

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

Year: I

Semester: II

Branch of Study: EEE

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AES0101	Basics of Civil & Mechanical Engineering	3	0	0	3

**Course Outcomes:**

CO 1: understand principles of Stress and Strain

CO 2: understand basic principles of Strain Measurement and apply the concepts of Strain Rosettes for strain measurement.

CO 3: understand common building materials used in construction and analyze characteristics of common building materials.

CO 4: Apply velocity ratio concepts in power transmission.

CO 5: Understand the principles of CAD, CAM &amp; CIM. (L.2)

**PART – A****UNIT – I:**

Basic Definitions of Force – Stress – Strain – Elasticity. Shear force – Bending Moment – Torsion. Simple problems on Shear force Diagram and Bending moment Diagram for cantilever and simply supported beams.

**UNIT – II:**

Measurement of Strain - Electrical Capacitance and Resistance Strain gauges – multi channel strain indicators. Rosette analysis – Rectangular and Triangular strain rosettes – Wheatstone bridge.

**UNIT – III:**

Characteristics of common building materials – Brick – Types – Testing; Timber – Classification – Seasoning – Defects in Timber; Glass – Classification – uses; steel and its applications in Construction Industry.

**PART – B****UNIT – I: Power Plants**

Classification of Power plants – Steam Power Plants – Nuclear Power Plants – Gas turbines – Hydro Power Plants – Solar energy – wind energy – Tidal Power – Geo Thermal Power.

**UNIT – II: Transmission of Power**

Transmission of Power – Belt and Rope Drives – Types of Belts – Materials – Velocity ratio – Speed Ratio – Rope Drives – V-Belt – Flat Belt.

**UNIT – III: Computer Aided Design & Manufacturing**

Introduction to engineering applications of computer aided design – Computer Aided Drawing – Advantages of CAD – Computer Aided Manufacturing – Functions of Robots in manufacturing Applications – advantages of Robots – Computer integrated Manufacturing (CIM).

**Text Books:**

1. Shanmugam G and Palanichamy M S, -Basic Civil and Mechanical Engineeringl, TataMcGraw Hill Publishing Co., New Delhi.
2. Ramamrutham S., -Basic Civil Engineeringl, Dhanpat Rai Publishing Co. (P) Ltd.

**References:**

1. S.Trymbaka Murthy., -Computer Aided Engineering Drawing| , Universities Press
2. Seetharaman S., -Basic Civil Engineering|, Anuradha Agencies.
3. Venugopal K. and Prahua Raja V., -Basic Mechanical Engineering|, Anuradha Publishers, Kumbakonam.
4. Er. R. Vaishnavi,Basic Civil and Mechanical Engineering, 2/e, S. Chand Publications.

List of COs	PO no. and keyword	CompetencyIndicator	Performance Indicator
CO1	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO2	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2
		2.3	2.3.1
CO3	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO 4	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
CO 5	PO1: Engineering knowledge	1.2	1.2.1
	PO2: Problem analysis	1.3	1.3.1
		1.4	1.4.1

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19ABS9906	Differential Equations and Vector Calculus	3	1	0	4

**Course Outcomes:**

1. Apply the mathematical concepts of ordinary differential equations of higher order.
2. Solve the differential equations related to various engineering fields .
3. Identify solution methods for partial differential equations that model physical processes .
4. Interpret the physical meaning of different operators such as gradient, curl and divergence .
5. Estimate the work done against a field, circulation and flux using vector calculus .

**UNIT I: Linear Differential Equations of Higher Order**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral ( $e^{ax}$ ,  $\sin ax$  (or)  $\cos ax$ ,  $X^k$ ,  $e^{ax}v$ ,  $x v(x)$ ), method of variation of parameters, simultaneous linear equations with constant coefficients.

**UNIT II: Equations Reducible to Linear Differential Equations and Applications**

Cauchy's and Legendre's linear equations, Applications to simple pendulum, oscillations of a spring, L-C-R Circuit problems and Mass spring system.

**UNIT III: Partial Differential Equations – First order**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations.

**UNIT IV: Vector differentiation**

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities

**UNIT V: Vector integration**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

**Text Books :**

1. B. S. Grewal, Higher Engineering Mathematics, 44<sup>th</sup> Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons, 2011.

**References:**

1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, AlphaScience International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publication,2008
4. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1:Apply the knowledge of mathematics	1.1	1.1.1
CO2	PO2:Analyse complex engineering problems	2.1	2.1.3
CO3	PO1:Apply the knowledge of mathematics	1.1	1.1.1
CO4	PO1:Apply the knowledge of mathematics	1.1	1.1.1
CO5	PO2:Analyse complex engineering problems	2.1	2.1.3

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19ABS9904	CHEMISTRY	3	0	0	3

**Course Outcomes:**

1. Understand the behaviour of, and interactions between matter and energy at both the atomic and molecular levels
2. Compare the materials of construction for battery and electrochemical sensors
3. Understand the preparation, properties, and applications of thermoplastics & thermo settings, elastomers & conducting polymers.
4. HPLC and GC methods used for separation of gaseous and liquid mixtures.
5. Understand the disadvantages of using hard water and select suitable treatments domestically and industrially.

**Unit 1: Structure and Bonding Models****(10 hrs)**

Planck's quantum theory, Schrodinger wave equation, significance of  $\Psi^1$  and  $\Psi^2$ , applications to hydrogen, particle in a box and their applications for conjugated molecules, crystal field theory – salient features – energy level diagrams for transition metal ions – splitting of orbital's in tetrahedral and octahedral complexes, magnetic properties, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of  $O_2$ ,  $N_2$  and  $CO$ , calculation of bond order.

**Unit 2: Electrochemistry and Applications****(10 hrs)**

Electrodes – concepts, reference electrodes (Calomel electrode,  $Ag/AgCl$  electrode and glass electrode) electrochemical cell, Nernst equation, cell potential calculations, numerical problems, concept of pH, pH meter and applications of pH metry (acid-base titrations), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, alkali metal sulphide batteries, Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells. Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions, button cells,

**Unit 3: Polymer Chemistry****(10 hrs)**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

**Unit 4: Instrumental Methods and Applications****(10 hrs)**

Principle and applications of Colorimetry, AAS, AES, UV-Visible spectrophotometry (Beer-Lambert's law, Instrumentation), Principles and applications of Chromatographic techniques (GC & HPLC), separation of gaseous mixtures and liquid mixtures (GC & HPLC methods).

**Unit 5: Water Technology****(10 hrs)**

Introduction – Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

**Text books:**

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

**Reference books:**

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. Willard Merritt Dean Settle, 7th Edition Instrumental methods for analysis

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 2	PO 1: Apply the knowledge of basic science	1.4	1.4.1
CO: 3	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 4	PO 4: Analyse complex engineering problems	2.4	2.4.4
CO: 5	PO 1: Apply the knowledge of Basic science	1.2	1.2.1

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Year: I	Semester : II	Branch of Study : EEE			
COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AES0502	Data Structures	3	0	0	3

**Course Objectives:**

1. To teach the representation of solution to the problem using algorithm
2. To explain the approach to algorithm analysis
3. To introduce different data structures for solving the problems
4. To demonstrate modeling of the given problem as a graph
5. To elucidate the existing hashing techniques

**Unit 1: Introduction**

Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort

**Unit – 2: Stack, Queue and Linked lists**

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

**Unit 3: Trees**

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B- Trees: B-Trees, B + Trees.

**Unit – 4 : Graphs and Hashing**

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure, Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

**Unit – 5: Files and Advanced sorting**

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization. Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

**Text Books:**

1. Ellis Horowitz and Sartaj Sahni, —Fundamentals of Data Structures in C++, 2<sup>nd</sup> Edition, Galgotia Book Source, Pvt. Ltd., 2004.
2. Alan L. Tharp, -File Organization and Processing, Wiley and Sons, 1988.

**Reference Books:**

1. D. Samanta, -Classic Data Structures, 2<sup>nd</sup> Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Peter Bras, —Advanced Data Structures, Cambridge University Press, 2016
3. Richard F. Gilberg, Behrouz A. Forouzan, -Data Structures A Pseudo code Approach with C++, Second Edition, Cengage Learning 2005.

**Course Outcomes:**

1. Select Appropriate Data Structure for solving a real world problem
2. Select appropriate file organization technique depending on the processing to be done
3. Construct Indexes for Databases
4. Analyse the Algorithms
5. Develop Algorithm for Sorting large files of data

<b>List of COs</b>	<b>PO no. and keyword</b>	<b>Competency</b>	<b>Performance Indicator</b>
CO1	PO1: Engineering Knowledge	1.4	1.4.1
CO2	PO4: Conduct investigations of complex problems	4.1	4.1.4
CO3	PO1: Engineering Knowledge	1.3	1.3.1
CO4	PO2: Problem analysis	2.1	2.1.2
CO5	PO2: Problem analysis	2.3	2.3.1



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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19ALC0301	Engineering Workshop	0	0	2	1

**Course Outcomes:**

- CO: 1 Apply wood working skills in real world applications.  
 CO: 2 Build different parts with metal sheets in real world applications.  
 CO: 3 Apply fitting operations in various applications.  
 CO: 4 Apply different types of basic electric circuit connections.  
 CO: 5 Demonstrate soldering and brazing.

**Wood Working:**

Familiarity with different types of woods and tools used in wood working and make following joints

- Half – Lap joint
- Mortise and Tenon joint
- Corner Dovetail joint or Bridle joint

**Sheet Metal Working:**

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- Tapered tray
- Conical funnel
- Elbow pipe
- Brazing

**Fitting:**

Familiarity with different types of tools used in fitting and do the following fitting exercises

- V-fit
- Dovetail fit
- Semi-circular fit
- Bicycle tyre puncture and change of two wheeler tyre

**Electrical Wiring:**

Familiarities with different types of basic electrical circuits and make the following connections

- Parallel and series
- Two-way switch
- Godown lighting
- Tube light
- Three phase motor
- Soldering of wires

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 2: Problem analysis	2.3	2.3.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AES0301	Engineering Graphics Lab	1	0	4	3

**Course Outcomes:**

- CO: 1 Draw various curves applied in engineering.  
 CO: 2 Show projections of solids and sections graphically.  
 CO: 3 Draw the development of surfaces of solids.  
 CO: 4 Use computers as a drafting tool.  
 CO: 5 Draw isometric and orthographic drawings using CAD packages.

### Manual Drawing

**UNIT I**

**Introduction to Engineering graphics:** Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.

- a) Conic sections including the rectangular hyperbola- general method only,
- b) Cycloid, epicycloids and hypocycloid
- c) Involutives

**Projection of points, lines:** Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line.

**UNIT II**

**Projections of Planes:** Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

**Projections of Solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

**UNIT III**

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

### Computer Aided Drafting:

**UNIT IV**

**Introduction to AutoCAD:** Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

**UNIT V**

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections.

**Isometric Projections:** Principles of isometric projection- Isometric scale; Isometric views: lines, planes, figures, simple and compound solids.

**Text Books and Reference Books:**

1. K. L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill
4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education
5. Basant Agrawal & C. M. Agrawal, Engineering Drawing, Tata McGraw-Hill

**Additional Sources**

YouTube: <http://sewor.carleton.ca/kardos/88403/drawings.html> conic sections-online, red woods.edu

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 5: Problem analysis	5.1	5.1.1

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AES0102	Basics of Civil & Mechanical Engineering Lab	0	0	3	1.5

**Course Outcomes:** Students will be able to

CO1: Impart basic principles of bending test on Cantilever beam and simply supported beam

CO2: Understand principles of strain measurement using electrical strain gauges

CO3: Impart concepts of Torsion, compression and water absorption

CO4: Apply velocity ratio concepts in power transmission

CO5: Understand the principles of CAD, CAM &amp; CIM

**PART - A**

**Laboratory Experiments:**

1. Bending test on (Steel/Wood) Cantilever beam.
2. Bending test on (Steel/Wood) simply supported beam.
3. Use of electrical resistance strain gauges.
4. Compression test on Bricks
5. Water absorption test on Bricks
6. Torsion test.
7. Tests on closed coiled and open coiled helical springs

**PART – B**

**The following contents are to be done by any 2D software package**

1. Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling,
2. Mirroring, layers, templates, polyline, trimming, extending, stretching, fillets, arrays, dimensions
3. Dimensioning principles and conventional representations.
4. Any three simple 2D diagram by using software package.

CO No.	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO2	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO3	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
		1.4	1.4.1
CO 4	PO1: Engineering knowledge	1.2	1.2.1
		1.3	1.3.1
CO 5	PO1: Engineering knowledge	1.2	1.2.1
	PO2: Problem analysis	1.3	1.3.1
		1.4	1.4.1

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19ABS9909	CHEMISTRY LAB	0	0	3	1.5

**Course Outcomes:**

1. To familiarize the students with the basic concepts of chemistry of materials
2. Prepare advanced polymer materials
3. Measure the strength of an acid present in secondary batteries
4. To familiarize with digital and instrumental methods of analysis

**List of Experiments:**

1. Determination of Hardness of a groundwater sample.
2. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method)
3. Determination of pH metric titration of strong acid vs. strong base,
4. Conductometric titration of strong acid vs. strong base
5. Determination of Fe(II) in Mohr's salt by potentiometric method.
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of phenol-formaldehyde resin
9. Preparation of TiO<sub>2</sub>/ZnO nano particles
10. Estimation of Calcium in port land Cement
11. Adsorption of acetic acid by charcoal
12. Thin layer chromatography

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO:1	PO 4: Analysis and interpretation of Data	4.3	4.3.3
CO:2	PO 4: Analysis and interpretation of Data	4.3	4.3.1
CO:3	PO 4: Analysis and interpretation of Data	4.3	4.3.1
CO:4	PO 4: Analysis and interpretation of Data	4.3	4.3.2

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AES0504	Data Structures Lab	0	0	3	1.5

**Course Objectives:**

1. To introduce to the different data structures
2. To elucidate how the data structure selection influences the algorithm complexity
3. To explain the different operations that can be performed on different data structures
4. To introduce to the different search and sorting algorithms.

**Laboratory Experiments**

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using '\_Ladies first' principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table datatype and support different operations on it.

**Course Outcomes:**

1. Select the data structure appropriate for solving the problem
2. Implement searching and sorting algorithms
3. Design new data types
4. Illustrate the working of stack and queue
5. Organize the data in the form of files

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering Knowledge	1.4	1.4.1
CO2	PO 2: Problem analysis	2.2	2.2.4
CO3	PO 1: Engineering Knowledge	1.3	1.3.1
CO4	PO 1: Engineering Knowledge	1.4	1.4.1
CO5	PO 1: Engineering Knowledge	1.4	1.4.1