SCHEME AND SYLLABUS

FOR

B.TECH

IN

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Offered by the Department of Computer Engineering,
National Institute of Technology, Kurukshetra

w.e.f. 2024-25 (1st year)

VISION AND MISSION OF THE INSTITUTE

VISION

To be a role-model in technical education and research, responsive to global challenges.

MISSION

To impart technical education that develops innovative professionals and entrepreneurs and to undertake research that generates cutting-edge technologies and futuristic knowledge, focusing on the socio-economic needs.

VISION AND MISSION OF THE DEPARTMENT

VISION

To address societal needs and global industry challenges in the field of Computer & IT with state-of-art education & research.

MISSION

M-1: To create a platform for education, research and development by providing sound theoretical knowledge and practical skills in Computer Engineering and Information Technology.

M-2: To produce motivated professional technocrats capable of generating solutions for industry and society.

M-3: To develop the ability to work ethically at individual and team level and be responsive towards socio-economic needs.

VISION AND MISSION OF THE PROGRAM

VISION

To disseminate state-of-the-art education to develop competent professionals in Computer Engineering with capability to serve the global society**.**

MISSION

To educate and train manpower engaged in cutting-edge research by offering latest in the field of Computer Engineering for sustainable development of society.

Scheme for B.Tech. in Artificial Intelligence and Data Science w.e.f. Academic Year 2024-25

SEMESTER - I

Sr. No.	Course Code	Course Title	L_T_P	Credits	Contact Hrs
1.	-	Communication Skills in English OR Financial Education	2 0 2	3	4
2.	-	Differential Calculus and Differential Equations	3 0 0	3	3
3.	-	Engineering Physics	3 0 2	4	5
4.	CSIC 101	Problem solving & Programming Skills I (For CO, IT & AI &ML, AI & DS, M&C)	3 0 2	4	5
5.	CSIC 103	Problem solving & Programming Skills II (for EE, ECE, CE, ME, PIE, IIOT)	3 0 2	4	5
6.	-	Energy & Environmental Science	2 0 2	3	4
7.	-	Engineering Practices (P)	1 0 3	2	4
8.	-	AU1	2 0 0	2	2
9.	-	Sports	0 0 2	1	2
10.	-	NCC/NSS/Yoga	0 0 2	1	2
Total				**21**	**31**

SEMESTER - II

Sr. No.	Course Code	Course Title	L_T_P	Credits	Contact Hrs
1.	-	Economics for Engineers OR Business Studies	3 0 0	3	3
2.	-	Integral Calculus and Difference Equations	3 0 0	3	3
3.	CSIC 100	Digital System Design	3 0 0	3	3
4.	CSIC 102	Web Design*	1 0 3	2	4
5.	CSIC 104	Programming Using Python	3 0 2	4	5
6.	DSPC 100	Data Structures	3 0 2	4	5
7.	-	AU2	2 0 0	2	2
8.	-	Sports	0 0 2	1	2
9.	-	NCC/Yoga/Clubs/NSS	0 0 2	1	2
Total				**21**	**29**

*** Treated as a practical course (not integrated), evaluation will be as per practical course.**

14-6-24

Course Code	**:**	**CSIC 101**
Course Title	**:**	**Problems Solving and Programming Skills-I (For CO, IT & AI &ML, AI & DS, M&C)**
Number of Credits & L/T/P Scheme	**:**	**4 and 3/0/2**
Prerequisites	**:**	
Course Type	**:**	**IC**

Course Learning Objectives:
The objective of this course is to provide fundamentals of problem-solving using C language programming.

Course Content:

Unit 1 Programming Fundamentals & Control Statements:
Block Diagram of Computer, Hardware vs software, concept of operating system and compiler, Introduction to C programming, basic programming using input and output operators and expressions, programming using if and if-else, Programming using looping-for, while, do-while; use of switch and break.

Unit 2 Arrays based Programming:
Defining and processing 1-D and 2-D Arrays for Problem Solving and Strings.

Unit 3 Modular programming using Functions:
Structured Programming, Defining and calling a function, modular programming using functions, passing arguments and arrays to functions, functions of void and returning values.

Unit 4 Programming using pointers, structures and unions:
Pointers in C: Pointer declaration, Passing Pointer to functions, pointers vs arrays, dynamic memory allocation. Structures and Unions, Programming Using Array of Structures and Unions, Memory Requirements for Unions.

Reference Books:
1. Byron S. Gottfried, Programming with C Language, Schaum Series, Tata McGraw Hill, 2015.
2. E Balaguruswamy, Programming with C, Tata McGraw Hill, 2015.
3. Kernighan & Richie, C Programming, Prentice Hall of India, 2002.

Course Outcomes:
1. Understand the use of software and programming for problem solving.
2. Learn programming using simple concepts of input, output and control statements.
3. Use arrays, functions, strings, structures and pointers for problem solving.

Course Code	**:**	**CSIC 102**
Course Title	**:**	**Digital System Design**
Number of Credits & L/T/P Scheme	**:**	**3 and 3/0/0**
Prerequisites	**:**	
Course Type	**:**	**IC**

Course Learning Objectives:

1. Awareness of intricate design details of components in any digital system.
2. Knowledge of number system and conceptual understanding of different codes.
3. Design fundamentals of computing machinery.
4. Introduction of computational automation process.

Course Content:

Unit 1 Number Systems and Coding Schemes:

Number Systems and Codes Introduction to the positional number system, signed magnitude numbers, floating point numbers, binary arithmetic: addition, subtraction, multiplication and division, Base conversion, conversion formulas with examples, one's and two's compliment arithmetic, Computer codes
– BCD codes, gray codes, excess-3 codes, parity checks, Hamming and alphanumeric codes.

Unit 2 Combinational Logic:

Design Introduction, standard representations for logical functions, Karnaugh map representation, simplification of logical functions using K-map, minimization of logical functions specified in minterms/maxterms or Truth Table, minimization of logical functions not specified in minterms/maxterms, Don't care conditions, design examples, Ex-or and Ex-nor simplification of Kmaps, five and six-variable K-maps, QM method, MEV method, Introduction of multiplexers and their use in combinational logic design, demultiplexers/decoders and their use in combinational logic design, adders and their use as subtractors, digital comparators, parity generators/checkers, code converters, priority encoders.

Unit 3 Synchronous Sequential Circuits:

Introduction, FSM model, memory elements and their excitation functions. Synthesis of synchronous sequential circuits, capabilities and limitation of FSM, state equivalence and minimization, simplification of incompletely specified machines, registers and counters, RAM design, ROM design and programmablelogic array.

Unit 4 Asynchronous Sequential Circuits:

Fundamental mode and Pulse mode Circuits Analysis and Design.

Books:

1. M. Morris Mano and Michael D. Ciletti: Digital Logic Design, Sixth Edition, Pearson Education.
2. R.P. Jain: Modern Digital Electronics, Fifth Edition, TMH.
3. Z Kohavi and Niraj. K. Jha: Switching And Finite Automata Theory, Third Edition, Cambridge UniversityPress.
4. Kumar A. Anand: Fundamentals of Digital Circuits, Fourth Edition, PHI.
5. James Bignell and Robert Donovan: Digital Electronics, Fifth Edition, Cengage Learning.

Course Outcomes:

1. Clarity of application of different number system and coding schemes.
2. Proficiency in design and analysis of combinational and sequential circuits.
3. Circuit level understanding of computer addressing and memory layouts.
4. Application of digital circuits for design of finite automaton.

Course Code	**:**	**CSIC 104**
Course Title	**:**	**Web Design**
Number of Credits & L/T/P Scheme	**:**	**2 and 1/0/3**
Prerequisites	**:**	
Course Type	**:**	**IC**

Course Learning Objectives:

1. Introduction and brief history of World Wide Web (WWW).
2. Web essentials: HTML, XHTML, CSS.
3. Addressing web standards, client requirements and principles of web page design.
4. Introduction of Web architecture.

Course Content:

Unit 1 Introduction: Introduction to world wide web, Web Browsers, Web Servers, Hypertext Transfer Protocol, URLs, Domain Names, Internet Service Provider, Basic steps for Developing Website, Choosing the Contents, Planning and Designing Web Site, Creating a Website, Web Publishing, Hosting Site, Types of hosting packages, Five Golden rules of web designing.

Unit 2 Web essentials and standards: Clients, servers, introduction to Markup languages, scripting languages, Introduction to elements of HTML, XHTML and CSS, Introduction to Document object model (DOM), working with text, list, tables, frames, hyperlinks, Images, forms and controls. CSS properties, Id and Class, Box Model.

Unit 3 Javascript: Javascript as programming language, Data types, Values, Variables, Expressions and Operators. JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure, random functions and maths library, representing dates, Pattern Matching and Regular Expressions, difference between server side and client side javascript, embedding javascript in HTML, hiding HTML elements, showing hidden HTML elements. DOM and event handling, error handling, mouse, text, and keyboard events and cookies.

Unit 4 XML: XML: Introduction – benefits of XML, well formed XML documents, XML syntax, XML declaration ,XML schema , XML with CSS, Document Type Definition (DTD),creating DTD – Types(internal DTD, external DTD),XSL.

Reference Books:

1. Thomas A Powell, HTML: The Complete Reference, Tata McGraw Hill Publications.
2. Scott Guelich, Shishir Gundavaram, Gunther Birzniek; CGI Programming with Perl 2/e,O'Reilly
3. Doug Tidwell, James Snell, Pavel Kulchenko; Programming Web Services with SOAP, O'Reilly
4. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education,2007.
5. Yong, XML Step by Step, PHI.
6. Chris Bales, "Web programming- Building Internet Application".
7. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition,Pearson Education, 2006.
8. Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II,Pearson Education, 2001.
9. Bayross Ivan, "Web Enabled Commercial Applications Development using HTML, Javascript, DHTML & PHP", BPB Publication, 2005.

Course outcomes

1. Knowledge of basic principles of web site design.
2. Design proficiency of websites adhering to current web standards (HTML, XML, CSS).
3. Knowledge of various scripting languages.

Course Code	**:**	**CSIC 106**
Course Title	**:**	**Programming using Python**
Number of Credits & L/T/P Scheme	**:**	**4 and 3/0/2**
Prerequisites	**:**	
Course Type	**:**	**IC**

Course Learning Objectives:

1. Building robust applications using Python programming.
2. Building multithreaded, platform-independent and GUI based python applications for business problems.

Course Content:

Unit 1 The concept of data types:

Variables, Assignments; Immutable Variables; Numerical Types; Arithmetic Operators And Expressions; comments in the program; understanding error messages; Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation; Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated); String manipulations: subscript operator, indexing, slicing a string.

Unit 2 Lists, tuples, and dictionaries:

Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries; Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments.

Unit 3 Simple Graphics and Image Processing:

"turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing: Simple image manipulations with 'image' module (convert to bw, greyscale, blur, etc). Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects; inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block

Unit 4 Graphical user interfaces:

Event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

Reference Books:

1. T.R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
2. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning,, 1st Ed., 2012.

Course outcomes:

1. Programming ability for solving simple business problems.
2. Design of robust and multithreaded python applications.
3. Familiarity of simple GUI interfaces.

Course Code	**:**	**DSPC 100**
Course Title	**:**	**Data Structures**
Number of Credits & L/T/P Scheme	**:**	**4 and 3/0/2**
Prerequisites	**:**	**Problems Solving and Programming Skills-I**
Course Type	**:**	**PC**

Course Learning Objectives

1. This course introduces the concept of Data Structures used in various computer science applications
2. The students are introduced to understand and efficiently apply various data structures such as stacks, queues, linked lists, trees and graphs for solving various computing problems using C programming language.

Course Content

Unit 1 Pointers & File Handling:

Revision of Pointers and Dynamic Memory, Files and related operations.
Searching techniques: Linear and Binary, Sorting techniques: Selection, Bubble, Insertion, Merge sort, Quicksort.

Unit 2 Simple Data Structures

Arrays based Linear Data Structures: Array storage, sparse arrays; Transpose, addition, and multiplication of sparse matrices, Stacks and Queues and their applications, multiple stacks and queues in an array.

Unit 3 Linked Data Structures

Singly, Doubly & Circular Linked Lists; representation, operations and applications, linked stacks and queues. linked lists based polynomial addition.

Unit 4 Advanced Data Structures

Trees, Basic concepts and definitions of a tree and binary tree and associated terminology, Binary tree traversal techniques, some more operations on binary trees, Heaps and heapsort.

Reference Books:

1. E Horowitz and S. Sahni: Fundamentals of Data Structures in C, Second Edition, Universities Press, Hyderabad.
2. R.L. Kruse: Data Structures & Program Design in C, PHI.
3. D.F. Knuth: The art of Computer Programming Vol-1, Narosa Publications, 1985.
4. Byron S. Gottfried & J K Chhabra: Theory and Problems of Programming with C Language, Schaum's Outlines Series, TMH, 2005.

Course Outcomes

1. Develop skill to identify and determine the usage of various data structures, operations, associated algorithms and implement their applications.
2. Apply knowledge of pointers, memory allocation and string handling for solving programming problems.
3. Understand the concept of trees and graphs, their implementation and applications.
4. Able to implement standard algorithms for searching and sorting.
5. Analyze efficiency of different algorithms using time and space complexity.