22ECC01 - BASICS OF ELECTRONICS ENGINEERING
(Common to AI&DS , CSE, CSE(CS), CSE(IOT) & IT Branches)

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To make students to learn and understand the basics of Electrical circuits.	**1.1**	The Students can apply the Ohm's law and Kirchhoff's law and investigates the behavior of electric circuits by analytical techniques.
2.0	To enable the student to understand the analysis of DC and AC circuits using Network theorems.	**2.1**	The Students will be able to analyze and forecast the Network theorems in DC and AC circuits.
3.0	To enable the student to understand the working of semiconductor devices.	**3.1**	The Students will be able to understand the characteristics of semiconductor devices.
4.0	To make the students to understand the working of rectifiers, filters and amplifiers.	**4.1**	The students will be able to understand the concept of rectifiers, filters and amplifiers.
5.0	To make the students to understand the functions of transducer and measuring instruments.	**5.1**	The students will be able to design transducers, measuring instruments and logic circuits.

UNIT I - UNIT I - BASIC CIRCUITS ANALYSIS	**(9)**
Current, Voltage, Power – Nodes, Paths, Loops and Branches – Ohm's Law – Kirchhoff's laws – Single loop circuit – Series and parallel connected independent sources – Resistors in series and Parallel – Current and voltage division.	
UNIT II - NETWORK THEOREMS FOR DC CIRCUITS	**(9)**
Source transformation – Mesh Analysis-Node Analysis – Thevenins and Norton Theorem – Superposition Theorem – Maximum power transfer theorem.	
UNIT III - SEMICONDUCTOR DEVICES	**(9)**
PN junction diode, Characteristics – Diffusion and Drift Current – Zener diode, Characteristics – BJT: PNP and NPN, CE Configuration of BJT – JFET – MOSFET – UJT.	
UNIT IV - RECTIFIERS, FILTERS AND AMPLIFIERS	**(9)**
Transformers: Construction & Types – Rectifiers: Half Wave, Full Wave and Bridge – Filters: Induction, Capacitor, LC – Operational Amplifiers – Applications of Amplifier.	

UNIT V -TRANSDUCERS, MEASURING INSTRUMENTS AND DIGITAL CIRCUITS	(9)
LED – Piezo electric Transducers – LCD – Moving Coil and Moving Iron Instrument – CRO – Logic Gates: AND, OR, NOT and Universal Gates: NAND, NOR – Flip Flop: SR, JK.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis," 8 th ed., Tata McGraw Hill publishers, New Delhi, 2013.
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGrawHill 4th ed. 2017.

REFERENCES:

1. Raghavan V, "Materials and Engineering", Prentice-Hall of India, New Delhi, 2013.
2. Dattuprasad and Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2016.
3. B. Rogers, J.Adams and S.Pennathur, "Nanotechnology: Understanding Small System" CRC Press, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	-	-	-	-	-	-	-	-	3	2
2	2	2	3	3	-	-	-	-	-	-	-	-	3	2
3	3	-	2	-	3	-	-	-	-	-	-	-	3	3
4	2	-	2	-	2	3	2	-	-	-	-	-	3	3
5	2	-	2	-	-	2	3	-	-	-	-	-	3	3
CO(W.A)	**2.4**	**2**	**2.2**	**3**	**2.5**	**2.5**	**2.5**	**-**	**-**	**-**	**-**	**-**	**3**	**2.6**

22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to All Branches)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand problem solving, problem solving aspects, programming and to know about various program design tools.	**1.1**	The student will be able to identify the appropriate problem solving techniques to drive the solution for the given problem.		
2.0	To learn basic structure and Control Statements in C programming.	**2.1**	The student will be able to implement the appropriate looping and control statements in C for developing applications.		
3.0	To learn the manipulation of arrays and strings	**3.1**	The student will be able to develop programs on arrays of different dimensions of arrays and strings concepts.		
4.0	To understand the concept of modular programming using user defined functions.	**4.1**	The student will be able to implement programs using user defined functions.		
5.0	To acquaint with the use and benefits of Memory Allocation and file handling.	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
	TOTAL (L:45) :45 PERIODS

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition., Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO(W.A)	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**

22ECP01- BASICS OF ELECTRONICS ENGINEERING LABORATORY *(Common to AI&DS, CSE, CSE(CS), CSE(IOT) and IT Branches)*					
			L	**T**	**P**	**C**
			0	**0**	**4**	**2**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To make students to examine the basics of Semiconductor Diodes and its characteristics.	**1.1**	The Students will be able to examine Semiconductor Diodes and its characteristics.		
2.0	To enable the student to analyze the characteristics of BJT, FET and UJT.	**2.1**	The Students will be able to analyze characteristics of BJT, FET and UJT working principles and operations.		
3.0	To make the students to analyze the operation of Rectifier circuit.	**3.1**	The students will be able to analyze the operation of rectifier circuit and its applications		
4.0	To motivate the students to learn and practice with measurement of Electrical circuits using various theorems.	**4.1**	The Students will apply the Ohm's law ,Kirchhoff's law and various theorems (Thevenin's, Norton's etc) and investigates the behavior of electric circuits by analytical techniques.		
5.0	To motivate the students to design a digital circuits using various basic logic gates.	**5.1**	The Students will be able to Design simple digital circuits by exploring logic gates.		

List of Experiments

(Cycle- I)
1.Plot the V-I Characteristics of PN junction diode and also find the forward and reverse resistance
2.Plot the V-I Characteristics of Zener diode and also find the forward and reverse resistance
3.Plot the Input-Output characteristics of Common Emitter Configuration(CE) using BJT
4.Find the Characteristics of FET and also plot the drain and transfer characteristics
5. Plot the V-I Characteristics of UJT
6.Construct the Half wave Rectifier & Full wave Rectifier and plot the graph
(Cycle- II)
1.Verification Kirchoff's Voltage Law (KVL) ,Kirchoff's Current Law(KCL)
2.Verfication of Thevenin's Theorem
3. Verfication of Norton's Theorem
4.Verification logic gates

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2
2	3	2	2	1	-	-	-	-	-	-	-	1	3	1
3	3	-	2	2	-	-	-	-	-	-	-	1	3	1
4	3	-	2	-	-	1	-	-	-	-	-	-	3	2
5	3	-	2	-	-	1	-	-	-	-	-	2	3	1
CO (W.A)	**3**	**2**	**1.8**	**1.3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1.3**	**3**	**1.4**

22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to All Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language.	**1.1**	The student will be able to identify the appropriate programming construct to develop programs for all types of problems.		
2.0	To study, analyze and implement the concepts of arrays and strings in C programming.	**2.1**	The student will be able to implement programs on arrays of different dimensions and string concepts.		
3.0	To learn the importance user defined functions and pointers.	**3.1**	The student will be able to develop programs using user defined functions and pointers.		
4.0	To gain knowledge in user defined data types and file handling functions in C programming	**4.1**	The student will be able to design programs using user defined data types and various file handling functions.		
5.0	To acquire skill in dynamic memory allocation	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

C-Programming:

1. Draw the flowchart for the following using Raptor tool.
    a) Simple interest calculation
    b) Greatest among three numbers
    c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO(W.A)	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**

22CIC01 –DATA STRUCTURES USING C

(Common to 22AIC01, 22CSC02, 22CCC01, and 22ITC01)

	L	T	P	C
	3	0	0	3

PREREQUISITE :

Course Objectives		Course Outcomes	
1.0	To learn the concept of pointers and strings	**1.1**	The student will be able to able to perform array and string operations using pointers
2.0	To be able to implement the abstract data type list as a linked list using the node and reference pattern.	**2.1**	The student will be able to able to manipulate different operations using linked list
3.0	To understand the Stack and Queue ADT	**3.1**	The student will be able to able to deploy different operations on stack and queue.
4.0	To gain knowledge on tree data structure.	**4.1**	The student will be able to determine the structure and operations on trees
5.0	To understand the various operations on graph	**5.1**	The student will be able to implement the various operations on graph

UNIT I - POINTERS USING ARRAYS AND STRINGS	**(9)**
Pointers : Introduction – Pointers and arrays– passing an array to a function– returning an array from function – NULL pointers –Array of pointers – Pointer-to-pointer – Dangling Pointer. Function pointers: calling a function using function pointer- Using pointer as a function argument	
UNIT II - LIST	**(9)**
Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT	
UNIT III - STACKS AND QUEUES	**(9)**
Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressionsInfix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues	
UNIT IV – TREE	**(9)**
Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.	

UNIT V - GRAPHS	(9)
Definitions – Representation of Graphs – Types of Graph – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Sumitabha Das, "Computer Fundamentals &C Programming", McGraw Hill Education(India) Private Limited, 1st Edition, 2018.
2. Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.

REFERENCES:

1. Yashavant Kanetkar, "Pointers in C", BPP Publications, 4th Edition, 2017.
2. PradipDey, Manas Ghosh, "Programming in C", Oxford Higher Education, 2nd Edition, 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2	1	-	-	2	-	2	3	3	3
2	3	3	2	2	2	2	-	-	1	-	2	3	3	3
3	2	3	2	2	2	2	-	-	2	-	2	3	3	3
4	3	3	2	2	2	1	-	-	1	-	2	3	3	3
5	3	3	2	2	2	1	-	-	2	-	2	3	3	3
CO (W.A)	2.8	3	2	2	2	1.4	-	-	1.6	-	2	3	3	3

*Ratified in Eleventh Academic Council

22CIC02 - PYTHON PROGRAMMING

(Common to 22AIC02, 22CSC03, 22CCC02, and 22ITC02)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To acquaint with data types, input output statements, decision making, looping in Python	**1.1**	The students will be able to develop understanding of basics of Python Programming constructs.
2.0	To acquire knowledge about manipulation of strings.	**2.1**	The students will be able to impart basic knowledge of all strings functions.
3.0	To be familiarized with programming concepts like list and tuples.	**3.1**	The students will be able to choose most appropriate programming constructs and features to solve the problems with list, tuples and dictionaries.
4.0	To understand the concepts of dictionaries, function and modules.	**4.1**	The students will be able to exhibit the programming skills for the use of the logical constructs of language using function and files.
5.0	To develop the skill of designing Graphical user Interfaces in Python	**5.1**	The students will be able to demonstrate significant experience with the Python program development environment.

UNIT I - INTRODUCTION TO PYTHON	**(9)**

Introduction to python: Features - Execution of python program – Flavors of Python – Comments - Data Types: Built-in data types– Sequences – Set - Literals– Operators – Input and Output Statements - Control Statements if – if-else –if-else-if – while-For –Nested loops – the else suite - Break – Continue - pass - assert – return.

UNIT II - STRINGS	**(9)**

Arrays: One Dimensional arrays - Multi Dimensional arrays - Strings and Characters: Creating - Length - Indexing - Slicing - Repeating - Concatenation - Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing - Splitting and Joining Strings - Changing Case - Checking Starting and Ending of a String – String Formatting - Working with Characters – Sorting - Searching Strings - Finding Number- Inserting sub string into a string.

UNIT III - LISTS , TUPLES AND DICTIONARIES	**(9)**

Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a tuples. Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.

UNIT IV - FUNCTIONS AND FILES	(9)
Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators. Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories.	
UNIT V - MODULES AND FRAMEWORKS	**(9)**
Modules: Importing module –Features – Built in functions. - Python Environment and Frameworks: NumPy: NumPy Arrays – Computation on NumPy Arrays – Aggregation – Sorting Arrays – Structured Arrays.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 2021 Edition.
2. Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1st Edition O'Reilly Publishers, 2016.

REFERENCES:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2018.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2013.

Mapping of COs with POs / PSOs

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	3	3	3	-	-	-	-	3	3	3
2	3	2	3	3	3	3	3	-	-	-	-	3	3	3
3	3	2	3	3	3	3	3	3	-	-	3	3	3	3
4	3	2	3	3	3	3	3	3	-	-	3	3	3	3
5	3	2	3	3	3	3	3	3	-	-	3	3	3	3
CO (W.A)	3	2	2.8	3	3	3	3	3	-	-	3	3	3	3

22CIP01 – DATA STRUCTURES LABORATORY

(Common to 22CSP02, 22AIP01, 22CCP01, and 22ITP01)

	L	T	P	C
	0	0	4	2

PREREQUISITE : 22CSP01

Course Objectives		Course Outcomes	
1.0	To learn the concept of pointers	**1.1**	The students will be able to perform array operations using pointers
2.0	To learn the implementation of all types linked list with its different operations.	**2.1**	The students will be able to explore various operations on linked list.
3.0	To impart the basic stack and queue concepts and its applications.	**3.1**	The students will be able to work with stack and queue concepts.
4.0	To Explore the concepts of tree data structures	**4.1**	The students will be able to construct and manipulate various tree operations.
5.0	To understand the various operations on graph	**5.1**	The students will be able to deploy different operations on graphs.

LIST OF EXPERIMENTS:

1. Pointer using 1D, 2D array
2. Implementation of singly linked list and its operations
3. Implementation of doubly linked list and its operations
4. Implementation of circular linked list and its operations
5. Implementation of Infix to postfix conversion using stack ADT
6. Implement the application for evaluating postfix expressions using array of stack ADT
7. Implementation of reversing a queue using stack
8. Binary Search Tree
9. AVL Tree
10. Priority Queues (Heaps)
11. Implementation of Graph Traversals(BFS, DFS)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.

Software:

Compiler – C

TOTAL (P:60) : 60 PERIODS

*Ratified in Eleventh Academic Council

Approved by Tenth Academic Council

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2	1	-	-	2	-	2	3	3	3
2	3	3	3	3	1	2	1	2	1	1	1	2	3	2
3	2	3	2	2	1	-	3	-	2	-	3	1	3	2
4	3	3	3	1	1	2	-	1	1	-	1	-	3	2
5	3	2	3	3	2	1	-	1	-	1	2	2	3	2
CO (W.A)	**2.8**	**2.8**	**2.6**	**2.2**	**1.4**	**1.5**	**2**	**1.3**	**1.5**	**1**	**1.8**	**2**	**3**	**2.2**

22CIP02 - PYTHON PROGRAMMING LABORATORY

(Common to 22AIP02, 22CSP03, 22CCP02, and 22ITP02)

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To impart the fundamental concepts of Python Programming	**1.1**	The students will be able to understand the basics of Python Programming constructs
2.0	To learn the operator concepts of Python Programming	**2.1**	The students will be able to understand the various operators of Python Programming.
3.0	To gain exposure about string manipulation, list, and tuples	**3.1**	The students will be able to realize the need of string manipulation, list, and tuples
4.0	To get knowledge about dictionaries, function and modules	**4.1**	The students will be able to design programs involving dictionaries, function and modules
5.0	To develop the skill of designing Graphical user Interfaces in Python	**5.1**	The students will be able to develop simple programs with GUI

List of Exercises:

1. Programs for demonstrating the use of different types of operators.
2. Programs for demonstrating control statements.
3. Programs to implement various string operations.
4. Programs for demonstrating the following
   i. Lists
   ii. Tuples
   iii. Dictionaries
5. Programs to demonstrate concepts using functions
6. Programs to implement applications using File handling
7. Programs to demonstrate modules.
8. Programs to implement applications using regular expression.
9. Program to demonstrate GUI.
10. Perform data manipulation using NumPy.

TOTAL (P:60) = 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,

Software:

OS – Windows / UNIX Clone

Open Source Software – Python

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	3	3	3	3	-	-	-	-	3	3	3
2	3	2	3	3	3	3	3	-	-	-	-	3	3	3
3	3	2	3	3	3	3	3	3	-	-	3	3	3	3
4	3	2	3	3	3	3	3	3	-	-	3	3	3	3
5	3	2	3	3	3	3	3	3	-	-	3	3	3	3
CO (W.A)	**3**	**2**	**2.8**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**

22CIC05 – INTERNET OF THINGS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To make students know the IoT ecosystem.	1.0	To understand the critical ecosystem required to mainstream IoTs.
2.0	To provide an understanding of the technologies and the standards relating to the Internet of Things.	2.0	To understand the technology and standards relating to IoTs.
3.0	To develop skills on IoT technical planning.	3.0	To Acquire skills on developing their own national and enterprise level technical strategies.
4.0	To make the students to know about Arduino processor and working of Analog and Digital I/O pins.	4.0	Students will be able to explain Arduino processor, working of Analog and Digital I/O pins and illustrate small projects
5.0	To develop skills on IoT applications for industry.	5.0	To Acquire skills on developing their own IoT applications for industry.

UNIT I - INTRODUCTION TO INTERNET OF THINGS	**(9)**
Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.	
UNIT II - M2M AND IOT ARCHITECTURE	**(9)**
Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model.	
UNIT III - IOT PROTOCOLS	**(9)**
PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.	
UNIT IV - PROGRAMMING USING ARDUINO	**(9)**
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.	

UNIT V - APPLICATIONS OF IOT	(9)
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher, 2015.
2. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	2	1	2	2	2	2	2	1	3	-
2	2	2	2	2	2	1	2	2	3	3	3	1	3	-
3	2	3	3	3	3	2	2	2	3	3	3	3	3	2
4	2	3	3	3	3	2	2	2	3	3	3	3	3	2
5	2	3	3	3	3	2	2	2	3	3	3	3	3	2
CO (W.A)	2	2.6	2.4	2.6	2.6	1.6	2	2	2.8	2.8	2.8	2.2	3	2

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22CIC06 - JAVA PROGRAMMING
(Common to 22AIC04,22CSC07,22CCC06, and 22ITC06)

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To understand Object oriented programming concepts and characteristics of Java	1.1	The students will be able to develop Java programs using OOP principles
2.0	To know the principles of Inheritance, abstraction and interfaces	2.1	The students will be able to develop Java programs with the concepts of inheritance
3.0	To define exceptions and use I/O streams	3.1	The students will be able to construct applications with exception handling.
4.0	To understand threads concepts	4.1	The students will be able to develop Java applications using threads
5.0	To design and build simple GUI programs using AWT and Swings.	5.1	The students will be able to develop interactive Java applications using GUI components.

UNIT I - INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	**(9)**
Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Strings, Packages - JavaDoc comments.	
UNIT II - INHERITANCE AND INTERFACES	**(9)**
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods-Keywords: Static-final-this- final methods and classes – Method overloading-Method overriding-Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces	
UNIT – III EXCEPTION HANDLING AND I/O	**(9)**
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing File	
UNIT – IV –THREADS	**(9)**
Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads — Thread Priorities – Synchronization – Inter thread Communication – Suspending, Resuming, and Stopping Threads – Using Multithreading.	

UNIT – V EVENT DRIVEN PROGRAMMING	(9)
Graphics programming - Frame – Components Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019 for Units I, II, III, IV.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015 for Unit V.

REFERENCE:

1. Cay. S. Horstmann, Gary Cornell, "Core Java-JAVA Fundamentals", Prentice Hall, 10th ed., 2016.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.3. SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	1	-	-	-	1	-	-	1	3	3
2	3	1	1	-	1	-	-	-	1	-	-	1	3	3
3	3	1	1	-	1	-	-	-	2	-	-	1	3	3
4	3	2	1	-	1	-	-	-	2	-	-	2	3	3
5	3	2	2	2	1	-	-	-	3	1	3	-	3	3
CO (W.A)	**3**	**1.6**	**1.2**	**2**	**1**	**-**	**-**	**-**	**1.8**	**1**	**1**	**1**	**3**	**3**

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22CIP04 - INTERNET OF THINGS AND ITS APPLICATIONS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the fundamentals of LED and light intensity control.	**1.1**	To acquire knowledge about Arduino, LED and control intensity of light.
2.0	To understand about the components such as Buzzer and LCD.	**2.1**	To implement buzzer and LCD in applications.
3.0	To understand how to work with sensors such as temperature and LDR.	**3.1**	To implement LM35sensor, LDR in applications.
4.0	To understand about key input and servo motor.	**4.1**	To implement the way to blink LED through key input and working with servo motor.
5.0	To understand the concept NODEMCU with app and sensor value to upload in Cloud.	**5.1**	To implement applications with NODEMCU with Blynk app and upload sensor value in Cloud.

LIST OF THE EXPERIMENTS

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:

Hardware:

WiFi UNIT or ESP 8266 UNIT 33, Connecting cable or USB cable 33, Ultrasonic sensor 33, Jumper wires 33, Vibration sensor 33, Touch Sensor 33, Temperature and humidity sensor 33, HDMI 33, Micro USB power input 33, Breadboard 33, Resistor (47K/1W) 33, LED 33, Arduino Uno 33, 16 x 2 LCD display 33, ACS712 Voltage sensor 33, 9/12V Battery 33, Center tapped transformer (230/6-0-6V) 33 , Diode (IN4007) 33, Opto-coupler 33

Software:

OS – Windows / UNIX Clone 33

Computer with Arduino IDE software 33

TOTAL (P:45) = 45 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	1	2	2	1	-	-	-	-	-	2	2
2	3	3	2	1	2	2	1	-	-	-	-	-	2	2
3	3	2	2	1	2	2	1	-	-	-	-	-	2	2
4	3	2	2	1	2	2	1	-	-	-	-	-	2	2
5	3	2	2	1	2	2	1	-	-	-	-	-	2	2
CO (W.A)	**3**	**2.4**	**2**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

22CIP05 - JAVA PROGRAMMING LABORATORY
(Common to 22AIP03,22CSP06,22CCP05, and 22ITP04)

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To impart fundamental concepts of OOP using java.	**1.1**	The students will be able to create simple Java programs using basic programming elements in Java.
2.0	To gain exposure about inheritance, packages and Interfaces.	**2.1**	The students will be able to develop applications using inheritance, packages and interfaces.
3.0	To explore about the exception handling mechanism.	**3.1**	The students will be able to construct applications with exception handling.
4.0	To understand threads concepts.	**4.1**	The students will be able to build applications using threads and collection framework.
5.0	To know about Event handling using swing components.	**5.1**	The students will be able to create GUIs and event driven programming applications for real world problems.

LIST OF EXPERIMENTS:

1. Write simple Java programs using operators, arrays and control statement
2. Programs using Static, final and this keywords.
3. Demonstrate the concepts of inheritance
4. Programs illustrating overloading and overriding methods in Java
5. Programs to use packages and Interfaces in Java.
6. Implement exception handling and creation of user defined exception.
7. Implement program to demonstrate multithreading and inter thread communication.
8. Write a program to perform file operations.
9. Develop applications using swing layouts

TOTAL (P:60) : 60 PERIODS

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:
- LAN System with 33 nodes (OR) Standalone PCs – 33 No's, Printers – 3 Nos.

Software:
- Java / Equivalent Compiler

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	-	2	-	3	2	2	2	3	3	1	3
2	2	2	3	3	3	1	3	3	2	2	3	3	1	3
3	2	2	3	3	3	1	3	3	2	2	3	3	1	3
4	2	2	3	3	3	1	3	3	2	2	3	3	1	3
5	2	2	3	3	3	2	3	3	2	2	3	3	1	3
CO (W.A)	**2.2**	**2.2**	**3**	**3**	**2.8**	**1**	**3**	**2.8**	**2**	**2**	**3**	**3**	**1**	**3**

22CIC11 - SENSORS AND ACTUATOR DEVICES

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To create a conceptual understanding of the basic principles of sensors, actuators, and their operations	1.0	Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics
2.0	To analyze the real-world problems and provide solutions using sensors and actuators	2.0	Analyze the working principles of thermal, optical & electric sensors and actuators to interpret their mathematical model
3.0	To promote awareness regarding recent developments in the fields of Mechanical Sensors and Actuators	3.0	Interpret the functional principles of Mechanical Sensors and Actuators to interpret their mathematical model
4.0	To promote awareness regarding recent developments in the fields of Acoustic Sensors , Chemical sensors and actuators	4.0	Interpret the functional principles of Acoustic Sensors & Chemical sensors and actuators to interpret their mathematical model
5.0	To promote awareness regarding recent developments in the fields of Radiation sensors, MEMS and smart sensors	5.0	Interpret the functional principles of Radiation sensors, MEMS and smart sensors and actuators to interpret their mathematical model

UNIT I - Overview of Sensors and Actuators & Temperature Sensors and Thermal Actuators	**(8)**
The five senses: vision, hearing, smell, taste, and touch – Definitions: Sensors & Actuators – Overview of Sensor and Actuator classifications – Performance characteristics of Sensors & Actuators: Transfer Function, Range, Span, Input and Output Full Scale, Resolution, and Dynamic Range - Calibration & Reliability. Thermo resistive sensors: Thermistors, Resistance temperature, and silicon resistive sensors – Thermoelectric sensors – Other Temperature sensors: Optical and Acoustical – Thermo mechanical Sensors and Actuators – Case study: Breath analyzer using temperature	
UNIT II - Optical Sensors , Electric and Magnetic Sensors and Actuators	**(10)**
Principles of Optics: Optical units – Quantum effects – Quantum-based Optical sensors – Photoelectric sensors – Charge coupled device (CCD) based – Thermal-based Optical sensors – Active infrared (AFIR) sensors – Optical Actuators – Case study: Liquid Level Indicator using Optical Sensors. Principles of Electric and Magnetic fields: Basic units – The Electric field: Capacitive Sensors & Actuators – Magnetic sensors and actuators – Magnetoresistance – Magnetostrictive Sensors and Actuators – Magnetometers – Magnetic actuators: Voice Coil Actuators, Motors as Actuators & Magnetic Solenoid Actuators and Magnetic Valves – Case Study: Speed sensing and odometer in a car using smart sensors.	
UNIT III - Mechanical Sensors and Actuators	**(9)**
Definitions and units – Force Sensors: Strain Gauges, Semiconductor Strain Gauges & Tactile Sensors – Accelerometers: Capacitive Accelerometers, Strain Gauge Accelerometers & Magnetic Accelerometers –	

Pressure Sensors: Mechanical, Piezoresistive, Capacitive & Magnetic – Velocity sensing – Inertial sensors and actuators: Mechanical or Rotor & Optical Gyroscopes – Case study: Tire-pressure monitoring system using smart sensors.

UNIT IV - Acoustic Sensors , Chemical Sensors and Actuators **(9)**

Definitions and units – Elastic waves and their properties – Microphones: Carbon, Magnetic, Ribbon and Capacitive Microphones – Piezoelectric effect – Piezoelectric Sensors – Acoustic Actuators: Loudspeakers, Headphones and Buzzers - Magnetic and Piezoelectric – Ultrasonic sensors and actuators – Case Study: Ultrasonic parking system. Chemical units and Definitions – Electrochemical sensors: Metal Oxide Sensors and Solid Electrolyte Sensors – Potentiometric smart sensors: Glass Membranes, Soluble Inorganic Salt Membrane and Polymer - Immobilized Ionophore Membranes sensors – Thermochemical, Optical, Mass humidity gas sensors – Chemical Actuators: The Catalytic Converter - The Airbag System using smart sensors – Case study: Water quality monitoring system.

UNIT V - Radiation sensors, MEMS and smart sensors and actuators **(9)**

Radiation sensors: Ionization sensors- Scintillation sensors- Semiconductor radiation detectors. Microwave radiation: Microwave sensors. Antennas as sensors and actuators: General relations- Antennas as sensing elements- Antennas as actuators. MEMS sensors and actuators: MEMS sensors- MEMS actuators- Nanosensors and actuators- Smart sensors and actuators.

TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. Nathan Ida, "Sensors, Actuators and their Interfaces - A Multidisciplinary Introduction", 2020, 2nd Edition, IET, United Kingdom.

REFERENCES:

1. Jacob Fraden, "Handbook of Modern Sensors Physics, Designs, and Applications", 2016, 5th Edition, Springer, Switzerland.
2. Subhas Chandra Mukhopadhyay, Octavian Adrian Postolache, Krishanthi P. Jayasundera, Akshya K. Swain, "Sensors for Everyday Life Environmental and Food Engineering", 2017, Volume 23, Springer, Switzerland.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	2	1	2	2	2	2	2	2	3	-
2	2	2	2	2	2	1	3	3	3	3	2	2	3	-
3	3	3	2	3	3	2	3	3	3	3	3	3	3	2
4	3	3	2	3	3	2	3	3	3	3	3	3	3	2
5	3	3	2	3	3	2	3	3	3	3	3	3	3	2
CO (W.A)	2.6	2.6	2	2.6	2.6	1.6	2.8	2.8	2.8	2.8	2.6	2.6	3	2

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22CIC12 – PRIVACY AND SECURITY IN IOT

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To impart knowledge on the state-of-the-art methodologies and Security in Internet of Things (IoT).	1.0	Identify different Internet of Things technologies and their applications.
2.0	To understand the blockchain Technology and Privacy Preservation in Internet of Things (IoT).	2.0	Assess the need for Privacy and security model for the Internet of Things.
3.0	To understand the Privacy Protection in Internet of Things (IoT).	3.0	Assess the need for Privacy Protection in IoT Applications
4.0	To understand the Trust Models in Internet of Things (IoT).	4.0	Explore various Trust Model for IoT and customize real time data for IoT applications.
5.0	To study security framework and management	5.0	Design security framework and solve IoT security issues.

UNIT I - Security in IoT, Network Robustness and Malware Propagation Control in IoT	**(8)**
IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle. Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification -Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.	
UNIT II - Blockchain Technology in IoT, Privacy Preservation in IoT	**(10)**
Technical Aspects - Integrated Platforms for IoT Enablement - Intersections between IoT and Distributed Ledger - Testing at scale of IoT Blockchain Applications - Access Control Framework for Security and Privacy of IoT - Blockchain Applications in Healthcare. Privacy Preservation Data Dissemination: Network Model, Threat Model - Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building.	
UNIT III - Privacy Protection in IoT	**(9)**
Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing	
UNIT IV - Trust Models for IoT	**(9)**
Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT.	

UNIT V - Security Protocols for IoT Access Networks	(9)
Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers - Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

REFERENCES:

2. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016, 1st edition, PACKT Publishing Ltd, UK
3. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.
4. Whitehouse O Security of things: An Implementers' guide to cyber-security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	2	1	2	2	2	2	2	1	3	-
2	2	2	2	3	3	1	2	2	3	3	3	1	3	-
3	2	3	3	3	3	2	2	2	3	3	3	3	3	2
4	2	3	3	3	3	2	2	2	3	3	3	3	3	2
5	2	3	3	3	3	2	2	2	3	3	3	3	3	2
CO (W.A)	2	2.6	2.4	2.8	2.8	1.6	2	2	2.8	2.8	2.8	2.2	3	2

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22CIP08 - SENSORS AND ACTUATOR DEVICES LABORATORY

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To create a conceptual understanding of the basic principles of sensors, actuators, and their operations.	**1.1**	Classify different Sensors & Actuators based on various physical phenomena and learn various sensor calibration techniques.
2.0	To learn various sensor calibration techniques.	**2.1**	Select the relevant sensors and actuators to design real-time data acquisition from ambience via case studies.
3.0	To analyze the real-world problems.	**3.1**	Design temperature control actuators for vehicles.
4.0	To provide solutions using sensors and actuators.	**4.1**	Generate new ideas in designing the sensors and actuators for automotive application.
5.0	To promote awareness regarding recent developments in the fields of sensors and actuators.	**5.1**	Understand the operation of the sensors, actuators and electronic control.

LIST OF THE EXPERIMENTS

1. Exploring the Arduino Programming Environment (IDE) and the different Sensors and Actuators available with the Arduino Kit
2. Design a data logger with different types of sensors and learn various sensor calibration techniques
3. Design and implementation of Breath analyzer using temperature sensors
4. Design and implementation of Liquid Level Indicator using optical Sensors
5. Design and implementation of odometer prototype to sense speed of an automobile
6. Design and implementation of a prototype to monitor real-time tire-pressure
7. Develop and validate a prototype for sensing PH and humidity parameters using polymer-based sensors
8. Design and demonstrate a water quality monitoring system
9. Demonstrate a simple parking system using ultrasonic sensors

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:

Hardware:

WiFi UNIT or ESP 8266 UNIT 33, Connecting cable or USB cable 33, Ultrasonic sensor 33, Jumper wires 33, Vibration sensor 33, Touch Sensor 33, Temperature and humidity sensor 33, HDMI 33, Micro USB power input 33, Breadboard 33, Resistor (47K/1W) 33, LED 33, Arduino Uno 33, 16 x 2 LCD display 33, ACS712 Voltage sensor 33, 9/12V Battery 33, Center tapped transformer (230/6-0-6V) 33 , Diode (IN4007) 33, Opto-coupler 33

Software:

OS – Windows / UNIX Clone 33

Computer with Arduino IDE software 33

TOTAL (P:45) = 45 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	-	2	-	2	2	2	-	1	-	-
2	2	2	2	3	-	2	-	-	3	2	-	1	-	-
3	2	3	3	3	-	2	1	-	3	2	-	2	2	2
4	2	3	3	3	-	2	-	-	3	2	-	2	2	2
5	2	3	3	3	-	2	1	-	3	2	-	2	2	2
CO (W.A)	2	2.6	2.4	2.8		2	1	2	2.8	2		2.2	2	2