

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY


(An Autonomous College under JNTUA, Anantapuramu, Approved by AICTE,  
Accredited by NBA, Accredited by NAAC with 'A' Grade)

Vidya Nagar, Pallavolu (V), Proddatur – 516362 (A.P) India



**Department of Computer Science Engineering**  
**[Data Science]**

**Second Year B.Tech**  
**Course Structure and Syllabi under**  
**R22 Regulations**

  
HEAD, Dept. of CSE (DS)  
Chaitanya Bharathi Institute of Technology  
(Autonomous)  
Vidyanagar, PRODDATUR, Y.S.R. (Dt.) A.P-516362



**COURSESTRUCTURE(R22)****II B.Tech-I Semester**

Sl. No.	CourseCode	CourseTitle	Contact Periods per week				Credits	Scheme of Examination Max.Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	22E00304T	DISCRETE MATHEMATICAL STRUCTURES	3	-	-	3	3	30	70	100
2.	22E05301T	PYTHON PROGRAMMING	3	-	-	3	3	30	70	100
3.	22E32302T	JAVA PROGRAMMING	3	-	-	3	3	30	70	100
4.	22E31402T	ARTIFICIAL INTELLIGENCE	3	-	-	3	3	30	70	100
5.	22E31304T	DIGITAL LOGIC DESIGN	3	-	-	3	3	30	70	100
6.	22E05301L	PYTHON PROGRAMMING LAB	-	-	3	3	1.5	30	70	100
7.	22E32302L	JAVA PROGRAMMING LAB	-	-	3	3	1.5	30	70	100
8.	22E31402L	ARTIFICIAL INTELLIGENCE LAB	-	-	3	3	1.5	30	70	100
9	22E05305SC	WEB DESIGNING	1	-	2	3	2	30	70	100
10	22E00304MC	CONSTITUTION OF INDIA	2	-	0	2	0	30	0	30
<b>Total:</b>			<b>18</b>	<b>-</b>	<b>11</b>	<b>29</b>	<b>21.5</b>	<b>300</b>	<b>630</b>	<b>930</b>

**II B.Tech-II Semester**

Sl. No.	CourseCode	CourseTitle	Contact Periods per week				Credits	Scheme of Examination Max.Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	22E04406T	COMPUTER ORGANIZATION	3	-	-	3	3	30	70	100
2.	22E00303T	STATISTICAL METHODS AND PROBABILITY THEORY	3	-	-	3	3	30	70	100
3.	22E05302T	OPERATING SYSTEMS	3	-	-	3	3	30	70	100
4.	22E33401T	MACHINE LEARNING	3	-	-	3	3	30	70	100
5.	22E00407T	MANAGEMENT. SCIENCE	3	-	-	3	3	30	70	100
6.	22E04406L	COMPUTER ORGANIZATION LAB	-	-	3	3	1.5	30	70	100
7.	22E05302L	OPERATING SYSTEMS LAB	-	-	3	3	1.5	30	70	100
8.	22E33401L	MACHINE LEARNING LAB	-	-	3	3	1.5	30	70	100
9	22E05403SC	R PROGRAMMING	1	-	2	3	2	30	70	100
10	22E00406T	UNIVERSAL HUMAN VALUES	3	-	-	3	3	30	70	100
<b>Total:</b>			<b>18</b>	<b>1</b>	<b>11</b>	<b>30</b>	<b>24.5</b>	<b>300</b>	<b>700</b>	<b>1000</b>

Community Service Project / Internship 2 Months (Mandatory) during summer vacation

Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0. also)	4	0	0	4	4	30	70	100
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**II B. Tech. - I Semester**  
**(22E00304T) DISCRETE MATHEMATICAL STRUCTURES**  
(Common to CSE, CSE-AI, CSE-DS, and CSE-AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** Differentiation, Integration.

**COURSE OBJECTIVES:**

1. Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions.
2. Solve problems using counting techniques and combinatorics
3. To introduce generating functions and recurrence relations.
4. Use Graph Theory for solving real world problems.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to

**CO1:** Apply mathematical logic to solve problems

**CO2:** Understand the concepts and perform the operations related to sets, relations and Functions

**CO3:** Gain the conceptual background needed and identify structures of algebraic nature

**CO4:** Formulate problems and solve recurrence relations.

**CO5:** Apply Graph Theory in solving computer science problems

**DETAILED SYLLABUS:**

**UNIT-I:**

**(09 Periods)**

**Mathematical Logic:**

Statements & Notation, Connectives, Well Formed Formulas, Equivalence & implications, Duality law, other connectives. Normal forms: Normal forms-Principle Disjunctive Normal form, Principle conjunctive Normal form, Theory of inference for statement calculus.

**UNIT-II: Set Theory**

**(10 Periods)**

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions, composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties.

**UNIT-III: Algebraic structures**

**(10 Periods)**

Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, Normal groups, homomorphism, Isomorphism

**UNIT-IV: Recurrence Relations:**

**(09 Periods)**

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relations.

  
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**UNIT-V: Graphs:**

**(10 Periods)**

Basic Concepts, Isomorphism and Sub graphs, Trees and Their Properties, Spanning Tress-Depth First search and Breadth First search, Minimal Spanning Trees, Kruskal's& Prim's Binary Trees, Planar and Non planar Graphs, Euler's Formula, Hamiltonian Graphs, Chromatic Numbers.

**Total Periods: 48**

**Text Books:**

1. Trembly. J.P and Manohar. R [2011], Discrete mathematical structures with applications to computer science, Mc-Graw-Hill International Editions.
2. Joe L.Mott, Abraham Kandel and Theodore P.Baker [2008], [2nd Edition], Discrete Mathematics for Computer Scientists and Mathematicians, PHI.

**Reference Books:**

1. N.Bali, M. Goyal, C.Watkins, Advanced Engineering Mathematics, Infinity Science press.
2. Dr. S.Chandrasekharaiah, Mathematical foundations of computerscience, -Prism books Pvt.Ltd.
3. Ralph P.Grimaldi [2006], [5th Edition], Discrete and Combinational Mathematics-An Applied Introduction, Pearson Education.

**WEB RESOURCES:**

1. <http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf>

**II B. Tech. – I Semester**  
**22E05301T PYTHON PROGRAMMING**

(Common to CSE, CSE-AI, CSE-DS, CSE-AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** Solving the Statistical Problems

**COURSE OBJECTIVES:**

1. To learn about Python programming language syntax, semantics, and the run time environment.
2. To be familiarized with universal computer programming concepts like data types, containers.
3. To be familiarized with general computer programming concepts like conditional execution, loops & functions.
4. To be familiarized with general coding techniques and object-oriented programming.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1:** Understand the Python syntax, semantics, basic programming constructs to be used to write the programs.
- CO2:** Utilize the methods of various data structures to manipulate the data.
- CO3:** Regular Expressions concepts to solve real life problems.
- CO4:** Apply the appropriate Object-Oriented Programming principle for a given scenario.
- CO5:** Apply File operations and Develop bug free applications by handling different types of Exceptions

**DETAILED SYLLABUS:**

**UNIT-I:**

**(10 Periods)**

**Basics of Python Programming:** Features of Python, Writing and Executing First Python Program, literal Constants, variables and identifiers, data types, Input Operation, comments, Reserved Words, indentation, Operators and Expressions, type conversion.

**Decision Control Statements:** selection/conditional branching statements, basic loop structures, nested loops, break, continue and pass statements, else statement used with loops.

**UNIT-II:**

**(10 Periods)**

**Functions:** Introduction, Function definition, Function call, Variable Scope and Life time, the return statement, more on Defining functions, lambda functions, recursive functions, Modules and Packages.

**Data Structures:** Sequence, Lists: access values in list, updating values in list, nested list, cloning lists, basic list operations, list methods, list comprehensions, looping in lists, Tuples, Sets, Dictionaries.

**UNIT-III:**

**(09 Periods)**

**Python Strings Revisited:** Concatenation, Appending and Multiplying strings, String formatting, Slicing operations, Comparing strings, Iterating strings and string module.

**Regular Expression Operations:** Regular Expression Methods, Meta character in regular expression and, Application of Regular Expression.

**UNIT-IV:**

**(10 Periods)**

**Classes and Objects:** Introduction, classes and objects, Features of object oriented programs, Class method and self-argument, The\_init\_() method, class variables and object variables, The del\_() method, other special methods, public and private data members, built-in functions to check, get, set and delete class attributes, garbage collection, class and static methods.

**Inheritance:** Introduction, inheriting classes, types of inheritance, overriding methods, abstract classes and interfaces.

**UNIT-V:**

**(09 Periods)**

**Files:** Introduction, Types of files, Opening and Closing files, Reading and Writing Files, File Positions, Renaming and Deleting files and Directory Methods.

**Error and Exception Handling:** Types of Errors, Exceptions, Handling Exceptions, types of exceptions, except block.

**Total Periods: 48**

**TEXT BOOKS:**

1. Reema thareja, Python Programming using problem solving approach, Oxford University Press.

**REFERENCE BOOKS:**

1. Dr. R. Nageswara Rao, Core Python Programming , Dreamtech Press
2. Dietel and Dietel, Python How to Program.
3. Kenneth A. Lambert, B.L. Juneja, Fundamentals of Python, Cengage Learning.

**WEB RESOURCES:**

1. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0125409616243425281061\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0125409616243425281061_shared/overview)
2. [https://www.tutorialspoint.com/python3/python\\_tutorial.pdf](https://www.tutorialspoint.com/python3/python_tutorial.pdf)
3. <https://docs.python.org/>
4. <https://realpython.com/>

**II B. Tech. - I Semester**  
**22E32302T JAVA PROGRAMMINIG**

(Only CSE[DS])

<b>Int. Marks</b>	<b>Ext. Marks</b>	<b>Total Marks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
30	70	100	3	-	-	3

**PRE-REQUISITES:** Good Knowledge in OOPS.

**COURSE OBJECTIVES:** *This course will enable students:*

1. To impart fundamentals of object-oriented programming in Java, defining classes invoking methods, using class libraries, etc.
2. To obtain knowledge about the principles of inheritance and polymorphism
3. To familiarize the concepts of Exceptions handling and Threading
4. To impart knowledge on applets and Data base connectivity

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Familiarize concepts of object-oriented programming in Java.
- CO2: Gain the knowledge about inheritance & Polymorphism in given a problem specification.
- CO3: Familiarize the concepts of Exceptions handling.
- CO4: Understand about Collections and i/o streams.
- CO5: Build GUIs using swings.

**DETAILED SYLLABUS:**

**UNIT-I: Java Basics (10 Periods)**

Introduction to Object Oriented Programming, Introduction to Classes, Objects, Methods, Constructors, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Operators, Static Keyword, Control Statements, String Class and Stringhandling methods.

**UNIT-II: Inheritance, Polymorphism & Abstraction (10 Periods)**

**Inheritance & Polymorphism:** Basic concepts, Types of inheritance, Usage of this, Super and Final keywords, Method Overloading, Method overriding, Constructor Overloading.

**Abstraction:** Defining and Implementing interfaces, Abstract classes, Abstract vs Interfaces.

**UNIT-III: Encapsulation & Exception Handling (08 Periods)**


**Encapsulation & Packages:** Encapsulation, Access Modifiers, Getter and Setter Methods, Finding packages, Access Protection, Importing packages.

**Exception Handling:** Hierarchy & Types of Java Exception Classes, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes.

**UNIT-IV: Collections & I/O Streams (10 Periods)**

**Collections:** The Collections Framework (java.util): Collections overview, Collection Interfaces, and The Collection classes.

**I/O Streams:** Concepts of streams, Stream classes- Byte and Character stream  
 Reading console Input and Writing Console output, File Handling.

  
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**UNIT-V: GUI Programming with Swings**

**(12 Periods)**

The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenutem, creating a main menu, show messagedialog, showconfirmdialog, showinputdialog, showoptiondialog, jdialog, create a modeless dialog.

**Total Periods: 48**

**TEXT BOOKS:**

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

**REFERENCE BOOKS:**

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume-1 Fundamentals, CayS. Horstmann, Pearson Education
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press.
4. Object Oriented Programming through Java, P. Radha Krishna, University Press.

**WEB RESOURCES:**

1. [https://www.w3schools.com/java/java\\_oop.asp](https://www.w3schools.com/java/java_oop.asp)
2. <http://peterindia.net/JavaFiles.html>
3. <https://www.javatpoint.com/java-tutorial>

**II B. Tech. - I Semester**  
**(22E31402T) ARTIFICIAL INTELLIGENCE**  
(Only CSE[DS])

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:**

**COURSE OBJECTIVES:** *The Course is designed to*

1. To Summarize and formulate appropriate logics and AI methods for problem solving.
2. To Apply various searching, game playing, and knowledge representation techniques to solve the real-world problems.
3. To understand logic concepts
4. To give explanation of Knowledge representation
5. To Analyze different expert systems and its applications

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Apply searching technique for problem solving
- CO2: Define intelligent agents.
- CO3: Develop Natural Language interfaces for machines.
- CO4: Analyze the Knowledge representation.
- CO5: Understand Expert systems and applications.

**DETAILED SYLLABUS:**

**UNIT-I:**

**(10 Periods)**

**Introduction to artificial intelligence:** Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends in AI.

**Problem solving:** state - space search and control strategies: Introduction, general problem-solving characteristics of problem.

**UNIT-II: Search Strategies**

**(09 Periods)**

**Search Strategies:** exhaustive searches, heuristic search techniques: A\*Algorithm and Hill Climbing, constraint satisfaction.

**Problem reduction and game playing:** Introduction, problem reduction, alpha -beta pruning

**UNIT-III: Logic concepts:**

**(09 Periods)**

**Logic concepts:** Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic.

**UNIT-IV: Knowledge representation:**

**(10 Periods)**

**Knowledge representation:** Introduction, approaches to knowledge representation, knowledge Representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

**Advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure.

**UNIT-V: Expert system and applications: (10 Periods)**

**Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems, rule- based expert systems blackboard systems truth maintenance systems, application of expert systems.

**Total Periods: 48**

**TEXT BOOKS:**

1. Artificial intelligence, A modern Approach, by Stuart Russel and Peter Norvig Second Edition, PEA.
2. Artificial Intelligence by Rich, Kevin Knight, Shiv Shankar B Nair, 3<sup>rd</sup> edition, TMH.

**REFERENCE BOOKS:**

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Luger, 5<sup>th</sup> ed, PEA.
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer.
3. Artificial Intelligence by Saroj Kaushik, CENGAGE Learning.
4. Introduction to Artificial Intelligence by Patterson, PHI.

**WEB RESOURCES:**

1. <https://www.mygreatlearning.com/artificial-intelligence/courses>
2. **NPTEL Course: Fundamentals of Artificial Intelligence**  
<https://nptel.ac.in/courses/112/103/112103280/>

**II B. Tech. - I Semester**  
**(22E31304T) DIGITAL LOGIC DESIGN**  
(Common to CSE-AI and CSE-DS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:**

**COURSE OBJECTIVES:**

- 1.To understand Foundation in design and analysis of the operation of digital gates;
- 2.To understand Concepts of Boolean algebra, Minimization of logic circuits;
- 3.To Design and implementation of combinational Logic.
- 4.To Design and implementation of Sequential logic circuits
- 5.To Design and implementation of Programmable logic circuits.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Apply knowledge of binary systems, logic gates and Boolean functions to represent a given problem using Boolean logic.
- CO2: Minimize and implement Boolean functions to build combinational logic circuits.
- CO3: Design sequential logic circuits for digital systems.
- CO4: Design of combinational logic circuits for digital systems.
- CO5: Design digital systems using programmable logic to solve engineering problems.

**DETAILED SYLLABUS:**

**UNIT-I: Binary Systems And Boolean Algebra**

**(10 Periods)**

Introduction, Binary Numbers, Number Base Conversions, Error Detection and Correction, Complements of Numbers, Signed Binary Numbers, Binary Codes, Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

**UNIT-II: Gate Level Minimization**

**(10 Periods)**

Map Method, Four Variable K-Map, Product-of-Sums and Sum-of-Products Simplification, Don't Care Conditions, NAND and NOR Implementations, Other Two Level Implementations, Exclusive-OR function.

**UNIT-III: Combinational Logic**

**(10 Periods)**

Combinational Circuits, Analysis of Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-Multiplexers.

**UNIT-IV: Sequential Logic:**

**(10 Periods)**

Latches, Flip-Flops, Analysis of Clocked Sequential Circuits, Design of Synchronous Sequential Circuits, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter and Johnson Counter.

  
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**UNIT-V: Programmable Logic**

**(08 Periods)**

**Programmable Memories** – RAM, ROM, Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices.

**Total Periods: 48**

**TEXT BOOKS:**

1. M. Morris Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Pearson, 2018.

**REFERENCE BOOKS:**

1. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI Learning Private Limited, India, 2016.
2. Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th edition, Cengage Learning, 2015.

**WEB RESOURCES:**

1. <https://nptel.ac.in/courses/106/108/106108099/>
2. <https://www.javatpoint.com/digital-electronics>
3. <https://www.javatpoint.com/logic-gates-in-digital-electronics>

  
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**II B. Tech. – I Semester**  
**(22E05301L) PYTHON PROGRAMMING LAB**  
(Common to CSE, CSE-AI, CSE-DS, and CSE-AI&ML)

<b>Int. Marks</b>	<b>Ext. Marks</b>	<b>Total Marks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>30</b>	<b>70</b>	<b>100</b>	-	-	<b>3</b>	<b>1.5</b>

**PRE-REQUISITES:**

**COURSE OBJECTIVES:** *This course will enable students to:*

1. To acquire Object Oriented Skills in Python
2. To Understand the ability to write database applications in Python
3. To Understand the skill of designing Graphical user Interfaces in Python

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Write, Test and Debug Python Programs
- CO2: Apply Conditionals and Loops for Python Programs.
- CO3: Understand and apply python data structures.
- CO4: Understand and apply the file operations using python
- CO5: Apply the OOPS concepts using Python Programming

**LIST OF EXPERIMENTS:**

1. Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 Pounds in a kilogram.
2. Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3. Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 71, 74, 77, 80, 83, 86, 89.
4. Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5. Use a for loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.
6. Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7. Write a program that asks the user for two numbers and prints Close if the numbers are within .001 of each other and Not close otherwise.
8. Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9. Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters abcde and ABCDE the program should print out AaBbCcDdEe.
11. Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For

- instance, if the user enters 1000000, the output should be 1,000,000.
12. In algebraic expressions, the symbol for multiplication is often left out, as in  $3x+4y$  or  $3(x+5)$ . Computers prefer those expressions to include the multiplication symbol, like  $3*x+4*y$  or  $3*(x+5)$ . Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
  13. Write a program that generates a list of 20 random numbers between 1 and 100. (a) Print the list. (b) Print the average of the elements in the list. (c) Print the largest and smallest values in the list. (d) Print the second largest and second smallest entries in the list. (e) Print how many even numbers are in the list
  14. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
  15. Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in  $[1,0,1,1,0,0,0,0,1,0,0]$  is 4.
  16. Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list  $[1,1,2,3,4,3,0,0]$  would become  $[1,2,3,4,0]$ .
  17. Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
  18. Write a function called sum digits that is given an integer num and returns the sum of the digits of num.
  19. Write a function called first diff that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
  20. Write a function called number of factors that takes an integer and return show many factors the number has.
  21. Write a function called is sorted that is given a list and returns True if the list is sorted and False otherwise.
  22. Write a function called root that is given a number x and an integer n and returns  $x^{1/n}$ . In the function definition, set the default value of n to 2.
  23. Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
  24. Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list. (a) Do this using the sort method. (b) Do this without using the sort method.
  25. Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
  26. Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
  27. Write a program that reads a list of temperatures from a file called temps.txt,

converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

28. Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method get price that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called make purchase ~~it~~ receives the number of items to be bought and decreases amount by that much.
29. Write a class called Time whose only field is a time in seconds. It should have a method called convert to minutes that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called convert to hours that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
29. Write a Python class to implement pow(x, n).
30. Write a Python class to reverse a string word by word.
31. Write a program to demonstrate Try/except/else.
30. Write a program to demonstrate try/finally and with/as.

**Text Books:**

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

**Reference Books:**

1. Introduction to Python Programming, Gowrishankar. S, Veena A, CRC Press.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

**Web Resources:**

1. <https://docs.python.org/3/tutorial/>
2. <https://www.programiz.com/python-programming>



**II B. Tech. – I Semester**  
**(22E32302L) JAVA PROGRAMMING LAB**  
(CSE[DS])

<b>Int. Marks</b>	<b>Ext. Marks</b>	<b>Total Marks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>30</b>	<b>70</b>	<b>100</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>1.5</b>

**PRE-REQUISITES:**

**COURSE OBJECTIVES:** *This course will enable students to:*

1. To impart fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
2. To inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification.
3. To familiarize the concepts of packages and interfaces.
4. To facilitate students in handling exceptions.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Students will gain understanding about the object-oriented principles in Construction of robust and maintainable programs.
- CO2: Students understand the concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification.
- CO3: Familiarize the concepts of packages and interfaces.
- CO4: Learn about handling exceptions.
- CO5: Familiarize Database connectivity using Applets and JDBC.

**LIST OF EXPERIMENTS:**

**(Any 10 experiments from the below list)**

1. (i) To Write a program to read a matrix of size m x n from the keyboard and display the same using function.
  - a. To Write a function power () which raise a number m to a power n. The function takes double value of m and integer value of n and returns the result. Use a default value of n is to make the function to calculate squares when this argument is omitted.
2. (i) To write a Program to show that the effect of default arguments can be alternatively achieved by overloading.
  - a. To write a class ACCOUNT that represents your bank account and then use it. The class should allow you to deposit money, withdraw money, calculate interest, and send you a message if you have insufficient balance.
3. To write a program to create an abstract class named Shape that contains an empty method named number of Sides ( ). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes inherits the class Shape. Each one of the classes contains only the method number OfSides ( ) that shows the number of sides in the given geometrical figures.
4. To write a program to demonstrate the concept of Default Constructor, Parameterized Constructor, Copy Constructor and Constructor overloading Concept.

5. (i) To write a program to implement the Multiple Inheritance  
(ii) To develop a java Program application to generate pay slip for different category of employees using the concept of Multilevel inheritance.  
(iii) To develop a java Program demonstrates hybrid inheritance using a combination of single inheritance and multiple inheritances using Interfaces.
6. To write a Program to show the concept of run time polymorphism using virtual function.
7. To write a Program to create a package that access the member of external class as well as same package.
8. (i) To write a Program to handle the Exception using try and multiple catch block.  
(ii) To write a Program to Implement the Nested try Statements.  
(iii) To write a Java Program to Implement Throw and Throws.  
(iv) To write a Java Program to Implement Custom Exception
9. (i) Creating a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.  
(ii) Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.
10. (i) Creating a Java program for writing to a file and Reading from a text file using File Input Stream and File Output Stream.  
(ii) Creating a Java program for Reading from a text file using File Reader and Buffered Reader class.  
(iii) Creating a Java program writing to a file using File Writer and Buffered Writer class.
11. (i) Creating a Java program to handle the Mouse Event Using Event Handling Concept.  
(ii) Creating a Java program to handle the key Event using Event Handling Concept.
12. (i) Develop a Java application to find the maximum value from the given type of elements using a generic function.  
(ii) Develop a Java application that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, \*, % operations. Add a text field to display the result.

**TEXT BOOKS:**

1. Herbert schildt (2010), The complete reference, 12th edition, Tata Mcgraw Hill, New Delhi.

**REFERENCE BOOKS:**

1. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, Pearson Education, India.
2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7<sup>th</sup> edition, Pearson education, India.

**WEB RESOURCES:**

1. <https://www.javatpoint.com/java-tutorial>

**II B. Tech. – I Semester**  
**(22E31402L) ARTIFICIAL INTELLIGENCE LAB**  
(Only CSE[DS])

<b>Int. Marks</b>	<b>Ext. Marks</b>	<b>Total Marks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>30</b>	<b>70</b>	<b>100</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>1.5</b>

**PRE-REQUISITES:**

**COURSE OBJECTIVES:** *This course will enable students to:*

1. To Implement different search algorithms.
2. Apply appropriate logic concepts and AI methods for solving a problem.
3. To Implement game playing techniques.
4. To Design Chabot and virtual assistant.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Implement different search algorithms.
- CO2: Apply appropriate logic concepts and AI methods for solving a problem.
- CO3: Implement game playing techniques
- CO4: Design Chabot and virtual assistant.
- CO5: Implementation of algorithms of AI.

**Experiments:**

1. Write a program to implement Breadth First Search Traversal.
2. Write a program to implement Depth First Search Traversal.
3. Write a program to implement Water Jug Problem.
4. Write a program to find the solution for traveling salesman Problem.
5. Write a program to implement 8 puzzle problem.
6. Write a program to implement Towers of Hanoi problem.
7. Write a program to implement A\* Algorithm.
8. Write a program to implement Hill Climbing Algorithm.
9. Write program to implement simple Chatbot.
10. Build a bot that provides all the information related to your college.
11. Write a program to sort the sentence in alphabetical order.
12. Write a program to implement Tic-Tac-Toe game

**TEXT BOOKS:**

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.

## REFERENCE BOOKS:

1. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.
2. Artificial Neural Networks, B. Yagna Narayana, PHI.
3. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight, TMH.
4. Artificial Intelligence and Expert Systems, Patterson, PHI.

## WEB RESOURCES:

1. <https://www.tensorflow.org/>
2. <https://pytorch.org/>
3. <https://github.com/pytorch>
4. <https://keras.io/>
5. <https://github.com/keras-team>
6. <http://deeplearning.net/software/theano/>
7. <https://github.com/Theano/Theano>
8. <https://caffe2.ai/>
9. <https://github.com/caffe2>
10. <https://deeplearning4j.org/Scikit-learn>:
11. <https://scikit-learn.org/stable/>
12. <https://github.com/scikit-learn/scikit-learn>
13. <https://www.deeplearning.ai/>
14. <https://opencv.org/>
15. <https://github.com/qqwweee/keras-yolo3>  
<https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/>
16. <https://developer.nvidia.com/cuda-math-library>
17. [http://vlabs.iitb.ac.in/vlabs-dev/labs/machine\\_learning/labs/index.php](http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php)

**II B. Tech. - II Semester**  
**(22E05305SC) Web Designing**  
(Common to CSE, CSE-AI, CSE-DS, and CSE-AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	1	-	2	2

**PRE-REQUISITES:**

**COURSE OBJECTIVES:**

1. Learn web site development using HTML, CSS, JavaScript.
2. Understand the concepts of responsive web development using the bootstrap framework.
3. Make use of the JQuery java script library to provide inter activeness to the websites.
4. Discover how to use Google Charts to provide a better way to visualize data on a website
5. Learn Content Management Systems to speed the development process

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Construct websites with valid HTML, CSS, JavaScript
- CO2: Create responsive Web designs that work on phones, tablets, or traditional laptops and wide-screen monitors.
- CO3: Develop websites using Query to provide interactivity and engaging user Experiences.
- CO4: Embed Google chart tools in a website for better visualization of data.
- CO5: Develop an HTML document to illustrate each chart with real time example.

**EXPERIMENTS:**

**Module-1:**

HTML: What is a browser?, What is HTML?, Elements and Tags, Basic HTML structure, Metadata,

<title>, Comments, headings

Task: Create a Basic HTML document

**Module-2:**

HTML(continued): Block-Level Elements & Inline Elements, Links (Understand Absolute vs Relative paths), Lists, Images, iframe (embed youtube video)

Task: Create your Profile Page

**Module-3:**

HTML(continued): Tables: <table>, <tr>, <th>, <td>, Attributes for each Table element

Task: Create a Class Time table (to merge rows/columns, use rowspan/colspan)

**Module-4:**

HTML (continued): Form Elements: <input>, <select>, <text area>, <button>, Attributes for each Form element

Task: Create a Student Hostel Application Form

**Module-5:**

Cascading Style Sheets(CSS):CSS Properties, Types of CSS, Selectors, box model, Pseudo-elements, z-index

Task: Make the Hostel Application Form designed in Module-4 beautiful using CSS (add colors, backgrounds, change font properties, borders, etc.)

**Module-6:**

Bootstrap-CSS Frame work: Layouts(Containers, Grid system), Forms, Other Components

Task: Style the Hostel Application Form designed in Module-5 still more beautiful using Bootstrap CSS (Re-size browser and check how the webpage displays in mobile resolution)

**Module-7**

HTTP & Browser Developer Tools: Understand HTTP Headers(Request & Response Headers), URL & its Anatomy, Developer Tools: Elements/Inspector, Console, Network, Sources, performance, Application Storage.

Task: Analyse various HTTP requests (initiators, timing diagrams, responses) and identify problems if any.

**Module-8:**

**Javascript:** Variables, Data Types, Operators, Statements, Objects, Functions, Events & Event Listeners, DOM.

Task: Design a simple calculator using JavaScript to perform sum, product, difference, and quotient operations:

**Module-9:**

Dynamic HTML with JavaScript: Manipulate DOM, Error Handling, Promises, async/await, Modules.

Task: Design & develop a Shopping Cart Application with features including Add Products, Update Quantity, Display Price(Sub-Total & Total), Remove items/products from the cart.

**Module-10:** JQuery-A Javascript Library: Interactions, Widgets, Effects, Utilities, Ajax using JQuery.

Task: Validate all Fields and Submit the Hostel Application Form designed in Module 6 using JQuery

**Module - 11:** Google Charts: Understand the Usage of Pie chart, Bar Chart, Histogram, Area & Line Charts, Gantt Charts. Task: Develop an HTML document to illustrate each chart with real-time examples.

**Text Books:**

1. Deitel and Deitel and Nieto, – Internet and World Wide Web-How to Program, Prentice Hall, 5th Edition, 2011.

**Reference Books:**

1. Web Technologies, Uttam K. Roy, Oxford Higher Education., 1<sup>st</sup> edition, 10<sup>th</sup> impression, 2015.
2. Gopalan N. P. and Akilandeswari J.,—Web Technology, Prentice Hall of India.

**WEB RESOURCES:**

1. HTML: <https://html.spec.whatwg.org/multipage/>
2. HTML: <https://developer.mozilla.org/en-US/docs/Glossary/HTML5>
3. <https://www.w3.org/Style/CSS/>
4. Bootstrap- CSS Framework: <https://getbootstrap.com/>
5. Browser Developer Tools:
  - a) [https://developer.mozilla.org/en-US/docs/Learn/Common\\_questions/What\\_are\\_browser\\_developer\\_tools](https://developer.mozilla.org/en-US/docs/Learn/Common_questions/What_are_browser_developer_tools)
  - b) <https://developer.mozilla.org/en-US/docs/Web/JavaScript>

  
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**II B. Tech. – I Semester**  
**(22E00304MC) CONSTITUTION OF INDIA**  
**(Common to All branches of Engineering)**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	0	30	2	-	-	0

**PRE-REQUISITES:** Students should know about fundamentals and basic principles in chemistry.

**COURSE OBJECTIVES:** This course will enable students:

The objectives of the course are

1. To enable the student to understand the importance of constitution To understand the structure of executive, legislature and judiciary
2. To understand philosophy of fundamental rights and duties
3. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
4. To understand the central-state relation in financial and administrative control.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government ie., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between, central, state and local self-government.

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

**DETAILED SYLLABUS:**

**UNIT-I:**

**(06 Periods)**

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

**UNIT-II:**

**(08 Periods)**

Union Government and its Administration Structure of the Indian Union- Federalism – Centre - State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions. Nano chemistry - Introduction, classification, properties, preparation of nanomaterials and applications of nano chemistry.

**UNIT- III:**

**(04 Periods)**

State Government and its Administration - Governor - Role and Position - CM and Council of ministers - State Secretariat-Organization Structure and functions.

**UNIT-IV:**

**(08 Periods)**

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions- PRI -Zilla Parishath - Elected officials and their roles - CEO,Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

**UNIT-V: INSTRUMENTAL METHODS OF ANALYSIS**

**(06 Periods)**

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission - Functions of Commissions for the welfare of SC/ST/OBC and Women.

**Total Periods: 32**

**TEXT BOOKS:**

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1.
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

**REFERENCE BOOKS:**

1. J.A. Siwach, "Dynamics of Indian Government & Politics".
2. H.M.Sreevai, "Constitutional Law of India", 4th edition in 3 volumes (Universal Law Publication).
3. J.C. Johari, "Indian Government and Politics", Hans India 185 Page.
4. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in Constitutional Law, Prentice - Hall of India Pvt.Ltd.. New Delhi.

**WEB RESOURCES:**

1. [nptel.ac.in/courses/109104074/8](http://nptel.ac.in/courses/109104074/8)
2. [nptel.ac.in/courses/109104045/](http://nptel.ac.in/courses/109104045/)
3. [nptel.ac.in/courses/101104065/](http://nptel.ac.in/courses/101104065/)
4. [www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
5. [www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)

  
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**II B. Tech. – II Semester**  
**(22E04406T) COMPUTER ORGANIZATION**  
(Common to CSE[DS], CSE[AI], CSE[AI&ML])

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** Good understanding of English Language

**COURSE OBJECTIVES:**

1. To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design
2. To understand the structure and behavior of various functional modules of a computer.
3. To learn the techniques that computers use to communicate with I/O devices
4. To acquire the concept of pipelining and exploitation of processing speed.
5. To learn the basic characteristics of multiprocessors

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Understand computer architecture concepts related to the design of modern processors, memories and I/Os.  
CO2: Identify the hardware requirements for cache memory and virtual memory.  
CO3: Design algorithms to exploit pipelining and multiprocessors.  
CO4: Understand the importance and trade-offs of different types of memories.  
CO5: Identify pipeline hazards and possible solutions to those hazards.

**DETAILED SYLLABUS:**

**UNIT-I:**

**(10 Periods)**

**Basic Structure of Computer:** Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.

**Machine Instructions and Programs:** Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

**UNIT-II:**

**(12 Periods)**

**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, Booths algorithm.

**Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Multiple- Bus Organization, Hardwired Control, and Multi Programmed Control, writing - punctuation, capital letters.

**Vocabulary and Grammar:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

  
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**UNIT-III:**

**(09 Periods)**

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

**UNIT-IV:**

**(08 Periods)**

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

**UNIT-V:**

**(09 Periods)**

**Pipelining:** Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

**Total Periods: 48**

**TEXT BOOKS:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5<sup>th</sup> Edition, McGrawHill Education, 2013.
2. M. Morris Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Pearson, 2018.

**REFERENCE BOOKS:**

1. M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.
2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning.
3. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw Hill Education.
4. John P. Hayes, "Computer Architecture and Organization", McGraw Hill Education.

**WEB RESOURCES:**

1. <https://www.javatpoint.com/computer-organization-and-architecture>
2. <https://nptel.ac.in/courses/106/103/106103068/>
3. <https://teachics.org/computer-organization-and-architecture-tutorial/>

## II B. Tech. - II Semester

### (22E00303T) STATISTICAL METHODS AND PROBABILITY THEORY (Common to CSE/CSE-AI/CSE-AI&ML/CSE-DS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** Probability.

#### **COURSE OBJECTIVES:**

1. This course aims at providing the student with the knowledge on
2. The theory of Probability and random variables.
3. Usage of statistical techniques like testing of hypothesis, testing of significance, chi-square test and basic concepts of Least square methods

**COURSE OUTCOMES:** Upon Successful Completion of the course , the student will be able to:

- CO1: Analyze the data quantitatively or categorically, measure of averages, Variability.
- CO2: Make use of probabilities of events in finite sample spaces from experiments and apply Bayes theorem to real time problems.
- CO3: Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies
- CO4: Apply the concept of hypothesis testing for large samples.
- CO5: Apply the concept of testing hypothesis for small samples to draw the Inferences.

#### **DETAILED SYLLABUS:**

##### **UNIT-I: Descriptive statistics (09 Periods)**

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, method of least squares, regression lines, regression coefficients and their properties.

##### **UNIT-II: Probability (10 Periods)**

Probability, probability axioms, addition law, conditional probability and multiplicative law of probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

##### **UNIT-III: Probability distributions (08 Periods)**

Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties

##### **UNIT-IV: Estimations and Testing of hypothesis-I (12 Periods)**

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, level of significance and the critical regions, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample Problems.

**UNIT-V: Testing of hypothesis-II**

**(09 Periods)**

$\chi^2$  - test for goodness of fit , Small sample tests- Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test),  $\chi^2$  - test for independence of attributes.

**Total Periods: 48**

**TEXT BOOKS:**

1. Miller and Friends, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

**REFERENCE BOOKS:**

1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. Peyton Z. Peebles, Probability, Random Variables & Random Signal Principles -, McGraw Hill Education, 4th Peyton Z. Peebles, Probability, Random Variables &, 2001.

**WEB RESOURCES:**

1. <http://www.digimat.in/nptel/courses/video/111108098/L42.html>
2. <https://www.digimat.in/nptel/courses/video/109104124/L14.html>
3. <https://archive.nptel.ac.in/courses/111/107/111107108/>
4. <https://www.digimat.in/nptel/courses/video/111105121/L33.html>

**II B. Tech. - II Semester**  
**(22E05302T) OPERATING SYSTEMS**  
(Common to CSE & CSE[DS])

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** -

**COURSE OBJECTIVES:** *This course will enable students:*

1. Understand basic concepts and functions of operating systems.
2. Evaluate the performance of scheduling algorithms which is bestsuited in a multi-programming environment.
3. Develop an algorithm to check the resources are effectively used inan operating system's component in a shared environment
4. Analyze an operating system's components to manage the user data

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Apply the knowledge of operating system fundamental concepts..
- CO2: Develop shell script for simple logical problems.
- CO3: Simulate CPU Scheduling algorithms.
- CO4: Develop solutions for inter process communication.
- CO5: Implement different page replacement algorithms.

**DETAILED SYLLABUS:**

**UNIT-I: Functionality of OS (10 Periods)**

OS Design issues - Structuring methods (monolithic, layered, modular, micro- kernel models) Overview of computer operating systems, protection and security, distributed systems, special purpose systems, operating systems structures: operating system services and systems calls, operating system structure, operating systems generation.

**UNIT-II: SCHEDULING (09 Periods)**

Process concepts, Cooperating processes, Inter process communication: Classical IPC Problems - Dining philosophers problem, Readers and writers problem. Threads: Overview, Multithreading Models, PThreads. CPU Scheduling: Basic concepts, Scheduling criteria, Algorithms, and their evaluation.

**UNIT-III: PROCESS SYNCHRONIZATION & DEADLOCK (10 Periods)**

**Process synchronization**, The critical-section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples, atomic transactions. Dining philosophers problem, Readers and writers problem.

**Deadlocks:** System model, deadlock characterization, Methods for handling deadlock, deadlock prevention, detection and avoidance, recovery form dead lock.

**UNIT-IV: MEMORY MANAGEMENT STRATEGIES:**

**(09 Periods)**

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory: demand paging, page replacement, algorithms, allocation of frames, Thrashing.

**UNIT-V: FILE SYSTEM INTERFACE**

**(10 Periods)**

File concepts, Access Methods, Directory structure, File system mounting, File System implementation: File system structure, file system implementation, directory implementation, allocation methods, Mass- storage structure: Disk structure, disk scheduling, disk management, swap-space management and disk attachment.

**Total Periods: 48**

**TEXT BOOKS:**

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne- Operating System Concepts, Wiley (2012).
2. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.

**REFERENCE BOOKS:**

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition 2009. Pearson education.
2. Aamez Elmasri, A Carrick, David Levine, Operating Systems, A Spiral Approach – McGrawHill Science Engineering Math ( (2009).
3. Dhamdhare D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.

**WEB RESOURCES:**

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. [https://www.tutorialspoint.com/operating\\_system/index.htm](https://www.tutorialspoint.com/operating_system/index.htm)
3. <https://www.scaler.com/topics/operating-system/>

**I B. Tech. – II Semester  
(22E33401T) MACHINE LEARNING**

(Only CSE[DS])

<b>Int. Marks</b>	<b>Ext. Marks</b>	<b>Total Marks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>30</b>	<b>70</b>	<b>100</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>

**PRE-REQUISITES:** - Students should know about experimental principle in chemistry.

**COURSE OBJECTIVES:** The course is introduced for students to

1. Understand basic concepts of Machine Learning
2. Study different learning algorithms
3. Illustrate evaluation of learning algorithms

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

- CO1: Identify machine learning techniques suitable for a given problem
- CO2: Solve the problems using various machine learning techniques.
- CO3: Design application using machine learning technique.
- CO4: Solve the problems using Regression model.
- CO5: Solve the problems using clustering.

**DETAILED SYLLABUS:**

**UNIT-V: Introduction to Machine Learning & Preparing to Model (10 Periods)**

Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.

**UNIT-II: Modeling and Evaluation & Basics of Feature Engineering (09 Periods)**

Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.

**UNIT-III: Bayesian Concept Learning & Supervised Learning: (10 Periods)**

Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour (KNN), Decision tree, Random forest model, Support vector machines.

  
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**UNIT-IV: Regression:**

**(09 Periods)**

Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

**UNIT-V: Unsupervised Learning:**

**(10 Periods)**

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rule.

**Total Periods: 48**

**TEXT BOOKS:**

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

**REFERENCE BOOKS:**

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

**WEB RESOURCES:**

1. Andrew Ng, "Machine Learning Yearning"
2. <https://www.deeplearning.ai/machine-learning-yearning/>
3. Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press .
4. <https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>

**II B. Tech. – II Semester**

**(22E00407T) MANAGEMENT SCIENCE**

(Common to CSE/CSE(AI)/CSE(DS)/CSE(AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**COURSE OBJECTIVES:**

The objectives of the course are

1. To equip the student the fundamental knowledge of management and its theories
2. To Provide basic knowledge about Operations Management
3. To make students understand the Role of Human Resource Department in an Organization
4. To make students understand the significance of Marketing Practices in an Organization.
5. To provide some basic knowledge about Strategic Management and Project management.

**COURSE OUTCOMES:** Upon Successful Completion of the course , the student will be able to:

- CO1: Gain knowledge about fundamentals of Management, principles and types of organizations.
- CO2: Understand the practices of Operations Management.
- CO3: Know HRM processes and practices in an organization.
- CO4: Gain knowledge about Marketing practices in an organization.
- CO5: Apply various strategies based on environmental Scanning and determine the probability of completing project by using PERT&CPM Techniques.

**DETAILED SYLLABUS:**

**UNIT-I: Introduction to Management**

**(09 Periods)**

Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management - Foyal's theory, Maslow's theory, Systems approach and Contingency Theory -Principles and Types of Organization.

**UNIT-II: Operations Management:**

**(10 Periods)**

Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis (Simple Problems), Business Process Re- Engineering, Total Quality Management(TQM)-Six Sigma

**UNIT-III: Human Resource Management (HRM)**

**(10 Periods)**

Significant and Basic functions of HRM, Human Resource Planning (HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances. Contemporary.

**UNIT-IV: Marketing Management**

**(09 Periods)**

Definitions- Functions of Marketing, Marketing Mix, Channels of distribution- Advertisement and sales promotion- Product Life Cycle and Marketing strategies. Recent trends in marketing- Digital marketing, E-Commerce.

**UNIT-V: Strategic Management**

**(10 Periods)**

Vision, Mission, Goals and Strategy- Corporate Planning Process-Environmental Scanning- SWOT analysis-Different Steps in Strategy Formulation, Implementation and Evaluation. Project Management: Network Analysis-PERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

**Total Periods: 48**

**TEXT BOOKS:**

1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill „Introduction to Management Science“ Cengage, Delhi, 2012.

**REFERENCE BOOKS**

1. A.K.Gupta “Engineering Management”,S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
4. Koontz &Weihrich: Essentials of Management, 6/e, TMH, 2005.
5. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
6. Memoria &S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
7. Parnell: Strategic Management, Biztantra, 2003.
8. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

**WEB RESOURCES:**

1. <https://archive.nptel.ac.in/courses/110/105/110105069/>
2. <https://archive.nptel.ac.in/courses/122/105/122105020/>
3. [https://onlinecourses.nptel.ac.in/noc22\\_mg05/preview](https://onlinecourses.nptel.ac.in/noc22_mg05/preview)
4. [https://onlinecourses.swayam2.ac.in/ugc19\\_hs26/preview](https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview)

  
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## II B.TECH. - II Semester

### (22E04406L) COMPUTER ORGANIZATION LAB

(Common to CSE-AI and CSE-DS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

#### COURSE OBJECTIVES:

1. Understanding the behavior of logic gates, adders, decoders, multiplexers and flip flops.
2. Understanding the behavior of ALU, RAM, STACK and PROCESSOR from working modules and the modules designed by the student as part of the experiment.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Gain knowledge about logic gates, adders
- CO2: Understand the Operations of decoders, multiplexers.
- CO3: Design and Implement a 4 bit shift register using Flip flops.
- CO4: Implement of convert a Hexadecimal, octal, and binary number to decimal number vice versa.
- CO5: Understand the behavior of ALU, RAM, STACK and PROCESSOR from working Modules.

#### DETAILED SYLLABUS:

##### Exercises in Digital Logic Design:

- Implement Logic gates using NAND and NOR gates
- Design a Full adder using gates
- Design and implement the 4:1 MUX, 8:1 MUX using gates /ICs.
- Design and Implement a 3 to 8 decoder using gates
- Design a 4 bit comparator using gates/IC
- Design and Implement a 4 bit shift register using Flip flops
- Design and Implement a Decade counter

##### Exercises in Computer Organization:

- Implement a C program to convert a Hexadecimal, octal, and binary number to decimal number vice versa.
- Implement a C program to perform Binary Addition & Subtraction.
- Implement a C program to perform Multiplication of two binary numbers
- Implement a C program to perform Multiplication of two binary numbers (signed) using Booth's Algorithms.
- Implement a C program to perform division of two binary numbers (Unsigned) using restoring division algorithm.
- Implement a C program to perform division of two binary numbers (Unsigned) using non-restoring division algorithm.

**TEXT BOOKS:**

1. M. Morris Mano, "Computer System Architecture", 3<sup>rd</sup> Edition, Pearson Education.

**REFERENCE BOOKS:**

1. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning.
2. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw Hill Education.

**WEB RESOURCES:**

1. <https://www.javatpoint.com/computer-organization-and-architecture->
2. <https://nptel.ac.in/courses/106/103/106103068/>
3. <https://teachics.org/computer-organization-and-architecture-tutorial/>

## II B. Tech. – II Semester

### (22E05302L) OPERATING SYSTEMS LAB (Common to CSE, & CSE[DS])

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

**PRE-REQUISITES:** - Good understanding of English Language.

**COURSE OBJECTIVES:** Verify the fundamental concepts with experiments.

1. Execute the basic command in UNIX operating system and shell program.
2. Design the principles of CPU scheduling concepts.
3. Design and symbolize the principles of synchronization and contiguous memory allocation technique.
4. Simulate the principle of page replacement algorithm
5. Simulate the concepts of disk scheduling algorithm

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Understand and use commands in Linux shell environment.
- CO2: Develop shell script for simple logical problems.
- CO3: Simulate CPU Scheduling algorithms.
- CO4: Develop solutions for inter process communication.
- CO5: Implement different page replacement algorithms.

#### DETAILED SYLLABUS:

##### List of Experiments:

1. Explain the following system calls in UNIX operating system (fork, exec, mkdir, cat, open, date, history, clear, pwd, ls, cd)
2. Write a shell script program
  - a. To perform arithmetic operations.
  - b. To find the given number is odd or even
3. Implement the various process scheduling mechanisms such as FCFS, SJF, Priority, round – robin.
4. Implement the solution for reader – writer’s problem.
5. Implement the solution for Producer – Consumer’s problem.
6. Implement the solution for dining philosopher’s problem.
7. Implement banker’s algorithm.
8. Implement the first fit; best fit and worst fit file allocation strategy.
9. Write a C program to simulate page replacement algorithms
  - a) FIFO b) LRU c) LFU.
10. Write a C program to simulate disk scheduling algorithm a)FIFO b)SCAN (c) CSCAN

**REFERENCE BOOKS:**

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition 2009. Pearson education.
2. Ramez Elmasri, A Carrick, David Levine, Operating Systems, A Spiral Approach – McGrawHill Science Engineering Math (2009).
3. Dhamdhare D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.

**WEB RESOURCES:**

1. <https://www.geeksforgeeks.org/operating-systems/>
2. <http://srmcem.ac.in/pdf/Opearting%20System%20Lab%20.pdf>

**II B. Tech. – II Semester**  
**(22E33401L) MACHINE LEARNING LAB**  
(Only CSE[DS])

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

**PRE-REQUISITES:** Nil.

**COURSE OBJECTIVES:** *this course will enable students:*

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

**COURSE OUTCOMES:** *After successful completion of the course, students will be able to:*

- CO1: Understand the Mathematical and statistical prospective of machine learning algorithms through python programming
- CO2: Appreciate the importance of visualization in the data analytics solution.
- CO3: Derive insights using Machine learning algorithms.
- CO4: Develop the programs to create .csv files
- CO5: Implement k-means algorithms.

**DETAILED SYLLABUS:**

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two

algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**Projects:**

1. Predicting the Sale price of a house using Linear regression.
2. Spam classification using Naïve Bayes algorithm.
3. Predict car sale prices using Artificial Neural Networks.
4. Predict Stock market trends using LSTM.
5. Detecting faces from images

**REFERENCE BOOKS:**

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020. Online

**Learning Resources/Virtual Labs:**

1. Machine Learning A-Z (Python & R in Data Science Course) | Udem.
2. Machine Learning | Courser

**WEB RESOURCES:**

1. [https://deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/ml\\_lab\\_exp\\_1.pdf](https://deepakdvallur.weebly.com/uploads/8/9/7/5/89758787/ml_lab_exp_1.pdf)
2. <https://machinelearningmastery.com/implement-backpropagation-algorithm-scratch-python/>
3. <https://www.vtupulse.com/machine-learning/backpropagation-algorithm-in-python/>
4. <https://github.com/AbhishekMali21/VTU-CSE-LAB-SOLUTIONS/blob/master/7th%20SEM/MACHINE%20LEARNING%20LABORATORY/5-Naive%20Bayesian%20Classifier/LAB%205.ipynb>
5. <https://www.javatpoint.com/k-nearest-neighbor-algorithm-for-machine-learning>
6. <https://www.springboard.com/blog/data-science/bayes-spam-filter/>

  
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**II B. Tech. – II Semester**

**(22E05403SC) R PROGRAMMING**  
(Common to CSE, CSE-AI, CSE-DS, CSE-AI&ML)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	1	-	2	2

**PRE-REQUISITES:** Nil.

**COURSE OBJECTIVES:** *this course will enable students:*

1. To understand Fundamentals of R programming, standard R libraries,
2. To get solid understanding of R functions
3. Writing programs using the R programming Language,
4. To get acquaintances with Arrays, Files,
5. To gain skills in Strings, Packages, and distributions using R.

**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Implement basic concepts of R programming, and its different modules
- CO2: Implement the concepts of R Script to extract the data from data frames and file operations.
- CO3: Implement the various statistical techniques using R.
- CO4: Extend the functionality of R by using add-on package.
- CO5: Use R Graphics and Tables to visualize results of various statistical operations on data.

**DETAILED SYLLABUS:**

**Experiments:**

**Week 1:**

- Installing R and RStudio Basic functionality of R, variable, data types in R

**Week 2:**

- a) Implement R script to show the usage of various operators available in R language.
- b) Implement R script to read person's age from keyboard and display whether he is eligible for voting or not.
- c) Implement R script to find biggest number between two numbers.
- d) Implement R script to check the given year is leap year or not.

**Week 3:**

- a) Implement R Script to create a list.
- b) Implement R Script to access elements in the list.
- c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation

**Week 4:**

Implement R script to perform following operations:

- a) various operations on vectors Finding the sum and average of given numbers using arrays.
- b) To display elements of list in reverse order.
- c) Finding the minimum and maximum elements in the array.

**Week 5:**

- a) Implement R Script to perform various operations on matrices
- b) Implement R Script to extract the data from data frames.
- c) Write R script to display file contents.
- d) Write R script to copy file contents from one file to another

**Week 6:**

- a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.
- b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset

**Week 7:**

- a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disk location.
- b) Reading Excel data sheet in R.
- c) Reading XML dataset in R

**Week 8:**

- a) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram (Introduction to ggplot2 graphics)
- b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.

**Week 9:**

- a) Implement R Script to perform Normal, Binomial distributions.
- b) Implement R Script to perform correlation, Linear and multiple regression.

**Week 10:**

- Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

**Week 11:**

- Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates, outliers, spelling

**Week 12:**

- **Data sources:** SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Google Spreadsheets, API and web scraping examples.

**Text Books**

1. R Fundamentals and Programming Techniques, Thomas Lumely

**REFERENCE BOOKS:**

1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications.
2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications.
3. R Programming For Dummies by Joris Meys, Andrie de Vries, Wiley Publications
4. Hands-On Programming with R by Golemund, O Reilly Publications.

**WEB RESOURCES:**

1. <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>(Online Resources)
2. <http://nptel.ac.in/courses/106104135/48>
3. <http://nptel.ac.in/courses/110106064/>

**SOFTWARE REQUIREMENTS:**

1. The R statistical software program. Available from: <https://www.r-project.org/>
2. RStudio an Integrated Development Environment IDE) for R. Available from: <https://www.rstudio.com/>

  
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**II B. Tech. – II Semester**

**(22E00406T) UNIVERSAL HUMAN VALUES**  
(Common to All Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

**PRE-REQUISITES:** Nil.

**COURSE OBJECTIVES:**

The objectives of the course include the following:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being.
3. Understanding of the harmony At the level of family and society and nature/existence.
4. Developing clarity about the Harmony in nature and existence.
5. To make engineering graduates understand the significance of Humanistic Education, Humanistic Constitution and Humanistic Universal Order

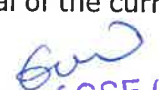
**COURSE OUTCOMES:** Upon Successful Completion of the course, the student will be able to:

- CO1: Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- CO3: They would have better critical ability.
- CO4: They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- CO5: Students could be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction..

**DETAILED SYLLABUS:**

**UNIT-I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education. (09 Periods)**

- Value – Universal Human Values and its features
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.

  
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**UNIT-II Understanding Harmony in the Human Being - Harmony in Myself!**  
**(09 Periods)**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.

**UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

**UNIT-IV Understanding Harmony in the Nature and Existence - Whole existence as Coexistence.**  
**(09 Periods)**

- The four orders of nature recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space Holistic perception of harmony at all levels of existence.

**UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics.**  
**(09 Periods)**

- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

**Total Periods: 45**

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### TEXT BOOKS

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
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