

**INTERNATIONAL SCHOOL OF TECHNOLOGY AND SCIENCES FOR WOMEN  
RAJANAGARAM–533294,AndhraPradesh,India**

**B. TECH-CSE(AI)(R23-II<sup>nd</sup> YEARCOURSESTRUCTURE& SYLLABUS**

**I Semester**

S.No	Subject Code	Title	L	T	P	Credits
1	23BS2101H	DiscreteMathematics& GraphTheory	3	0	0	3
2	23BS2104H	Universalhumanvalues– understandingharmonyand Ethicalhuman conduct	2	1	0	3
3	23ES2101C	ArtificialIntelligence	3	0	0	3
4	23PC2101C	AdvancedDataStructures &AlgorithmsAnalysis	3	0	0	3
5	23PC2102C	Object-OrientedProgrammingThroug h JAVA	3	0	0	3
6	23PC2103C	AdvancedDataStructures andAlgorithmsAnalysisLab	0	0	3	1.5
7	23PC2104C	Object-Oriented ProgrammingThroughJAVA Lab	0	0	3	1.5
8	23SE2101C	Pythonprogramming	0	1	2	2
9	23AC2101B	EnvironmentalScience	2	0	0	-
Total			<b>15</b>	<b>2</b>	<b>10</b>	<b>20</b>
<b>MandatoryMiniProject/Internship</b>						

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**SEMESTER 2**

<b>S.No.</b>	<b>Subject Code</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	23MC2202M	Optimization Techniques	2	0	0	2
2	23BS2201H	Probability & Statistics	3	0	0	3
3	23PC2204C	Machine Learning	3	0	0	3
4	23PC2202C	Database Management Systems	3	0	0	3
5	23PC2206E	Digital Logicand Computer Organization	3	0	0	3
6	23PC2209C	AI&ML Lab	0	0	3	1.5
7	23PC2207C	Database Management Systems Lab	0	0	3	1.5
8	23SE2201C	FullStack Development-1	0	1	2	2
9	23HS2203H	Design Thinking &Innovation	1	0	2	2
<b>Total</b>			<b>15</b>	<b>1</b>	<b>12</b>	<b>21</b>
MandatoryCommunityServiceProjectInternshipof08weeksdurationduring summervacation						

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**I Semester**

L	T	P	C
3	0	0	3

**ARTIFICIALINTELLIGENCE**

**Pre-requisite:**

1. KnowledgeinComputerProgramming.
2. Acourseon“MathematicalFoundationsofComputerScience”.
3. Backgroundinlinearalgebra,datastructuresandalgorithms,andprobability.

**CourseObjectives:**

1. ThestudentshouldbemadetostudytheconceptsofArtificialIntelligence.
2. ThestudentshouldbemadetolearnthemethodsofsolvingproblemsusingArtificialIntelligence.
3. ThestudentshouldbemadetointroducetheconceptsofExpertSystems.
4. TounderstandtheapplicationsofAI,namelygameplaying,theoremproving,andmachinelearning.
5. Tolearndifferentknowledgerepresentationtechniques

**UNIT-I**

**Introduction:** AI problems, foundation of AI and history of AI intelligent agents: Agents andEnvironments,theconceptofrationality,thenatureofenvironments,structureofagents,problemsolving agents,problemformulation.

**UNIT-II**

**Searching-** Searching for solutions, uniformed search strategies – Breadth first search, depthfirstSearch.Searchwithpartialinformation(Heuristicsearch)Hillclimbing,A\*,AO\*Algorithms,Problemreduction,GamePlaying-Adversialsearch,Games,mini-maxalgorithm,optimaldecisionsinmultiplayergames,ProbleminGameplaying,Alpha-Betapruning,Evaluationfunctions.

**UNIT-III**

**RepresentationofKnowledge:**Knowledgerepresentationissues,predicatelogic-logicprogramming,semanticnets-framesandinheritance,constraintpropagation,representingknowledgeusing rules,rulesbaseddeductionsystems.Reasoning under uncertainty,reviewofprobability,Bayes’probabilisticinterferencesanddempster Shaferttheory.

**UNIT-IV**

**Logic concepts:** First order logic. Inference in first order logic, propositional vs. first orderinference,unification&liftsforwardchaining,Backwardchaining,Resolution,Learning from observation Inductive learning, **Decision trees**,Explanation based learning, StatisticalLearningmethods,Reinforcement Learning.

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**UNIT-V**

**ExpertSystems:**Architectureofexpertsystems,Rolesofexpertsystems–KnowledgeAcquisition  
Meta knowledge Heuristics. Typical expert systems – MYCIN, DART,  
XCON:Expertsystemsshells.

**Textbooks:**

1. S.RusselandP.Norvig,“ArtificialIntelligence–  
AModernApproach”,SecondEdition,PearsonEducation.
2. KevinNightandElaineRich,NairB.,“ArtificialIntelligence(SIE)”,McGrawHill

**ReferenceBooks:**

1. DavidPoole,AlanMackworth,RandyGoebel,”ComputationalIntelligence:alogicalapproac  
h”,OxfordUniversityPress.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for  
complexproblemsolving”,FourthEdition,PearsonEducation.
3. J.Nilsson,“ArtificialIntelligence:AnewSynthesis”,ElsevierPublishers.
4. ArtificialIntelligence,SarojKaushik,CENGAGELearning.

**OnlineLearningResources:**

1. <https://ai.google/>
2. [https://swayam.gov.in/nd1\\_noc19\\_me71/preview](https://swayam.gov.in/nd1_noc19_me71/preview)

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**ISemester**

L	T	P	C
3	0	0	3

**ADVANCEDDATASTRUCTURES&ALGORITHMANALYSIS**

**CourseObjectives:**

The main objectives of the course is to

- provide knowledge on advanced data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

**UNIT–I:**

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.  
AVL Trees–Creation, Insertion, Deletion operations and Applications  
B-Trees–Creation, Insertion, Deletion operations and Applications

**UNIT–II:**

Heap Trees (Priority Queues)–Min and Max Heaps, Operations and Applications  
Graphs–  
Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications  
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

**UNIT–III:**

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths  
Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths–  
General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

**UNIT–IV:**

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem  
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

**UNIT–V:**

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem  
NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)  
NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

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**Textbooks:**

1. FundamentalsofDataStructuresinC++,Horowitz,Ellis;Sahni,Sartaj;Mehta,Dinesh2nd Edition UniversitiesPress
2. ComputerAlgorithms/C++EllisHorowitz,SartajSahni,SanguthevarRajasekaran2ndEditionUniversityPress

**ReferenceBooks:**

1. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
2. AnintroductiontoDataStructureswithapplications,Trembley &Sorenson,McGrawHill
3. TheArtofComputerProgramming, Vol. 1:FundamentalAlgorithms,DonaldEKnuth,Addison-Wesley,1997.
4. DataStructuresusingC&C++:Langsam,Augenstein&Tanenbaum,Pearson,1995
5. Algorithms+DataStructures&Programs:,N.Wirth,PHI
6. FundamentalsofDataStructuresinC++:HorowitzSahni&Mehta,GalgottiaPub.
7. DatastructuresinJava:,ThomasStandish,PearsonEducationAsia

**OnlineLearningResources:**

1. [https://www.tutorialspoint.com/advanced\\_data\\_structures/index.asp](https://www.tutorialspoint.com/advanced_data_structures/index.asp)
2. <http://peterindia.net/Algorithms.html>
3. AbdulBari,[1.IntroductiontoAlgorithms\(youtube.com\)](https://www.youtube.com/watch?v=1.IntroductiontoAlgorithms)

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I Semester

L	T	P	C
3	0	0	3

### OBJECT-ORIENTEDPROGRAMMINGTHROUGHJAVA

#### CourseObjectives:

Thelearningobjectivesofthiscourseareto:

- IdentifyJavalanguagecomponentsandhowtheyworktogetherinapplications
- Learnthefundamentalsofobject-orientedprogramminginJava,includingdefiningclasses,invokingmethods,usingclasslibraries.
- LearnhowtoextendJavaclasseswithinheritanceanddynamicbindingandhowtouseexception handling inJavaapplications
- UnderstandhowtodesignapplicationswiththreadsinJava
- UnderstandhowtouseJavaAPIsforprogramdevelopment

**UNIT I: Object Oriented Programming:** Basic concepts, Principles, Program Structure inJava: Introduction,WritingSimple JavaPrograms,Elements orTokens in Java Programs,JavaStatements,CommandLineArguments,UserInputtoPrograms,EscapeSequencesComments,ProgrammingStyle.

**DataTypes, Variables,andOperators:**Introduction,DataTypesinJava,DeclarationofVariables,Data Types,TypeCasting,ScopeofVariableIdentifier,LiteralConstants,Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods,AttributeFinal,**IntroductiontoOperators**,PrecedenceandAssociativityofOperators,Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement (- -)Operators,TernaryOperator,RelationalOperators,BooleanLogicalOperators,BitwiseLogicalOperators.

**Control Statements:** Introduction, if Expression, Nested if Expressions, if–else Expressions,TernaryOperator?::,SwitchStatement,IterationStatements,whileExpression,do–whileLoop,forLoop,NestedforLoop,For–EachforLoop,BreakStatement,ContinueStatement.

**UNITII:ClassesandObjects:**Introduction,ClassDeclarationandModifiers,ClassMembers,DeclarationofClassObjects,AssigningOneObjecttoAnother,AccessControlfor Class Members,Accessing PrivateMembers ofClass, Constructor Methods for Class,OverloadedConstructorMethods,NestedClasses,FinalClassandMethods,PassingArguments by Valueand byReference,Keywordthis.

**Methods:**Introduction,DefiningMethods,OverloadedMethods,OverloadedConstructorMethods, ClassObjectsasParametersinMethods,AccessControl,RecursiveMethods,NestingofMethods,OverridingMethods,AttributesFinalandStatic.

**UNIT III: Arrays:**Introduction, Declaration and Initialization of Arrays, Storage of Array inComputer Memory, Accessing Elements of Arrays, Operations on Array Elements, AssigningArraytoAnotherArray,DynamicChangeofArraySize,SortingofArrays,Searchfor

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Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

**Inheritance:** Introduction, Process of Inheritance, Types of Inheritance, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

**Interfaces:** Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

**UNIT IV: Packages and Java Library:** Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

**Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keyword throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

**Java I/O and File:** Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

### UNIT V: String Handling in

**Java:** Introduction, Interface CharSequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class StringBuffer.

**Multithreaded Programming:** Introduction, Need for Multiple Threads, Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority- Synchronization, Deadlock and Race Situations, Inter-thread Communication- Suspending, Resuming, and Stopping of Threads.

**Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

**Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scenegraph, mouse events (Text Book 3)

### Text Books:

1. JAVA A one step ahead, Anitha Seth, B.L. Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4<sup>th</sup> Edition, Pearson.

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**ReferencesBooks:**

1. ThecompleteReferenceJava,11<sup>th</sup>edition,HerbertSchildt,TMH
2. IntroductiontoJavaprogramming,7<sup>th</sup>Edition,YDanielLiang,Pearson

**OnlineResources:**

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_012880464547618816347\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)

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I Semester

L	T	P	C
0	0	3	1.5

### ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

#### Course Objectives:

The objectives of the course are to

- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

#### Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

#### Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
  - a) Adjacency Matrix
  - b) Adjacency Lists
5. Write a program for finding the bi-connected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

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**ReferenceBooks:**

1. FundamentalsofDataStructuresinC++,HorowitzEllis,SahniSartaj,Mehta,Dinesh,2<sup>nd</sup>Edition,Universities Press
2. ComputerAlgorithms/C++EllisHorowitz,SartajSahni,SanguthevarRajasekaran,2<sup>nd</sup>Edition,UniversityPress
3. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
4. AnintroductiontoDataStructureswithapplications,Trembley&Sorenson,McGrawHill

**OnlineLearningResources:**

1. <http://cse01-iiith.vlabs.ac.in/>
2. <http://peterindia.net/Algorithms.html>

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ISemester

L	T	P	C
0	0	3	1.5

### OBJECT-ORIENTEDPROGRAMMINGTHROUGHJAVALAB

#### CourseObjectives:

Theaimofthiscourseisto

- PracticeobjectorientedprogrammingintheJavaprogramminglanguage
- implement Classes, Objects, Methods, Inheritance, Exception, RuntimePolymorphism, UserdefinedExceptionhandlingmechanism
- Illustrateinheritance,Exceptionhandlingmechanism,JDBCconnectivity
- ConstructThreads,EventHandling,implementpackages,JavaFXGUI

#### ExperimentscoveringtheTopics:

- ObjectOrientedProgrammingfundamentals-datatype,controlstructures
- Classes,methods,objects,Inheritance,polymorphism,
- Exceptionhandling,Threads,Packages,Interfaces
- Files,I/Ostreams,JavaFXGUI

#### SampleExperiments:

##### Exercise-1:

- a) WriteaJAVAProgramtodisplaydefaultvalueofallprimitivedatatypeofJAVA
- b) Writeajavaprogramthatdisplaytherootsofaquadraticequation $ax^2+bx=0$ .CalculatethediscriminateDandbasingonvalueofD,describethenatureofroot.

##### Exercise-2

- a) WriteaJAVAProgramtosearchforanelementinagivenlistofelementsusingbinarysearchmechanism.
- b) WriteaJAVAProgramtosortforanelementinagivenlistofelementsusingbubblesort
- c) WriteaJAVAProgramusingStringBuffertodelete,removecharacter.

##### Exercise-3

- a) WriteaJAVAProgramtoimplementclassmechanism.Createaclass,methodsandinvoketheminsidemain method.
- b) WriteaJAVAProgramimplementmethodoverloading.
- c) WriteaJAVAProgramtoimplementconstructor.
- d) WriteaJAVAProgramtoimplementconstructoroverloading.

##### Exercise-4

- a) WriteaJAVAProgramtoimplementSingleInheritance
- b) WriteaJAVAProgramtoimplementmultilevelInheritance
- c) WriteaJAVAProgramforabstractclasstofindareasofdifferentshapes

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### Exercise-5

- Write a JAVA program give example for “super” keyword.
- Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- Write a JAVA program that implements Runtime polymorphism

### Exercise-6

- Write a JAVA program that describes exception handling mechanism
- Write a JAVA program illustrating Multiple catch clauses
- Write a JAVA program for creation of Java Built-in Exceptions
- Write a JAVA program for creation of User Defined Exception

### Exercise-7

- Write a JAVA program that creates threads by extending Thread class. First thread display “GoodMorning” every 1sec, the second thread displays “Hello” every 2seconds and the third display “Welcome” every 3seconds, (Repeat the same by implementing Runnable)
- Write a program illustrating isAlive and join()
- Write a Program illustrating Daemon Threads.
- Write a JAVA program Producer Consumer Problem

### Exercise-8

- Write a JAVA program that import and use the user defined packages
- Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
- Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

### Exercise-9

- Write a java program that connect to a database using JDBC
- Write a java program to connect to a database using JDBC and insert values into it.
- Write a java program to connect to a database using JDBC and delete values from it.

### Add-on Programs:

- Write a java program to print the following patterns



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I Semester

L	T	P	C
0	1	2	2

### PYTHONPROGRAMMING(SKILL ENHANCEMENTCOURSE)

#### CourseObjectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

#### UNIT-

**I:** History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

**Part of Python Programming Language:** Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type() Function and Is Operator, Dynamic and Strongly Typed Language.

**Control Flow Statements:** if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

#### Sample Experiments:

1. Write a program to find the largest element among three numbers.
2. Write a program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following operators in Python with suitable examples.
  - i) Arithmetic Operators
  - ii) Relational Operators
  - iii) Assignment Operators
  - iv) Logical Operators
  - v) Bitwise Operators
  - vi) Ternary Operator
  - vii) Membership Operators
  - viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

#### UNIT-II: Functions: Built-

In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, \*args and \*\*kwargs, Command Line Arguments. **Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

**Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

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**Sample Experiments:**

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
  - i. Addition
  - ii. Insertion
  - iii. slicing
6. Write a program to perform many 5 built-in functions by taking any list.

**UNIT-III: Dictionaries:** Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

**Tuples and Sets:** Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set.

**Sample Experiments:**

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

**UNIT-IV: Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

**Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

**Sample Experiments:**

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

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**UNIT-V:**

**Introduction to Data Science:** Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

**Sample Experiments:**

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using `array()` function.
3. Python program to demonstrate use of `ndim`, `shape`, `size`, `dtype`.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find `min`, `max`, `sum`, `cumulative sum` of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
  - a) `Apply head()` function to the pandas data frame
  - b) Perform various data selection operations on DataFrame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in `matplotlib`

**Reference Books:**

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, VM Hariharan, 2<sup>nd</sup> Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

**Online Learning Resources/Virtual Labs:**

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

**B. TECH-CSE(AI)(R23-II<sup>nd</sup> YEAR COURSE STRUCTURE & SYLLABUS**

**II Year II Semester**

L	T	P	C
3	0	0	3

**MACHINE LEARNING**

**Course Objectives:**

The objectives of the course are to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

**UNIT-I: Introduction to Machine Learning:** Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

**UNIT-II: Nearest Neighbor-Based Models:**

Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

**UNIT-**

**III: Models Based on Decision Trees:** Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias-Variance Trade-off, Random Forests for Classification and Regression.

**The Bayes Classifier:** Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimal, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

**UNIT-**

**IV: Linear Discriminants for Machine Learning:** Introduction to Linear Discriminant, Linear Discriminant for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptron (MLPs), Back propagation for Training an MLP.

**UNIT-V: Clustering :** Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomeration Clustering, Partition Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

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**Text Books:**

1. "Machine Learning Theory and Practice", MN Murthy, VS Ananthanarayana, Universities Press (India), 2024

**Reference Books:**

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action", Peter Harrington, Dream Tech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

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**II Year II Semester**

L	T	P	C
3	0	0	3

**DATABASE MANAGEMENT SYSTEMS**

**Course Objectives:**

The main objectives of the course are to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

**UNIT I: Introduction:** Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

**Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

**Unit II: Relational Model:** Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

**UNIT III: SQL:** Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, subqueries, grouping, aggregation, ordering, implementation of different types of joins, view (updateable and non-updateable), relational set operations.

**UNIT IV: Schema Refinement (Normalization):** Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form (4NF), Fifth Normal Form (5NF).

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**UNIT V: Transaction Concept:** Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lockbased, timestampbased, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

**Introduction to Indexing Techniques:** B+ Trees, operations on B+ Trees, Hash Based Indexing:

Add on Topic(s):

Types of indexing (primary index, secondary index)

**Text Books:**

1. Database Management Systems, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

**Reference Books:**

1. Introduction to Database Systems, 8<sup>th</sup> edition, C.J. Date, Pearson.
2. Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

**Web-Resources:**

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01275806667282022456\\_s\\_hared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_s_hared/overview)

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II Year II Semester

L	T	P	C
3	0	0	3

**DIGITAL LOGIC & COMPUTER ORGANIZATION**

**Course Objectives:**

The main objectives of the course are to

- provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

**UNIT-I:**

**Data Representation:** Binary Numbers, Fixed Point Representation, Floating Point Representation, Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

**Digital Logic Circuits-**

**I:** Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions, K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

**UNIT-II:**

**Digital Logic Circuits-II:** Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

**Basic Structure of Computers:** Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi-computers, Computer Generations, Von-Neumann Architecture

**UNIT-III:**

**Computer Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

**Processor Organization:** Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multiprogrammed Control

**UNIT-IV:**

**The Memory Organization:** Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

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**UNIT-V:**

**Input/Output Organization:** Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

**Textbooks:**

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6<sup>th</sup> edition, McGraw Hill, 2023.
2. Digital Design, 6<sup>th</sup> Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11<sup>th</sup> Edition, Pearson, 2022.

**Reference Books:**

1. Computer Systems Architecture, M. Moris Mano, 3<sup>rd</sup> Edition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5<sup>th</sup> Edition, Thomson, 2003.

**Online Learning Resources:**

<https://nptel.ac.in/courses/106/103/106103068/>

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**II Year II Semester**

**AI & ML LAB**

**Course Objectives:**

L	T	P	C
0	0	3	1.5

1. The students should be made to study the concepts of Artificial Intelligence.
2. The students should be made to learn the methods of solving problems using Artificial Intelligence.
3. The students should be made to introduce the concepts of Expert Systems and machine learning.
4. To learn about computing central tendency measures and Data preprocessing techniques.
5. To learn about classification and regression algorithms.
6. To apply different clustering algorithms for a problem.

**Software Required for ML: Python/R/Weka List of Experiments**

1. Pandas Library
  - a) Write a Python program to implement Pandas Series with labels.
  - b) Create a Pandas Series from a dictionary.
  - c) Create a Pandas DataFrame.
  - d) Write a program which makes use of the following Pandas methods
    - i) describe()
    - ii) head()
    - iii) tail()
    - iv) info()
2. Pandas Library: Visualization
  - a) Write a program which uses Pandas inbuilt visualization to plot following graphs:
    - i. Bar plots
    - ii. Histograms
    - iii. Line plots
    - iv. Scatter plots
3. Write a Program to Implement Breadth First Search using Python.
4. Write a program to implement Best First Searching Algorithm.
5. Write a Program to Implement Depth First Search using Python.
6. Write a program to implement the Heuristic Search.
7. Write a Python program to implement A\* and AO\* algorithm. (Ex: find the shortest path)
8. Apply the following Pre-processing techniques for a given dataset.
  - a. Attribute selection
  - b. Handling Missing Values
  - c. Discretization
  - d. Elimination of Outliers
9. Apply KNN algorithm for classification and regression.
10. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results.
11. Apply Random Forest algorithm for classification and regression.
12. Demonstrate Naïve Bayes Classification algorithm.
13. Apply Support Vector algorithm for classification.
14. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

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**II Year II Semester**

L	T	P	C
0	0	3	1.5

**DATABASE MANAGEMENT SYSTEMS LAB**

**Course Objectives:**

This course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers,

**Experiments covering the topics:**

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming-control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity-ODBC/JDBC

**Sample Experiments:**

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with subqueries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to\_char, to\_number and to\_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next\_day, add\_months, last\_day, months\_between, least, greatest, trunc, round, to\_char, to\_date)
5.
  - i. Create a simple PL/SQL program which includes declaration section, executable section and exception – Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
  - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

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6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USER defined Exceptions, RAISE-APPLICATION ERROR.
8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURE S.
9. Program development using creation of stored functions, invoke functions in SQL statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT OF clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

**Add-on experiment(s):**

1. Queries using different types of joins.

**Text Books/Suggested Reading:**

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F VanderLans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

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**II Year II Semester**

L	T	P	C
0	1	2	2

**FULL STACK DEVELOPMENT –  
1 (SKILL ENHANCEMENT COURSE)**

**Course Objectives:**

The main objectives of the course are to

1. Make use of HTML elements and their attributes for designing static web pages
2. Build a web page by applying appropriate CSS styles to HTML elements
3. Experiment with JavaScript to develop dynamic web pages and validate forms

**Experiments covering the Topics:**

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

**Sample Experiments:**

**1. Lists, Links and Images**

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using `<a>` tag and `href`, `target` Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100\*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

**2. HTML Tables, Forms and Frames**

- Write a HTML program, to explain the working of tables. (use tags: `<table>`, `<tr>`, `<th>`, `<td>` and attributes: `border`, `rowspan`, `colspan`)

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- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select> & <option> tags, <text area> and two buttons i.e. submit and reset. Use tables to provide a better view).
- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts in either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).

**3. HTML5 and Cascading Style Sheets, Types of CSS**

- a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.
- b. Write a HTML program, to embed audio and video into HTML webpage.
- c. Write a program to apply different types (or level of styles or style specification formats) - inline, internal, external styles to HTML elements. (Identify selector, property and value).

**4. Selector forms**

- a. Write a program to apply different types of selector forms
  - Simple selector (element, id, class, group, universal)
  - Combinator selector (descendant, child, adjacent sibling, general sibling)
  - Pseudo-class selector
  - Pseudo-element selector
  - Attribute selector

**5. CSS with Color, Background, Font, Text and CSS Box Model**

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
  - i. font-size
  - ii. font-weight
  - iii. font-style
  - iv. text-decoration
  - v. text-transformation
  - vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
  - i. Content
  - ii. Border
  - iii. Margin
  - iv. padding

**6. Applying JavaScript-internal and external, I/O, Type Conversion**

- a. Write a program to embed internal and external JavaScript in a webpage.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.

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- d. Create a web page which uses prompt dialog box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

**7. JavaScript Pre-defined and User-defined Objects**

- Write a program using document object properties and methods.
- Write a program using window object properties and methods.
- Write a program using array object properties and methods.
- Write a program using math object properties and methods.
- Write a program using string object properties and methods.
- Write a program using regex object properties and methods.
- Write a program using date object properties and methods.
- Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

**8. JavaScript Conditional Statements and Loops**

- Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
- Write a program to display weekdays using switch case.
- Write a program to print 1 to 10 numbers using for, while and do-while loops.
- Write a program to print data in object using for-in, for-each and for-of loops
- Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,  $1^3+5^3+3^3=153$ ]
- Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1-10's, 1-2's & 1-1's)

**9. Javascript Functions and Events**

- Design appropriate functions should be called to display
  - Factorial of that number
  - Fibonacci series up to that number
  - Prime numbers up to that number
  - Is it palindrome or not
- Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
  - Factorial of that number
  - Fibonacci series up to that number
  - Prime numbers up to that number
  - Is it palindrome or not

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- c. Write a program to validate the following fields in a registration page
- Name (start with a letter and followed by alphanumeric and the length should not be less than 6 characters)
  - Mobile (only numbers and length 10 digits)
  - E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

**Text Books:**

- Programming the World Wide Web, 7th Edition, Robert W. Sebesta, Pearson, 2013.
- Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
- Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2<sup>nd</sup> edition, A Press, O'Reilly.

**Web Links:**

- <https://www.w3schools.com/html>
- <https://www.w3schools.com/css>
- <https://www.w3schools.com/js/>
- <https://www.w3schools.com/nodejs>
- <https://www.w3schools.com/typescript>