstract Data Types, Internal Representation of Primitive Data Structures, Arrays, Strings, Structures, Pointers.	
	LINEAR LISTS	**(06 Hours)**
	Sequential and Linked Representations of Linear Lists, Comparison of Insertion, Deletion and Search Operations for Sequential and Linked Lists, Doubly Linked Lists, Circular Lists, Lists in Standard Template Library (STL), Applications of Lists.	
	STACKS	**(06Hours)**
	Sequential and Linked Implementations, Representative Applications such as Recursion, Expression Evaluation Viz., Infix, Prefix and Postfix, Parenthesis Matching, Towers of Hanoi, Wire Routing in a Circuit, Finding Path in a Maze.	
	QUEUES	**(06 Hours)**
	Operations of Queues, Circular Queue, Priority Queue, Dequeue, Applications of Queues, Simulation of Time Sharing Operating Systems, Continuous Network Monitoring System Etc.	
	SORTING AND SEARCHING	**(04 Hours)**

	Sorting Methods, Bubble Sort, Selection Sort, Quick Sort, Radix Sort, Bucket Sort, Dictionaries, Hashing, Analysis of Collision Resolution Techniques, Searching Methods, Linear Search, Binary Search, Character Strings and Different String Operations.	
	TREES	**(08 Hours)**
	Binary Trees and Their Properties, Terminology, Sequential and Linked Implementations, Tree Traversal Methods and Algorithms, Complete Binary Trees, General Trees, AVL Trees, Threaded Trees, Arithmetic Expression Evaluation, Infix-Prefix-Postfix Notation Conversion, Heaps as Priority Queues, Heap Implementation, Insertion and Deletion Operations, Heapsort, Heaps in Huffman Coding, Tournament Trees, Bin Packing.	
	MULTIWAY TREES	**(05 Hours)**
	Issues in Large Dictionaries, M-Way Search Trees, BTrees, Search, Insert and Delete Operations, Height of B-Tree, 2-3 Trees, Sets and Multisets in STL.	
	GRAPHS	**(07 Hours)**
	Definition, Terminology, Directed and Undirected Graphs, Properties, Connectivity in Graphs, Applications, Adjacency Matrix and Linked Adjacency Chains, Graph Traversal, Breadth First and Depth First Traversal, Spanning Trees, Shortest Path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours + 30 Hours = 90 Hours)	

3.	**Tutorials**
1	Problems on Array
2	Problems on Stack and Queue
3	Problems on Linked List
4	Problems on Trees
5	Problems on Graph

4.	**Practicals**
1	Implementation of Array and its applications
2	Implementation of Stack and its applications

3	Implementation of Queue and its applications
4	Implementation of Link List and its applications
5	Implementation of Trees and its applications
6	Implementation of Graph and its applications
7	Implementation of Hashing functions and collision resolution techniques
8	Mini Project (Implementation using above Data Structure)

5.	**Books Recommended**
1	Trembley & Sorenson: "An Introduction to Data Structures with Applications", 2/E, TMH, 1991.
2	Tanenbaum & Augenstein: "Data Structures using C and C++", 2/E, Pearson, 2007.
3	Horowitz and Sahani: "Fundamentals of Data Structures in C", 2/E, Silicon Press, 2007.
4	T. H. Cormen, C. E. Leiserson, R. L. Rivest: "Introduction to Algorithms",3/E, MIT Press, 2009.
5	Robert L. Kruse, C. L. Tondo and Brence Leung: "Data Structures and Program Design in C", 2/E, Pearson Education, 2001.

B.Tech. I (AI) Semester – II **WEB PROGRAMMING AND PYTHON (CORE-4)** **AI104**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about the basics of web pages, need of web server, configuration, client and server side scripting, style of web pages and script programming.
CO2	install and configure the web server and apply the knowledge of programming to develop web application pages using html, style sheets, client and server side scripts using script programming.
CO3	analyse given problem for the requirement of html, style sheets, client side or server side script with different programming constructs.
CO4	evaluate web application programming solutions with different aspects like the presentation and working of the web application and usage of different scripting constructs.
CO5	utilize the standard tools for design and development of web project solution for given problems by integrating html, client and server pages with style and scripting.

2.	**Syllabus**	
	INTRODUCTION	**(03 Hours)**
	Basics of Internet, World Wide Web, HTTP Protocol, Universal Resource Locator, Web Server, Different Types of Web Servers, Domain Name Server, Web Server Configuration, Internet Browser, Web Document and Mark-Up Language, Hypertext Mark-Up Language, Hypermedia, Web Site Organization, Content Organization, Web Server on Different Operating System Platforms, Web Applications, Web Interface, Web Standards & Accessible Design.	
	STATIC AND DYNAMIC WEB PAGES, STYLE SHEETS AND WEB PUBLISHING	**(17 Hours)**
	Web Page, Static Web Page, Hypertext Mark-Up Tags, Handling Font Style, Types, Size, Colour Etc., Handling Table, List, Images, Graphics, Menu Etc; Forms, Input Text Box, Drop Down Menu, Name Variable, Cookie Management, Session Management, Animation, Structure Web Pages, Image Mapping, Link Setup In Image, Frames, Structuring Web Pages Using Frames, Multimedia Handling, Linking To Pages; Dynamic Web Pages and Scripting - Scripting Language, Dynamic Pages and Forms Validation, Validation of Input Text Box, Dynamic Drop Down Menu, Validation and Accessing Name Variable-Value Pair, Cookie Management Through Scripting, Session Management through Scripting, Animation through Scripting, Dynamic Image Mapping Through Scripting, Link Handling through Scripting, Multimedia Handling through Scripting; Web Page Designing using Style Sheet, Different Types of Style Sheet, Defining Different Styles, Export and Importing Style Sheet, Cascade Style Sheet. Web Hosting and Publishing - Different Steps of Web	

	Hosting and Publishing, Documents Interchange Standards, Website Evaluation, Components of Web Publishing, Document Management, Search Engines, and Registration of a Web Site on Search Engines, Publishing Tools.	
	PYTHON PROGRAMMING	**(25 Hours)**
	Basics of Python Programming: Variables, Keywords, Expressions, Data Types, Operators and Operands, Assignments, Order of Operations, Controlling Statements, Branching and Loops, Functions, Definitions, Arguments, Returning Values, Scopes, Recursive Functions, Modules and Import, Strings, Tuples, and Lists; Handling Exceptions – Try/Except, Standard Exceptions, Exceptions as Control Flow Mechanisms; Object Oriented Programming – Classes, Abstract Data Types, Inheritance, Encapsulation; Debugging – Syntax errors, Runtime Errors, Semantic Errors, Test Cases; Files – Reading, Iterating over Lines, Finding a File in File system, Writing Data to Files, CSV Format, Read and Write To/From CSV File; Dictionaries – Introduction, Dictionary Operations, Aliasing, Copying, Dictionary Accumulation, Introduction to Module Packages.	
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	To prepare the web page using hypertext markup language
2	To study and setup the web server for implementation
3	To learn client side scripting
4	To learn server side scripting
5	To apply style to the web pages
6	To implement functions for files
7	To implement dictionary

4.	**Books Recommended**
1	Martin C. Brown, “Python: The Complete Reference, Osborne, McGraw-Hill, 2018.
2	Thomas Powell and fritz Schneider, “JavaScript: The Complete Reference, McGraw-Hill, 2017.
3	J. Sklar, “Principles of Web Design”, 7/E, Cengage Learning, 2017.
4	H. Deitel, A. Deitel, “Internet and World Wide Web How to Program”, 5/E, Pearson, 2012.
5	John V. Guttag, “Introduction to Computation and Programming Using Python”, MIT Press, 2013 Edition.

ADDITIONAL REFERENCE BOOKS	
1	Martin C. Brown, “Python: The Complete Reference, Osborne, McGraw-Hill, 2018.
2	1. M. L. Young,” The Complete reference of Internet”, Tata Mc Graw Hill, 2002.
3	2. W. G. Lehnert, “Internet 101, 1/E, Person Education, 2001.
4	B. Underdahle and K. Underdahle, “Internet and Web Page/ Website design”, 2/E, IDG Books India (P) Ltd., 2001.
5	D. Comer, “The Internet Books,” Prentice Hall of India, 2/E, 2001.

B.Tech. I (CSE) Semester – II **ENERGY AND ENVIRONMENTAL ENGINEERING** **EG110**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	Explain the components of ecosystems, various biogeochemical cycles and importance of different urban network services
CO2	Differentiate between various types of environmental pollution along with their impacts and regulatory standards
CO3	Examine various global environmental issues and their management
CO4	Discuss the fundamental principles of energy, including classification, conservation and related policy frameworks and regulations.
CO5	Get acquainted with the concept of energy systems and their components

2.	**Syllabus**	
	ENVIRONMENT AND ECOSYSTEMS	**(10 Hours)**
	Introduction: Concept of an ecosystem - structure and functions of ecosystem; Components of ecosystem - producers, consumers, decomposers; Food chains, food webs, ecological pyramids, energy flow in ecosystem; Bio-geochemical cycles, hydrologic cycle Components of environment and their relationship, impact of technology on environment, environmental degradation, environmental planning of urban network services such as water supply, sewerage, solid waste management; closed loop cycle, concepts of sustainability	
	ENVIRONMENTAL POLLUTION	**(10 Hours)**
	Water, air, soil, noise, thermal and radioactive, marine pollution - sources, effects and engineering control strategies; Centralized and decentralized treatment system, Drinking water quality and standards, ambient air and noise standards	
	GLOBAL ENVIRONMENTAL ISSUES AND ITS MANAGEMENT	**(10 Hours)**
	Engineering aspects of climate change, concept of carbon credit, CO_2 sequestration, concepts of environmental impact assessment and environmental audit, life cycle assessment	
	BASICS OF ENERGY AND ITS CONSERVATION	**(07 Hours)**

	Classification of energy sources, Global and national energy scenario, Fossil and alternate fuels and its characterization. General aspects of energy conservation and management; Energy conservation act, Energy policy of company; Need for energy standards and labelling; Energy building codes.	
	INTRODUCTION TO ENERGY CONSERVATION SYSTEMS	**(08 Hours)**
	Energy conversion systems: Working principle, Basic components, General functioning and normal rating specifications of various energy conversion systems like Power plant, Pump, Refrigerator, Air-conditioner, Internal combustion engine, Solar PV cell, Solar water heating system, Biogas plant. Wind turbine, Fuel cells.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Performance Test on a single cylinder Kirloskar diesel engine.
2	Performance Test on Three-cylinder petrol engine.
3	Determination of COP of vapor compression refrigeration system.
4	Study of General Motors Cruze Vehicle Automotive System.
5	Study of MG Hector Vehicle Automotive Systems.
6	Production of Biodiesel using Transesterification Method.
7	Determination of flash and fire point of biodiesel and its comparison with diesel.
8	Determination of density and viscosity of biodiesel and its comparison with diesel.
9	Determination of cloud point and pour point of biodiesel and its comparison with diesel.
10	Measurement of direct and diffused Solar radiation using pyranometer.
11	Determination of I-V Characteristics of solar PV Panel.
10	Study of electricity and or gas bill
11	Study of pollutants from diesel Engine
10	Study of pollutants from petrol Engine
11	Comparison of pollutants from SI and CI Engines.

4.	**Books Recommended**
1	Daniel B. Botkin & Edward AKeller, Environmental Sciences, John Wiley & Sons.
2	R. Rajagopalan, Environmental Studies, Oxford University Press.
3	Benny Joseph, Environmental Studies, TMH Publishers.
4	Dr. Suresh K. Dhameja, Environmental Studies, S. K. Kataria & Sons, 2007.
5	U. K. Khare, Basics of Environmental Studies, Tata McGraw Hill, 2011.

ADDITIONAL REFERENCE BOOKS	
1	C. S. Rao, Environmental Pollution Control Engineering, New Age International Publishers, 2018

B.Tech. I (AI) Semester – II **LINEAR ALGEBRA AND STATISTICS** **MA106**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	accept the challenge to solve the problem with statistics
CO2	apply the knowledge of Linear Algebra to solve problem of engineering.
CO3	identify, formulate and analyze complex engineering and affiliated field problems, specifically the Partial differential equation concept in different engineering field
CO4	apply the knowledge of vector calculus and analyze computational processes
CO5	design solutions to work on engineering industrial problems with effective mathematical skill.

2.	**Syllabus**	
	PROBABILITY THEORY AND RANDM PROCESS	**(09 Hours)**
	Fundamentals of Probability Theory: - views of probability, Random variables and Joint distributions, Marginal distribution, Conditional probability, Conditional independence, Expectation and variance, Probability distributions Central limit theorem, Functions of random variable, Sum of independent random variable, Correlation and regression, Random process, Stationary random process, Autocorrelation and cross correlation, Ergodic process, Markov process, Birth and death process, Poisson process, Markov chain, Chapman Kolmogorov theory, Spectral analysis of random processes, power spectral density.	
	ESTIMATION AND STATISTICS	**(08 Hours)**
	Sampling theory, Population and sample, Statistical interference, Sampling distribution, Sample mean, Bias estimation, Unbiased estimator, Confidence interval, Point estimation and interval estimates, Statistical decision, Hypothesis testing, Statistical hypotheses, Null hypotheses, Significance test, Type I and types II errors, Level of significance, One tail and two tailed test, Chi square test, Maximum likelihood estimate, Least square estimate, MAP estimate, Minimum mean square estimate.	
	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(09 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq =R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p,q).	

	BASIC CONCEPTS OF VECTOR CALCULUS	**(08 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties.	
	LINEAR ALGEBRA	**(11 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method; Vector spaces, Subspace, Field, Ring, Norm and distance, Linear Mapping, Orthogonality, Eigenvectors and Eigenvalues, Least square, Least square data fitting, Constrained least square applications.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Books Recommended**
1	Kreyszing E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015.
2	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
3	Gilbert Strang, "Introduction to Linear Algebra", Wellesley Cambridge Press, 4th Ed., 2009.
4	David C. Lay, "Linear Algebra and its applications", 3rd Ed., Pearson, 2006.
5	A. Papoulis and S. U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Ed., Mc-Graw Hill, 2002.

ADDITIONAL REFERENCE BOOKS	
1	Ramana D. V., "Higher Engg. Mathematics", McGraw-Hill Inc., New Delhi, 2007.
2	Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015.
3	Mary L. Boas, "Mathematical Methods in the Physical Sciences", John Wiley & Sons, Ed.2005.

B.Tech. I (AI) Semester – II **DIGITAL ELECTRONICS & LOGIC DESIGN** **EC106**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**0**	**2**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, students will be able to**
CO1	acquire knowledge about different types of diodes and circuits.
CO2	apply the knowledge of gates, Boolean algebra and operational amplifier in designing logical and integrated circuits.
CO3	analyse the logical, integrated, and operational amplifier based circuits.
CO4	evaluate the different circuits and compare their performance.
CO5	design ALU and control unit.

2.	**Syllabus**	
	PN DIODE AND TRANSITOR	**(07 Hours)**
	PN Diode Theory, PN Characteristic and Breakdown Region, PN Diode Application as Rectifier, Zener Diode Theory, Zener Voltage Regulator, Diode as Clamper and Clipper, Photodiode Theory, LED Theory, 7 Segment LED Circuit Diagram and Multi Colour LED, LASER Diode Theory and Applications, Bipolar Junction Transistor Theory, Transistor Symbols And Terminals, Common Collector, Emitter and Base Configurations, Different Biasing Techniques, Concept of Transistor Amplifier, Introduction to FET Transistor And Its Feature.	
	WAVESHAPING CIRCUITS AND OPERATIONAL AMPLIFIER	**(06 Hours)**
	Linear Wave Shaping Circuits, RC High Pass and Low Pass Circuits, RC Integrator and Differentiator Circuits, Nonlinear Wave Shaping Circuits, Two Level Diode Clipper Circuits, Clamping Circuits, Operational Amplifier OP-AMP with Block Diagram, Schematic Symbol of OP-AMP, 741 Package Style and Pinouts, Specifications of Op-Amp, Inverting and Non-Inverting Amplifier, Voltage Follower Circuit, Multistage OP-AMP Circuit, OP-AMP Averaging Amplifier, OP-AMP Subtractor.	
	BOOLEAN ALGEBRA AND SWITCHING FUNCTIONS	**(04 Hours)**
	Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Standard Representations of Logic Functions- SOP and POS Forms, Simplification of Switching Functions-K-Map and Quine-Mccluskey Tabular Methods, Synthesis of Combinational Logic Circuits.	
	COMBINATIONAL LOGIC CIRCUIT USING MSI INTEGRATED CIRCUITS	**(07 Hours)**

	Binary Parallel Adder; BCD Adder; Encoder, Priority Encoder, Decoder; Multiplexer and Demultiplexer Circuits; Implementation of Boolean Functions Using Decoder and Multiplexer; Arithmetic and Logic Unit; BCD to 7-Segment Decoder; Common Anode and Common Cathode 7-Segment Displays; Random Access Memory, Read Only Memory and Erasable Programmable ROMS; Programmable Logic Array (PLA) and Programmable Array Logic (PAL).	
	INTRODUCTION TO SEQUENTIAL LOGIC CIRCUITS	**(04 Hours)**
	Basic Concepts of Sequential Circuits; Cross Coupled SR Flip-Flop Using NAND or NOR Gates; JK Flip-Flop Rise Condition; Clocked Flip-Flop; D-Type and Toggle Flip-Flops; Truth Tables and Excitation Tables for Flip-Flops; Master Slave Configuration; Edge Triggered and Level Triggered Flip-Flops; Elimination of Switch Bounce using Flip-Flops; Flip-Flops with Preset and Clear.	
	SEQUENTIAL LOGIC CIRCUIT DESIGN	**(06 Hours)**
	Basic Concepts of Counters and Registers; Binary Counters; BCD Counters; Up Down Counter; Johnson Counter, Module-N Counter; Design of Counter Using State Diagrams and Table; Sequence Generators; Shift Left and Right Register; Registers with Parallel Load; Serial-In-Parallel-Out (SIPO) And Parallel-In-Serial-Out (PISO); Register using Different Type of Flip-Flop.	
	REGISTER TRANSFER LOGIC	**(04 Hours)**
	Arithmetic, Logic and Shift Micro-Operation; Conditional Control Statements; Fixed-Point and Floating-Point Data; Arithmetic Shifts; Instruction Code and Design Of Simple Computer.	
	PROCESSOR LOGIC DESIGN	**(03 Hours)**
	Processor Organization; Design of Arithmetic Logic Unit; Design of Accumulator.	
	CONTROL LOGIC DESIGN	**(04 Hours)**
	Control Organization; Hard-Wired Control; Micro Program Control; Control Of Processor Unit; PLA Control.	
	Practicals will be based on the coverage of the above topics separately.	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Study of BJT Characteristics
2	Study of CE Amplifier
3	Study of RC Coupled / Tuned Amplifier
4	Study of FET Characteristics
5	Study of Diode Clipper Circuits

6	Study of Diode Clamper Circuits
7	Study and Implement RC Low Pass and High Pass Filter Circuits
8	Study and Implement RC Integrator Circuits
9	Study and Implement RC Differentiator Circuits
10	Full and Half-Adder/ Half-subtarctor Circuits using a serial Input
11	4-Bit Gray to Binary/ Binary to Gray Code convertor using Select input
12	Logic expression with the Help of MUX IC 74153
13	Flip-flops using NAND/ NOR Gate
14	Modulo-7 Ripple Counter
15	4-Bit Shift Left/Right Register
16	Sequence Generator

4.	**Books Recommended**
1	Schilling Donald L. and Belove E., "Electronics Circuits- Discrete and Integrated", 3rd Ed., McGraw-Hill, 1989, Reprint 2008.
2	Millman Jacob, Halkias Christos C. and Parikh C., "Integrated Electronics", 2nd Ed., McGraw-Hill, 2009.
3	Taub H. and Mothibi Suryaprakash, Millman J., "Pulse, Digital and Switching Waveforms", 2nd Ed., McGraw-Hill, 2007.
4	Mano Morris, “Digital Logic and Computer Design”, 5th Ed., Pearson Education, 2005.
5	Lee Samual, “Digital Circuits and Logic Design”, 1st Ed., PHI, 1998.

ADDITIONAL REFERENCE BOOKS	
1	Malvin Albert & David J. Bates, "Electronic Principles", 7th edition, Tata McGraw Hill, 2007.
2	De Debashis, "Basic of Electronics", 1st Ed., Pearson Education, 2008.
3	Floyd and Jain, “Digital Fundamentals”, Pearson Education, 2006.