

Regulation 2023

Program Structure

1056 Diploma in Artificial Intelligence and Machine Learning

Program Outcomes (PO's)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

Credit Distribution

Semester	No of Courses	Periods	Credits
Semester I	9	640	20
Semester II	9	625	20
Semester III	8	640	21
Semester IV	7	640	19
Semester V	8	640	21
Semester VI	3	675	19
Total Credits			120

Semester III

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1056233110	Introduction to Python Programming	4-0-0	60	4	Theory
2	Program Core	Practicum	1056233230	Fundamentals of data science	3-0-2	75	4	Theory
3	Program Core	Practical	1056233320	Programming Paradigms with Python	0-0-4	60	2	Practical
4	Program Core	Practicum	1056233440	OOPS with JAVA	2-0-2	60	3	Practical
5	Program Core	Practicum	1056233540	Introduction to Database Concepts	1-0-4	75	3	Practical
6	Program Core	Practicum	1052233640	Operating Systems	1-0-2	45	2	Practical
7	Open Elective	Advanced Skill Certification	1056233760	Advanced Skills Certification - 3	1-0-3	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1056233880	Growth Lab	0-0-2	30	0	NA
9	Audit Course	Integrated Learning Experience	1056233881	Induction Program II	.	16	0	.
10	Audit Course	Integrated Learning Experience	1056233882	I&E/ Club Activity/ Community Initiatives	.	16	0	.
11	Audit Course	Integrated Learning Experience	1056233883	Shop floor Immersion	.	8	0	.
12	Audit Course	Integrated Learning Experience	1056233884	Student-Led Initiative	.	6	0	.
13	Audit Course	Integrated Learning Experience	1056233885	Emerging Technology Seminars	.	14	0	.
14	Audit Course	Integrated Learning Experience	1056233886	Health & Wellness	.	30	1	.
				Test & Revisions		70		
				Library		15		
				Total Periods		640	21	

Semester IV

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1056234110	Probability and Statistics	3-0-0	45	3	Theory
2	Program Core	Practicum	1052234230	Data Structures Using Python *	3-0-2	75	4	Theory
3	Program Core	Practicum	1056234340	R Programming	1-0-4	75	3	Practical
4	Program Core	Practicum	1056234440	Data Exploration and visualization	1-0-4	75	3	Practical
5	Program Core	Practicum	1056234540	Embedded Systems and IOT	1-0-2	60	2	Practical
6	Program Core	Project/Internship	1056234640	Real Time Mini project	0-0-4	60	2	Practical
7	Open Elective	Advanced Skill Certification	1056234760	Advanced Skills Certification - 4	1-0-3	60	2	NA
8	Audit Course	Integrated Learning Experience	1056234882	I&E/ Club Activity/ Community Initiatives		20	0	
9	Audit Course	Integrated Learning Experience	1056234883	Shop floor Immersion		16	0	
10	Audit Course	Integrated Learning Experience	1056234884	Student-Led Initiative		16	0	
11	Audit Course	Integrated Learning Experience	1056234885	Emerging Technology Seminars		22	0	
12	Audit Course	Integrated Learning Experience	1056234886	Health & Wellness		15	0	
13	Audit Course	Integrated Learning Experience	1056234887	Special Interest Groups		16	0	
				Test & Revisions		70		
				Library		15		
				Total Periods		640	19	

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Practicum	1056235110	Introduction to AI	3-0-0	45	3	Theory
2	Program Elective	Theory		Elective-1	2-0-2	60	3	Theory
3	Program Core	Practical/Lab	1056235320	Artificial Intelligence Laboratory	0-0-6	90	3	Practical
4	Program Core	Practicum	1056235440	Fundamentals of Machine learning	2-0-2	60	3	Practical
5	Program Elective	Practicum		Elective-2	1-0-4	75	3	Practical
6	Humanities & Social Science	Practicum	1056235654	Innovation & Startup	1-0-2	45	2	Project
7	Project / Internship	Project/Internship	1056235773	Industrial Training * [Summer Vacation - 90 Hours]			2	Project
8	Open Elective	Advanced Skill Certification	1056235860	Advanced Skills Certification - 5	1-0-3	60	2	NA
9	Audit Course	Integrated Learning Experience	1056634882	I&E/ Club Activity/ Community Initiatives		30	0	
10	Audit Course	Integrated Learning Experience	1056234883	Shop floor Immersion		8	0	
11	Audit Course	Integrated Learning Experience	1056234884	Student-Led Initiative		14	0	
12	Audit Course	Integrated Learning Experience	1056234885	Emerging Technology Seminars		8	0	
13	Audit Course	Integrated Learning Experience	1056234886	Health & Wellness		30	0	
14	Audit Course	Integrated Learning Experience	1056234887	Special Interest Groups		30	0	
				Test & Revisions		70		
				Library		15		
				Total Periods		640	21	

Elective 1

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Theory	1056235211	Essentials of Software Engineering	2-0-2	60	3	Theory
2	Program Elective	Theory	1056235212	Deep learning	2-0-2	60	3	Theory
3	Program Elective	Theory	1056235213	Data Science and Big Data	2-0-2	60	3	Theory

Elective 2

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practicum	1056235541	Web Analytics	1-0-4	75	3	Practical
2	Program Elective	Practicum	1056235542	Cloud Computing & IOT	1-0-4	75	3	Practical
3	Program Elective	Practicum	1052235544	Multimedia Systems*	1-0-4	75	3	Practical
4	Program Elective	Practicum	1052235546	Robotic Process Automation*	1-0-4	75	3	Practical

Semester VI

#	Course Category	Course Type	Course code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1056236110	Artificial Intelligence and Robotics	4-0-0	60	4	Theory
2	Program Elective	Practicum		Elective-3	1-0-4	75	3	Practical
3	Project / Internship	Project / Internship		In-house Project / Internship / Fellowship	.	540	12	Project
	Total Periods					675	19	

Elective 3

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective	Practicum	1056236241	Game Development	1-0-4	75	3	Practical
2	Elective	Practicum	1056236242	Applied AI	1-0-4	75	3	Practical
3	Elective	Practicum	1052236245	Mobile Application Development*	1-0-4	75	3	Practical
4	Elective	Practicum	1052236246	UI & UX Design*	1-0-4	75	3	Practical

Project / Internship

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Project / Internship	Project / Internship	1056236351	Internship	-	540	12	Project
2	Project / Internship	Project / Internship	1056236353	Fellowship	-	540	12	Project
3	Project / Internship	Project / Internship	1056236374	In-house Project	-	540	12	Project



DIRECTORATE OF TECHNICAL EDUCATION, CHENNAI - 600 025
2023 REGULATION

SEMESTER 3

1056233110	INTRODUCTION TO PYTHON PROGRAMMING	L	T	P	C
THEORY		4	0	0	4

INTRODUCTION

Python is a versatile and powerful programming language that has gained immense popularity in recent years. Known for its simplicity and readability, Python is favoured by beginners and seasoned developers alike. Due to its ease of learning and usage, python codes can be easily written and executed much faster than other programming languages. Python has several modules to write programs to solve Artificial Intelligence, Machine Learning, Data Analysis problems.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- To read and write simple python programs.
- To define strings in python and operations on string.
- Represent compound data using python lists, tuples, dictionaries.
- To define and access multi-dimensional arrays.
- To do input/output with files in python.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Demonstrate the installation process of python IDE and modules.

CO2: Write and predict the output of simple python programs.

CO3: Knowledge of the syntax and semantics of python language.

CO4: Create and access string, list, tuple, and dictionary.

CO5: Read and write text files using python.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	3	–	–	–
C02	3	3	3	3	–	–	–
C03	3	3	3	3	–	–	–
C04	3	2	3	3	–	–	–
C05	3	3	3	3	–	–	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Use technology and simulations to help students visualize and explore the logic behind the programming concepts.
- Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5×20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056233110	INTRODUCTION TO PYTHON PROGRAMMING	L	T	P	C
THEORY		4	0	0	4
UNIT I	INTRODUCTION				
Features of Python – Installing and running Python – Interpreter and Interactive mode Identifiers – Reserved Keywords – Variables – Comments in Python. Data Types – Numeric, String, List, Sets, Tuple, Dictionary. Operators – Arithmetic, Relational, Assignment, Logical, Bitwise, Membership operator, identity operator. Statements and Expressions, String Operations; Expressions, Data Type Conversion, Type coercion; Input from keyboard – input function, raw_input function, Mutable and immutable Objects.					12
UNIT II	DECISION MAKING, CONTROL STRUCTURE AND FUNCTIONS				
Decision Making – Simple if, if...else and if...elif statement; Control Statement – for loop, range(), while, break, continue, pass Functions: Built in functions – Mathematical functions, Date and Time, dir(), help() Functions; User defined functions – Return values, parameters and arguments, function calls, local and global scope, function composition, recursion, anonymous functions.					12
UNIT III	STRINGS AND LISTS				
Strings – Strings in python, String functions and methods, string slicing, immutable property, string Traversal, Escape Characters, string formatting operators and functions.					6
Lists – Creation of List, values and accessing elements, mutable property, Traversing a List, copying the list, altering values, deleting elements from list. Built-in List operators and built-in methods.					6
UNIT IV	TUPLES AND DICTIONARIES				
Tuples – creating, accessing values, immutable property, assignment of tuples, returning tuples, tuples as arguments – variable length arguments – basic tuple operations, Built-in tuple functions.					6
Dictionaries: Creating a Dictionary, accessing values, updating dictionary, deleting elements from dictionary; dictionary keys – Properties, operations in Dictionary, Built-in dictionary methods.					6
UNIT V	FILE AND EXCEPTION HANDLING				
Files: Text files, opening a file, closing a file, reading from a file and writing into a file, file opening modes, closing a file. Directory: Directory methods – mkdir(), chdir(), getcwd(), rmdir().					6

Exceptions in Python: Definition - Built-in exceptions, Handling Exceptions-try...except, except with No Exception, except with Multiple Exceptions, try...finally; User defined exceptions.	6
TOTAL HOURS	60

Suggested List of Students Activity:

- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Allen B. Downey, Think Python: How to Think like a Computer Scientist, 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and programming, 1st Edition, BCS Learning & Development Limited, 2017.
3. Paul Deitel and Harvey Deitel, Python for Programmers, Pearson Education, 1st Edition, 2021.

Website link for reference:

- i. The Joy of computing using Python. <https://nptel.ac.in/courses/106106182>

1056233230	FUNDAMENTALS OF DATA SCIENCE	L	T	P	C
PRACTICUM		3	0	2	4

INTRODUCTION

Data Science is a combination of multiple disciplines that uses statistics, data analysis, and machine learning to analyse data and to extract knowledge and insights from it. Data Science is about data gathering, analysis and decision-making. Data Science is about finding patterns in data, through analysis, and makes future predictions. By using Data Science, companies can make better decisions (should we choose A or B), Predictive analysis (what will happen next?), Pattern discoveries (find pattern, or maybe hidden information in the data). Data Science is used in many industries in the world today, e.g. banking, consultancy, healthcare, and manufacturing. In this course, data science involving numbers, graphs and Natural language processing are being taught for making the student industry ready.

COURSE OBJECTIVES

- To understand the data science fundamentals and process.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python
- To explore graph in real time situations.
- To define the terminologies in NLP and Text analytics.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Define the processes in data science.

CO2: Use the Python Libraries for handling data and manipulating them.

CO3: Apply visualization Libraries in Python to interpret and explore data.

CO4: Explore graph and its hidden properties in real time applications.

CO5: Understand the basics of Natural Language Processing and Text Analytics.

PREREQUISITES: Knowledge of basic mathematics and python.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	3	-	-	-
C02	3	3	3	3	-	-	-
C03	3	3	3	3	-	-	2
C04	3	2	3	3	2	3	2
C05	3	3	3	3	-	-	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Provide instructional content (lectures, videos, PPTs) for students to review and learn.
- Present students with real-world problems that require critical thinking and problem-solving skills.
- Incorporate a variety of instructional modalities, such as visualizations, simulations, and demonstrations.
- Utilize demonstrations and plan interactive student activities for an engaging learning experience.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Any Two Units)	Written Test Theory (Another Two units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6 th Week	12 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal

assessment of 10 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 15 Marks for the internal mark. Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise / experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION – PRACTICAL TEST		
S.NO	DESCRIPTION	MARKS
A	Aim (05), Program (30)	35
B	Execution	20
C	Output	10
D	Practical document (All Practicals)	30
E	Viva Voce	05
TOTAL		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination – Theory Exam

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056233230	FUNDAMENTALS OF DATA SCIENCE			L	T	P	C
PRACTICUM				3	0	2	4
UNIT I	INTRODUCTION TO DATA SCIENCE						
THEORY							
Data Science – An Introduction – Artificial Intelligence vs Machine learning – Traditional Programming vs Machine learning – Skills and Role of a data scientist – Real time Applications of Data science. Data Mining – Data Warehousing – Basic Statistical descriptions of Data – Introduction to NumPy Library and functions – Properties of NumPy Array – Introduction to Pandas – Creating Objects – Viewing Data – Selection – Manipulating Data – Grouping Data – Merging, Joining and Concatenating – Working With Text Data – Working with CSV and Excel files.							
9							
PRACTICAL							
Exercise 1: Creating NumPy Array using various built-in functions like the Array() Function, Zeros() Function, Ones() Function, Full() Function, Arange() Function, Eye() Function, Linspace() Function and Random() Function.							
Exercise 2: Creating Objects in Pandas – Viewing Data in Pandas – Selecting and Manipulating Data in Pandas – Grouping Data – Merging, Joining and Concatenating in Pandas.							
6							
UNIT II	DATA PREPROCESSING						
THEORY							
Data – Information – Types of Data – Type of Variables – Describing Data with Tables and Graphs – Describing Data with Averages – Data cleaning, Handling missing values, Data Science process workflow. Label-Encoding for Categorical Data, Data normalization.							
9							
PRACTICAL							
Exercise 3: Importing Library to Read and Slice the data. Understand the data and Handling Missing Values.							
Exercise 4: Applying Label Encoding, Hot-Encoding for Categorical Data.							
Exercise 5: Applying Data normalization using Standard Scaler and minmax							
6							
UNIT III	DATA VISUALIZATION						
THEORY							
Data Visualization – Introduction – Some Theoretical Principles Behind Data Visualization – Histograms – Visualize the Distribution of Continuous Numerical							
9							

Variables – Boxplots – Visualize the Distribution of Continuous Numerical Variables – Scatter Plot – Visualize the Relationship Between two Continuous Variables – Bar plot – Pie Chart – Line Chart.		
PRACTICAL Exercise 6: Create Line Plots, Bar Chart, and Histogram of Data. Exercise 7: Plotting a Boxplot and Creating Visualization for Categorical Data. Exercise 8: Create Pie Charts, Scatter Plots and multiple plots.		6
UNIT IV	INTRODUCTION TO GRAPH DATA SCIENCE AND GRAPH DATA ANALYTICS	
THEORY Graph Data Science – Graph Data Statistics – Graph Data Analytics – Graph Algorithms for Data Science – Random Walks – Path Analytics – connectivity Analytics – Community Analytics – Centrality Analytics.		9
PRACTICAL Exercise 9: Construct a graph and apply graph algorithms and compute the centrality measures using networkX library.		6
UNIT V	INTRODUCTION TO NATURAL LANGUAGE PROCESSING	
THEORY Natural Language Processing – Concepts and Definitions, Text Analytics and Text Mining, Text Mining Applications, Text Mining Process, Text Mining Tools.		9
PRACTICAL Exercise 10: Preprocess a text document using NLTK of Python and perform a. Stop word elimination, b. Stemming, c. Lemmatization, d. POS tagging.		6
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science",

Manning Publications, 2016.

2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
3. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Website link for reference:

- i. Nptel course: Python for Data science- <https://nptel.ac.in/courses/106106212>
- ii. Nptel course: Data Analytics With Python <https://nptel.ac.in/courses/106107220>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- Python IDLE / Spyder

1056233320	PROGRAMMING PARADIGMS WITH PYTHON	L	T	P	C
PRACTICAL		0	0	4	2

INTRODUCTION

Programming Paradigms is a practical course designed to provide hands-on experience and practical understanding of various concepts in Python. Through a series of 10 experiments, students will explore the basic datatypes, operators, and various built-in functions available with the Python programming language. The laboratory exercises will cover areas so as to equip the students with the nuances of python programming language.

COURSE OBJECTIVES

- To familiarize students with Python syntax and semantics.
- To design and implement simple python programs.
- To provide practical experience in working with lists, tuples and dictionaries.
- To read and write data from/to files in Python.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Write, test, and debug simple Python programs.

CO2: Implement Python programs with conditionals and loops.

CO3: Develop Python programs step-wise by defining functions and calling them.

CO4: Use Python lists, tuples, dictionaries for representing compound data.

CO5: Read and write data from/to files in Python.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	3	–	–	–
C02	3	3	3	3	–	–	–
C03	3	3	3	3	–	–	–
C04	3	2	3	3	–	–	–
C05	3	3	3	3	–	–	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- The laboratory sessions will be conducted in a computer lab equipped with necessary software and tools.
- Each experiment will consist of a theoretical introduction followed by practical implementation and analysis.
- Students will work individually or in small groups to complete the experiments.
- Instructors will provide guidance and support as needed, fostering an environment of active learning and collaboration.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	Each Practical 10 Marks	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
1	Aim & Program	35
2	Execution & Result	15
TOTAL		50

CA3: Practical document should be maintained for every exercise / experiment immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination – Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Procedure for the experiment from Part – A (30)	35
2	Aim (05), Procedure for the experiment from Part – B (30)	35
3	Execution of any one experiment from Part – A OR Part – B	25
4	Viva Voce	05
TOTAL		100

1056233320		PROGRAMMING PARADIGMS WITH PYTHON			
PRACTICAL		L	T	P	C
		0	0	4	2
1	(i) Write a Python program to compute HCF and LCM of two numbers. (ii) Write a Python program to print ASCII Value of a character.				6
2	(i) Write a Python program to read three numbers and print the smallest of three numbers. (ii) Write a Python program to calculate Simple Interest.				6
3	(i) Write a Python Program to print perfect square numbers between given range. (ii) Write a Python Program to accept line of text and find the number of characters, vowels and blank spaces on it.				6
4	(i) Write a Python Program using function to display all such numbers which is divisible by 3 but are not multiple of 5 in a given range. (ii) Write a Python Program using recursion to print 'n' terms in Fibonacci series.				6
5	(i) Write a Python program to find minimum and maximum of a list of numbers (ii) Write a Python program to display a list in reverse order.				6
6	(i) Write a Python Program to add 'ing' at the end of a given string if the string has 3 or more characters. If the given string is already ends with 'ing' then add 'ly' instead. If the string has less than 3 characters, leave it unchanged. (ii) Write a Python Program to do basic trim and slice operations on String.				6
7	(i) Write a python program to create a tuple and convert into a list and print the list in sorted order. (ii) Write a python program to create a dictionary and check whether a key or value exists in the dictionary.				6
8	Write a Python Program to print the first half values of tuple in one line and last half values in next line.				6
9	Write a Python Program to multiply two matrices.				6
10	Write a Python Program to copy file contents from one file to another and display number of words copied.				6
TOTAL HOURS				60	

Suggested List of Students Activity:

Python Programming Practice: Students can engage in coding exercises to reinforce their Python skills, focusing on syntax and data structures.

Textbook for reference:

1. Al Sweigart, Automate the Boring Stuff with Python, Second Edition, No Starch Press, 2019.
2. Jake Vanderplas, Python Data Science Handbook, Essential tool for working with data, First Edition, O'Reilly Media, Inc, 2017.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy and Ipython, Wes McKinney, Second Edition, O'REILLY, 2017.

Website link for reference:

- <https://www.w3schools.com/python/>
- File Handling in Python: <https://www.geeksforgeeks.org/file-handling-python/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- Python IDLE / Spyder

Board Practical Examination**PART – A**

1. (i) Write a Python program to compute HCF and LCM of two numbers.
(ii) Write a Python program to print ASCII Value of a character.
2. (i) Write a Python program to read three numbers and print the smallest of three numbers.
(ii) Write a Python program to calculate Simple Interest.
3. (i) Write a Python Program to print perfect square numbers between given range.
(ii) Write a Python Program to accept line of text and find the number of characters, vowels and blank spaces on it.
4. (i) Write a Python Program using function to display all such numbers which is divisible by 3 but are not multiple of 5 in a given range.
(ii) Write a Python Program using recursion to print 'n' terms in Fibonacci series.

5. (i) Write a Python program to find minimum and maximum of a list of numbers
(ii) Write a Python program to display a list in reverse order.

PART – B

6. (i) Write a Python Program to add 'ing' at the end of a given string if the string has 3 or more characters. If the given string is already ends with 'ing' then add 'ly' instead. If the string has less than 3 characters, leave it unchanged.
(ii) Write a Python Program to do basic trim and slice operations on String.
7. (i) Write a python program to create a tuple and convert into a list and print the list in sorted order.
(ii) Write a python program to create a dictionary and check whether a key or value exists in the dictionary.
8. Write a Python Program to print the first half values of tuple in one line and last half values in next line.
9. Write a Python Program to multiply two matrices.
10. Write a Python Program to copy file contents from one file to another and display number of words copied.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056233440	OOPS WITH JAVA	L	T	P	C
PRACTICUM		2	0	2	3

INTRODUCTION

Java is a class-based, object-oriented programming language. Java programming is a versatile and widely-used programming language known for its platform independence, robustness, and scalability. Java is widely used for developing applications for desktop, web, and mobile devices. Students will learn Java tokens, variables, data types, control structures, functions, arrays, strings, object - oriented programming concepts and swing components. Through hands-on students will develop proficiency in writing structured and efficient Java programs to solve a variety of computational problems.

COURSE OBJECTIVES

The objectives of this course are enabling the students

- To understand the concepts of Object Oriented Programming.
- To learn about the control structures, class with attributes and methods used in Java.
- To gain knowledge of arrays and strings.
- To understand the concept of exception handling mechanism.
- To comprehend the basics of swing components and its importance in application development.

COURSE OUTCOMES

At the end of the course, students will be able to

C01: Demonstrate knowledge on Java Programming fundamentals.

C02: Develop programs in Java using control structures, array and string.

C03: Demonstrate use of object - oriented programming concepts in Java.

C04: Apply programming skills to solve overriding problems using interface.

C05: Develop applications using swing components.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	3	3	1	1	2
C02	3	3	3	3	1	1	2
C03	3	3	3	3	1	2	2
C04	3	3	3	3	1	2	2
C05	3	3	3	3	1	3	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Internal Marks	40				60
Tentative	7 th Week	14 th Week	15 th Week	16 th Week	-

Schedule					
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Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION			MARKS
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056233440	OOPS WITH JAVA			L	T	P	C
PRACTICUM				2	0	2	3
UNIT I	INTRODUCTION TO JAVA						
THEORY	Introduction to OOPS: Basic concepts of Object-Oriented Programming – Benefits of OOPs – Java features – Java Environment – JDK – API. Creating and Executing a Java program – Java Tokens – Java Virtual Machine (JVM) – Command Line Arguments – Constants – Variables – Data types – Scope of variables – Type casting – Operators.						4
PRACTICAL	Exercise 1: Write a Java program to read the temperature in Celsius and convert into Fahrenheit. Exercise 2: Write a Java program to compute the factorial of a number.						8
UNIT II	CONTROL STRUCTURES, ARRAY AND STRING						
THEORY	Control structures: Decision making statements – looping statements – branching statement – Arrays: One Dimensional Array – Multidimensional Array – String: String Arrays.						4
PRACTICAL	Exercise 3: Write a Java program to find the sum and average of your tenth standard marks. Exercise 4: Write a Java program to multiply two matrices.						8
UNIT III	CLASS AND OBJECTS						
THEORY	Class and objects: Defining a class – Methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Destructors.						4
PRACTICAL	Exercise 5: Write a Java program to find the Fibonacci series using recursive and non-recursive functions. Exercise 6: Write a Java program for method overloading. Exercise 7: Write a Java program for Constructor overloading.						8
UNIT IV	INHERITANCE AND INTERFACE						
THEORY							4

Inheritance: Defining Inheritance – Types of Inheritances – Overriding Methods – Final Variables and Methods – Abstract Class Interfaces: Defining Interfaces and Introduction to Interfaces		
PRACTICAL Exercise 8: Write a Java program to create a class called Vehicle with a method called drive(). Create a subclass called Car that overrides the drive() method to print "Repairing a car". Exercise 9: Write a Java program that creates a class hierarchy for employees of a company. The base class should be Employee, with subclasses Manager, Developer, and Programmer. Each subclass should have properties such as name, address, salary, and job title. Implement methods for calculating bonuses, generating performance reports, and managing projects.		8
UNIT V	EXCEPTION HANDLING AND SWING	
THEORY Exception Handling: Basics of Exception Handling – try and catch block – Swing Components and Event Handlers: Event Handlers – Event Listeners – Input Events.		4
PRACTICAL Exercise 10: Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.		8
TOTAL HOURS		60

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Programming assignments.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for reference

1. E. Balagurusamy, Programming with Java, 5th Edition, TataMc-Graw Hill.
2. Sagayaraj, Denis, Karthick and Gajalakshmi, Java Programming for Core and advanced learners, Universities Press (INDIA) Private Limited, 2018.

3. Herbert Schildt, The complete reference Java, TataMc-Graw Hill, 7th Edition.

Website link for reference:

- i. NPTEL & MOOC courses titled Java: <https://nptel.ac.in/courses/106105191/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- Net Beans 8.0.2 / 8.2 with JDK

Board Practical Examination

PART – A

1. Write a Java program to read the temperature in Celsius and convert into Fahrenheit.
2. Write a Java program to compute the factorial of a number.
3. Write a Java program to find the sum and average of your tenth standard marks.
4. Write a Java program to multiply two matrices.
5. Write a Java program to find the Fibonacci series using recursive and non-recursive functions.

PART – B

6. Write a Java program for method overloading.
7. Write a Java program for Constructor overloading.
8. Write a Java program to create a class called Vehicle with a method called drive(). Create a subclass called Car that overrides the drive() method to print "Repairing a car".
9. Write a Java program that creates a class hierarchy for employees of a company. The base class should be Employee, with subclasses Manager, Developer, and Programmer. Each subclass should have properties such as name, address, salary, and job title. Implement methods for calculating bonuses, generating performance reports, and managing projects.
10. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056233540	INTRODUCTION TO DATABASE CONCEPTS	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

All modern database management systems like SQL, MS SQL Server, IBM DB2, ORACLE, MySQL, and Microsoft Access are based on RDBMS. It is called Relational Database Management System (RDBMS) because it is based on the relational model introduced by E.F. Codd. A relational database is the most commonly used database. Due to a collection of an organized set of tables, data can be accessed easily in RDBMS.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- To know the fundamentals of DBMS
- To share of data and speedy forming of new applications, restrict repetition or redundancy of data
- To avoid data inconsistencies providing better integrity
- To familiarize all the possible operations of data in the database
- To familiarize programming skills for all the operations in database

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Describe fundamentals of DBMS, installation and working with admin.

CO2: Apply SQL commands to create, insert, retrieve, update, delete data from the Relational databases.

CO3: Describe MySQL programming constructs, control statements and subprograms.

CO4: Describe how indexes increases the performance.

CO5: Apply cursors, triggers and Exception handling concepts.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	3	2	-	-
C02	3	2	3	2	3	-	-
C03	2	3	2	2	2	-	-
C04	2	2	3	3	3	-	-
C05	3	3	3	2	2	-	-

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Internal Marks	40				60
Tentative	7 th Week	14 th Week	15 th Week	16 th Week	-

Schedule					
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Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION			MARKS
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056233540	INTRODUCTION TO DATABASE CONCEPTS	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	MYSQL INSTALLATION AND DATABASE CONCEPTS				
THEORY	<p>MySQL Installation: Install, configure and test MySQL server on Microsoft Windows. Creating, selecting and describing database – show command – backing up databases. Introduction to database concepts – Components of DBMS – Table Structure – Keys: types of Keys – Data Constraints and types of Constraints.</p>				5
PRACTICAL	<p>Exercise 1: Install, configure and connect to MySQL server and MySQL workbench in Windows.</p> <p>Exercise 2: Write a query to create a database, show and backing up databases.</p>				10
UNIT II	INTERACTIVE MYSQL				
THEORY	<p>MySQL data types – Data Definition Commands – Data Manipulation Commands – Data Retrieval Commands. Types of operators – Arithmetic, Comparison and Logical Operators – Pattern Matching – Import and Export Data.</p>				5
PRACTICAL	<p>Exercise 3: Create a database named college and create a table for student and employee with the fields as you like.</p> <p>Exercise 4: Create a table student with marks field for 10 students. Apply built in functions to do calculations.</p>				10
UNIT III	QUERYING THE DATABASE				
THEORY	<p>Querying the table: Selecting rows using where, order by, group by and Having clauses – Sub-queries – correlated sub-queries Views Introduction – Advantages of views – creating, updating and deleting views.</p>				5
PRACTICAL	<p>Exercise 5: Create a table bank and select the accounts having balance greater than Rs.1,00,000 and sort them in ascending order.</p> <p>Exercise 6: Create a table library with proper fields and create another table library1 and insert rows from library using views</p>				10
UNIT IV	PERFORMANCE TUNING				

THEORY		
Indexes and Sequences: Index Types – simple and compound. Sequences – Creation Joins – definition – types of joins: natural join, inner join, self join, outer join. Union types: union, Union All, Union Distinct – order by and limit handling.		5
PRACTICAL		
Exercise 7: Create a table named student with sequences.		
Exercise 8: Create any two tables with common column name and perform join and union.		10
Exercise 9: Create two tables and perform union and union all on these tables.		
UNIT V	STORED PROGRAM CONCEPTS & DEVELOPMENT	
THEORY		
MySQL Procedures & Functions: Creating, executing and deleting stored procedures – creating – executing and deleting stored functions – advantages		5
MySQL Trigger: Use of trigger – creating trigger – types of triggers		
PRACTICAL		
Exercise 10: Create a stored procedure to get employee details from employee table.		
Exercise 11: Create a program using function.		10
Exercise 12: Create a program to illustrate triggers.		
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Adam Aspin, Querying MySQL: Make your MySQL database analytics accessible with SQL operations, data extraction, and custom queries, 1st Edition, BPB Publication ,2022
2. Vikram Vaswani, MySQL: The Complete Reference (Osborne Complete Reference Series), 1st edition, McGraw Hill Education,2017
3. George Reese, MySQL Pocket Reference, 2nd Edition, O'Reilly Media 2007
4. Baron Schwartz, Peter Zaitsev, et al. ,High Performance MySQL: Optimization, Backups, Replication, Third Edition, O'Reilly Media,2012

Website links for reference:

- i. <https://www.w3schools.com/mysql/>
- ii. <https://www.mysqltutorial.org/>
- iii. <https://www.javatpoint.com/mysql-tutorial>
- iv. <https://www.guru99.com/mysql-tutorial.html>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- <https://dev.mysql.com/downloads/installer/>

Board Practical Examination**PART – A**

1. Install, configure and connect to MySQL server and MySQL workbench in Windows.
2. Write a query to create a database, show and backing up databases.
3. Create a database named college and create a table for student and employee with the fields as you like.
4. Create a table student with marks field for 10 students. Apply built in functions to do calculations.
5. Create a table bank and select the accounts having balance greater than Rs.1,00,000 and sort them in ascending order.
6. Create a table library with proper fields and create another table library1 and insert rows from library using views.

PART – B

7. Create a table named student with sequences.
8. Create any two tables with common column name and perform join and union.
9. Create two tables and perform union and union all on these tables.
10. Create a stored procedure to get employee details from employee table.
11. Create a program using function.
12. Exercise 12: Create a program to illustrate triggers.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1052233640	OPERATING SYSTEMS	L	T	P	C
PRACTICUM		1	0	2	2

INTRODUCTION

Students have to be conversant with computer, its terminology and functioning. The heart of a computer is based around its Operating System. An operating system acts as an interface between the user of a computer and the computer hardware. The processor deals with request coming from all directions asynchronously. The operating system has to deal with the problems of contention, resource management and both program and user data management, and provide a useful no-wait user interface. The course provides clear vision, understanding and working of Operating Systems.

COURSE OBJECTIVES

On completion of the following units of syllabus contents, the students must be able to

- To understand the purpose, goals, functions and evolution of Operating Systems. Login and logoff Procedures
- To know how to use of General purpose and communication commands
- To study the use of Search patterns, simple filters and advanced filters
- To know the details of process status
- To understand shell scripts, define the elements of the shell script and write shell script for various problems.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand functional architecture of an operating system.

CO2: Distinguish CPU scheduling algorithms.

CO3: Analyze process coordination.

CO4: Classify File System and directory implementations.

CO5: Resource Management

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	2	2	2	2	2	-	-
CO2	2	3	3	2	2	-	-
CO3	2	2	2	3	3	-	-
CO4	2	2	3	2	2	-	-
CO5	2	3	2	3	3	-	-

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The

students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1052233640	OPERATING SYSTEMS	L	T	P	C
PRACTICUM			1	0	2
PART A	INTRODUCTION TO OS				
THEORY					
Introduction to operating system: Basics of Operating system – types of operating system – operating system services – operating system structures – Process Management – Process scheduling					
Basics of Linux OS: Entering and Exiting from a Linux System – User Accounts – Different shells – Learn the syntax and usage of Directory Management Commands – Check the process status – process management commands – search patterns		8			
Deadlocks – Virtual Memory – Page Replacement Algorithms					
PRACTICAL					
Exercise 1: Write a syntax and execute the directory management commands : ls, cd, pwd, mkdir, rmdir					
Exercise 2: Write a syntax and execute the file management commands such as cat, chmod, cp, mv, rm, more					
Exercise 3: Write a syntax and execute the general purpose commands : wc, cal, date, who, tty, ln					
Exercise 4: Using the simple filters verify pr, head, tail, cut, paste, nl, sort grep, egrep, fgrep, write and wall		15			
PART B	SHELL SCRIPTS				
THEORY					
File operations (New, Open, Close, Save, Save and Exit, Print) – Text Editing operations (inserting ,deleting ,finding, replacing, copying and moving)– use of shell scripts – Numerical operations – Looping – Swapping techniques – string operations – using command line arguments – filters – date function – Relational Operations – Logical Operations – Boolean operations – Basic Arithmetic operations – case statement – search directory or file.		7			
PRACTICAL					
Exercise 5: Write a shell script that accepts a numerical value N and find sum .					
Exercise 6: Write a shell script to find factorial of the given number .					
Exercise 7: Write a shell script to perform arithmetic calculator using case statement.		15			

Exercise 8: Write a shell script using command line arguments and reports on whether it is a directory, file or something else.	
TOTAL HOURS	45

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles, 9th Edition, John Wiley & Sons, 2018.
2. William Stallings, Operating Systems – Internal and Design Principle”, 9th Edition, Pearson Education/PHI, 2018.
3. Andrew S Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson/PHI, 2014.

Website link for reference:

- i. <https://nptel.ac.in/courses/106/105/106105214/>
- ii. <https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/pages/lecture-notes-and-readings/>
- iii. <https://www.geeksforgeeks.org/what-is-an-operating-system/>
- iv. <https://www.w3schools.in/operating-system/intro>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Linux Operating System

Board Practical Examination

PART – A

1. Write a syntax and execute the directory management commands : ls, cd, pwd, mkdir, rmdir
2. Write a syntax and execute the file management commands such as cat, chmod, cp, mv, rm, more
3. Write a syntax and execute the general purpose commands : wc, cal, date, who, tty, ln
4. Using the simple filters verify pr, head, tail, cut, paste, nl, sort grep, egrep, fgrep, write and wall

PART – B

5. Write a shell script that accepts a numerical value N and find sum .
6. Write a shell script to find factorial of the given number .
7. Write a shell script to perform arithmetic calculator using case statement.
8. Write a shell script using command line arguments and reports on whether it is a directory, file or something else.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

SEMESTER 4

1056234110	PROBABILITY AND STATISTICS	L	T	P	C
THEORY		3	0	0	3

INTRODUCTION

Uncertainty is the absence of perfectly detailed knowledge. In the field of Artificial Intelligence and other engineering, science disciplines it so happens and to deal with uncertainty having knowledge on mathematical notions that deals with uncertainty becomes vital. This course is designed to give that mathematical framework so-called probability and statistics which deals with uncertainty at an introductory level and their application in AI and other engineering domains.

COURSE OBJECTIVES

- To understand the basic concepts of combinatorics.
- To provide necessary basic concepts in probability for applications in the field of Artificial Intelligence.
- To understand the basic concepts of probability, one dimensional random variables and to introduce some standard distributions.
- To introduce the basic concepts of two dimensional random variables.
- To introduce basic concepts of statistics which are needed for handling various real-world problems.

COURSE OUTCOMES

After successful completion of this course, the students should

CO1: Be aware of the counting principles.

CO2: Understand the fundamental knowledge of the concepts of probability.

CO3: Understand the basic concepts of one dimensional random variables and standard distributions.

CO4: Understand the basic concepts of two dimensional random variables.

CO5: Have the notion of statistical techniques used in real-world problems.

PREREQUISITES: Knowledge of High School Mathematics

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	3	3	1	2	2
C02	3	3	2	–	–	–	2
C03	3	3	2	–	–	–	2
C04	3	2	1	–	–	–	1
C05	3	3	3	2	2	2	1

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Use technology and simulations to help students visualize and explore probability concepts.
- Introduce concrete and familiar examples that relate to their interests and experiences.
- Use graphs, tables, and charts to display and analyze data, and show how they are related to measures of central tendency and variability.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056234110	PROBABILITY AND STATISTICS			L	T	P	C
THEORY				3	0	0	3
UNIT I	COMBINATORICS						
The basics of counting (fundamental principle of addition, multiplication) – The pigeonhole principle – Permutations: Concept, Permutation of objects not all distinct, Permutation when objects can repeat, Circular permutations – Combinations: Concept, Combinations with repetition (0 - n objects, at least 1 object) – Principle of inclusion and exclusion (two sets, three sets, concept only for multiple sets).							10
UNIT II	BASICS OF PROBABILITY						
Basic Concepts: Random experiment, Sample space, Event – Classical definition of probability – Axioms of probability – Conditional probability – Mutually exclusive events and addition rule – Independent Events and multiplication rule – Chain rule – Total probability – Baye’s Theorem.							9
UNIT III	ONE DIMENSIONAL RANDOM VARIABLES						
Random variables (RV) – Discrete RV: probability mass function (pmf), cumulative distribution function (cdf), properties – Continuous RV: probability density function (pmf), cumulative distribution function (cdf), properties – Moments about origin – Moments about mean (central moments) – Mathematical Expectation and properties – Variance and properties. Special distributions : Bernoulli, Binomial, Poisson, Normal, Uniform, Exponential.							10
UNIT IV	TWO DIMENSIONAL DISCRETE RANDOM VARIABLES						
Bivariate random variable – Joint probability mass function – Properties – Marginal pmf – Joint cumulative distribution function – Properties – Marginal cdf – Independence – Covariance and Correlation Coefficient.							8
UNIT V	STATISTICS						
Population and sample – Measures of central tendency: Mean, Median, Mode, Geometric mean, Harmonic mean – Empirical relationship between Mean, Median, and Mode – Relationship between AM, GM and HM – Root mean square – Quartiles, Deciles, Percentiles – Measures of dispersion: Range, Mean deviation, Standard deviation, Variance – Moments, Skewness, Kurtosis.							8
TOTAL HOURS							45

Suggested List of Students Activity:

- Solving puzzles involving the concepts of probability (like 3 hats and strange probability), combinatorics.
- Finding out the various measures of central tendency and dispersion from the results obtained by the students of the class or the data gathered from a sports event.
- Explore the permutation and combinations of student participants in a sports event or cultural event.

Textbooks for Reference:

1. Higher Secondary First Year Statistics, Tamilnadu Textbook and Educational Services Corporation, Government of Tamilnadu, 2022.
2. Richard A. Brualdi, Introductory Combinatorics, 5th Edition, *Pearson Education*, 2009.
3. T. Veerarajan, Probability, Statistics and Random Processes, 3rd Edition, Tata McGraw Hill Education Publishing Company Limited, 2008.
4. Murray R. Spiegel, Larry J. Stephens, Theory and Problems of Statistics, 4th Edition, The McGraw-Hill Companies, 2011.

Website link for reference:

- i. Introduction to probability and Statistics: <https://nptel.ac.in/courses/111106112>
- ii. <https://brilliant.org/wiki/combinatorics/>

1052234230	DATA STRUCTURES USING PYTHON	L	T	P	C
PRACTICUM		3	0	2	4

INTRODUCTION

Data structure is a subject of primary importance in Information and Communication Technology. Knowledge of data structures is essential for implementation of efficient algorithms and program development. Learning data structures with Python offer flexibility and ease of programming with many built in data structures and libraries.

COURSE OBJECTIVES

The objective of this course is to

- Provide the knowledge of various types of data structures.
- Familiarize with the representation of data structures.
- Use various data structures in organizing data.
- Reinforce theoretical concepts by writing relevant programs.
- Gain knowledge in practical applications of data structures.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the fundamental data structures.

CO2: Understand the concepts of linked lists.

CO3: Apply the operations of stack and queue.

CO4: Illustrate tree structure and apply trees traversal techniques.

CO5: Implement various sorting and searching techniques.

PREREQUISITES: Knowledge in C and Python programming.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	3	3	3	3	–	–	–
CO2	3	2	2	1	–	–	–
CO3	3	3	3	2	–	–	–
CO4	3	3	3	2	–	–	–
CO5	3	3	2	2	–	–	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Any Two Units)	Written Test Theory (Another Two units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6 th Week	12 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks

scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 15 Marks for the internal mark. Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise / experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION – PRACTICAL TEST		
S.NO	DESCRIPTION	MARKS
A	Aim (05), Program (30)	35
B	Execution	20
C	Output	10
D	Practical document (All Practicals)	30
E	Viva Voce	05
TOTAL		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination – Theory Exam

Answer ten questions by selecting two questions from each unit. Each question carries 10

marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1052234230	DATA STRUCTURES USING PYTHON	L	T	P	C
PRACTICUM			3	0	2
UNIT I	INTRODUCTION TO DATA SCIENCE				
THEORY					
Data structures – Introduction, classification of data structures: primitive and non-primitive data structures with python examples – Linear and nonlinear data structures with python examples. Operations on data structures.					9
Abstract data types – Introduction, abstractions, Abstract data types, example of abstract data type (student, date), Defining the ADT, Using the ADT, Implementing the ADT.					
Algorithm Analysis – space complexity, time complexity, Asymptomatic notations: Big-O notation.					
PRACTICAL					
Exercise 1: Write a program to implement any one python data structure with the following operations: A) Create B) Add elements C) Access elements D) Remove elements.					2
UNIT II	LINEAR DATA STRUCTURES – LINKED LISTS				
THEORY					
Linked List – Terminology: node, address, information, null pointer, empty list, Types – singly linked lists: creating nodes, traversing the nodes, searching for a node, prepending nodes, removing nodes – doubly linked list & circular linked list – organization – operations: traversal, searching, adding nodes, removing nodes (concepts only, no implementations)					8
PRACTICAL					
Exercise 2: Write a python program to implement a singly linked list					4
a) create a singly linked list					
b) Add element to singly linked list c) Remove element from singly linked list					
UNIT III	LINEAR DATA STRUCTURES – STACK & QUEUE				
THEORY					
Stacks- Overview of stack, Implementation of stack using python list: push, pop, display. Stack applications: balanced delimiters, evaluating postfix expressions. Recursion – Properties of recursion – Recursive functions: Factorials, Recursive call tree.					10

Queues – Overview of queue – Implementing the queue and its operations using python list – Applications of queues – Circular queue and Priority queue (concepts only)		
PRACTICAL Exercise 3: Write a python program to implement stack Exercise 4: Write a python program to implement queue		8
UNIT IV	NON-LINEAR DATA STRUCTURES – TREES	
THEORY Tree – Terminology: node, edge, parent, children, path, level of a node, depth of a node, height of a tree – Binary tree: full binary tree, complete binary tree – Linear representation of binary tree – binary tree traversals: in-order, pre-order, post-order. Binary Search Tree – Introduction, Creation of a Binary Search tree without duplicate node, Applications.		9
PRACTICAL Exercise 5: Write the python program for pre-order traversal of a binary tree.		4
UNIT V	SEQUENTIAL STORAGE REPRESENTATION – SORTING & SEARCHING	
THEORY Sorting – Introduction to different sorting techniques – Bubble sort, Insertion sort, Quick sort and Merge Sort. Searching – Introduction to different searching techniques – Linear search and Binary search.		9
PRACTICAL Exercise 6: Write a python program to implement bubble sort. Exercise 7: Write a python program to implement linear search. Exercise 8: Write a python program to implement binary search.		12
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference

1. Rance D. Necaie, Data Structures and Algorithms using Python, John Wiley, 2011
2. Benjamin Baka, Python Data Structures and Algorithms, Packt Publishing Ltd., 2017
3. Roberto Tamassia, Michael H. Goldwasser, Michael T. Goodrich, Data Structures and Algorithms in Python, 1st Edition, Wiley, 2013

Website link for reference:

- i. https://onlinecourses.nptel.ac.in/noc22_cs26/preview
- ii. <https://www.classcentral.com/classroom>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- Python IDLE / Spyder

1056234340	R PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

This course provides a comprehensive understanding of R Programming. The foundation on R Programming is laid to understand the core concepts and the techniques that underlie today's R Programming technologies. This course helps the students in identifying and applying appropriate techniques and tools to solve problems.

COURSE OBJECTIVES

- To study the fundamentals of R programming to apply in quantitative analysis.
- Apply regression models, such as simple and multiple regression, to analyze relationships among attributes and make predictions.
- Recognize the characteristics of Big Data and its handling techniques, including data identification, acquisition, filtering, extraction, validation, cleansing, aggregation, representation, and analysis.
- Describe the components and features of the Hadoop ecosystem, including its core components, distributed file system (HDFS), and tools for data processing.
- Explain the concepts of distributed data processing and the Hadoop framework, including batch processing with Map Reduce and real-time processing, and their application in handling large-scale datasets.

COURSE OUTCOMES

CO1: Gain an understanding of fundamental concepts in R Programming, including its subfields, basic programming languages, and common data problems.

CO2: Develop proficiency in regression analysis techniques, such as simple and multiple regression, to analyze and interpret relationships among attributes.

CO3: Acquire knowledge of R Programming characteristics, handling techniques, and challenges, enabling effective data management and analysis in large-scale environments.

CO4: Demonstrate comprehension of the Hadoop ecosystem, its core components, and tools for distributed data processing, facilitating efficient handling of massive datasets.

CO5: Attain competency in distributed data processing concepts and the Hadoop framework, enabling efficient batch and real-time processing of large datasets for actionable insights.

PREREQUISITES: Programming Skills

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	1	2	2	2	2	2	1
C02	2	3	2	3	2	2	2
C03	2	2	3	2	3	2	2
C04	3	3	3	3	3	2	2
C05	3	3	3	3	3	2	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Massive open on-line courses (MOOCs) may be used to teach various topics/subtopics
- Different types of teaching methods such as flipped class room, tutorials, peer to peer learning and self-learning may be employed by teachers to develop the outcomes.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be

considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the logbook and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056234340	R PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	INTRODUCTION TO R PROGRAMMING				
THEORY	Evolution of R – Features of R – Essentials of R – R-Environment setup – Basic syntax: command prompt, script file. Variables in R – Reserved Words – Constants in R - Operators – Data types and R Objects – Accepting Input from keyboard. R-Decision and Control Loop Statements – if condition, if else condition, switch condition, repeat loop, while loop, for loop, break statement, Next statement.				6
PRACTICAL	Exercise 1: (a) Write an R Program to Find the Factors of a Number (b) Write an R Program to check if the given Number is a Prime Number. Exercise 2: (a) Write a program to find list of even numbers from 1 to n using R-Loops. (b) Write an R Program to check if the given Number is a Prime Number				9
UNIT II	FUNDAMENTALS OF R PROGRAMMING				
THEORY	Creating arrays – Accessing array elements – manipulating array elements – Calculations across array elements. Creating matrices – Accessing elements of a Matrix – Operations on Matrices – Matrix transpose. Functions – Important Built-in functions – Formal and Actual arguments – Named arguments – Global and local variables – Recursive functions- Debugging in R.				6
PRACTICAL	Exercise 3: Write an R Program to Find the Fibonacci sequence Using Recursive Function. Exercise 4: Create a function in R to print squares of numbers in sequence.				9
UNIT III	CREATION OF R PROGRAMMING				
THEORY	Creating strings – Reading and Writing Strings – String manipulation using string package – Dates in R. Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Adding and				6

Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing Creating Lists, General List Operations – List Indexing – Adding and Deleting List Elements - Getting the Size of a List – Accessing List Components and Values - Merge list - converting List to Vector.		
PRACTICAL Exercise 5: Implement different String Manipulation functions in R Exercise 6: Write an R Program to (a) Create a vector v1 with elements 1 to 10. (b) Add 2 to every element of the vector v1. (c) Divide every element in v1 by 5 (d) Create a vector v2 with elements from 11 to 20. Now add v1 to v2.		9
UNIT IV	R PROGRAMMING STORAGE	
THEORY Tree – Terminology: node, edge, parent, children, path, level of a node, depth of a node, height of a tree – Binary tree: full binary tree, complete binary tree – Linear representation of binary tree – binary tree traversals: in-order, pre-order, post-order. Binary Search Tree – Introduction, Creation of a Binary Search tree without duplicate node, Applications.		6
PRACTICAL Exercise 7: (a) Write an R Program to create a Data Frame and access a Data Frame like a List. (b) Write a program to join columns and rows in a data frame using cbind() and rbind() in R. Exercise 8: Write an R Program to create a Factor and Access and Modify Components of a Factor.		9
UNIT V	WORKING WITH DATA	
THEORY Working with files: CSV file: input CSV, read CSV, analyzing CSV, writing into CSV		6

- Excel file: install, load, input, read excel files – XML files: input and read XML files. MySQL package – connection R with MySQL – querying the table – table manipulation: create, insert, drop and update - Need for data visualization - R Pie charts: Pie chart title, color - slice percentages and chart legend – 3D Pie chart - Bar charts – Histograms – Line graphs – Scatter plots: creating scatter plot, scatter plot matrices – Bar plot – Plotting categorical data	
PRACTICAL Exercise 9: Write a program to read a csv file and analyze the data in the file in R. Exercise 10: (a) Create pie chart using R. (b) Plot a bar plot with matrix using R. Exercise 11: Create a data set and do statistical analysis on the data using R.	9
TOTAL HOURS	75

Suggested List of Students Activity:

- Give seminar on relevant topics.
- Undertake MOOCs on-line course.
- Conduct quiz, role play, group discussion, etc.,

Text and Reference Books:

1. Tilman M. Davies, The Book of R, first edition, publication William Pollock, 2016.
2. Norman Matloff , The Art of R Programming: A Tour of Statistical Software Design, first edition, publication No Starch Press.
3. Andriede Vries, Joris Meys, R Programming for Dummies, 2nd edition, Packt Publishing Ltd, 2016.

Website link for reference:

- i. https://onlinecourses.nptel.ac.in/noc19_ma33/preview

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers / Laptop
- Printer

Software Requirement:

- Windows / Linux Operating System
- R Programming

Board Practical Examination**PART – A**

1. a) Write an R Program to Find the Factors of a Number
b) Write an R Program to check if the given Number is a Prime Number.
2. a) Write a program to find list of even numbers from 1 to n using R-Loops.
b) Write an R Program to check if the given Number is a Prime Number.
3. Write an R Program to Find the Fibonacci sequence Using Recursive Function.
4. Create a function in R to print squares of numbers in sequence.
5. Implement different String Manipulation functions in R
6. Write an R Program to
 - a) Create a vector v1 with elements 1 to 10.
 - b) Add 2 to every element of the vector v1.
 - c) Divide every element in v1 by 5
 - d) Create a vector v2 with elements from 11 to 20. Now add v1 to v2.

PART – B

1. a) Write an R Program to create a Data Frame and access a Data Frame like a List.
b) Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
2. Write an R Program to create a Factor and Access and Modify Components of a Factor.
3. Write a program to read a csv file and analyze the data in the file in R.
4. a) Create pie chart using R.
b) Plot a bar plot with matrix using R.
5. Create a data set and do statistical analysis on the data using R.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056234440	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

This course emphasizes practical application alongside theoretical knowledge of Data Exploration and Visualization. Data is a collection of discrete objects, events, and facts in the form of numbers, text, pictures, videos, objects, audio, and other entities. Processing data provides a great deal of information. To get meaningful information from data **Exploratory Data Analysis (EDA)** is used. EDA is an approach to data analysis that applies a variety of techniques to maximize specific insights into a dataset, reveal an underlying structure, extract significant variables, detect outliers and anomalies, test assumptions, develop models, and determine best parameters for future estimations. The main pillars of EDA are, data cleansing, data preparation, data exploration, and data visualization. Data visualization portrays data in graphical form and makes complex statistical data analyses and business intelligence more marketable.

COURSE OBJECTIVES

The objective of this course is

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib/ggplot.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To perform data transformation on raw data.

COURSE OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Interpret the fundamentals of exploratory data analysis.

CO2: Implement the data visualization using Matplotlib/ggplot.

CO3: Perform univariate data exploration and analysis.

CO4: Apply bivariate data exploration and analysis.

CO5: Apply data transformation on raw data.

PREREQUISITES

- Knowledge of basic Computer Science.
- Basic programming skills.

- Hands-on practice in python programming.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	3	2	–	–	–	2	–
CO2	3	3	–	2	2	–	–
CO3	–	3	1	2	1	1	1
CO4	–	3	1	2	1	1	3
CO5	–	3	1	2	1	1	3

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The

students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056234440	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
PRACTICUM		1	0	4	3
INTRODUCTION					
Introduction to Data exploration – Exploratory Data Analysis (EDA) – Significance of EDA – Making sense of Data – Elementary Python and R packages for Data Analysis – Numpy, Pandas, SciPy, Matplotlib, tidyverse, janitor, seplyr, ggplot2 – Loading dataset in Python and R – Descriptive Statistics – distribution function, Measure of central tendency and dispersion, Correlation Analysis.					7
PRACTICAL					
<p>Exercise 1: Working with R Variables and basic data structures - Vector, matrix, dataframe</p> <p>(a) Assume two vectors (2.1, 3.4, 2.5, 2.7, 2.9) and (0.3, 0.5, 0.6, 0.9, 1.1) are length and diameters of cylinders. Calculate the correlation between lengths and diameters.</p> <p>(b) Assume the measurements are in centimeters. Recalculate the volumes so that their units are in cubic millimeters. Calculate the mean, standard deviation, and coefficient of variation of these new volumes.</p> <p>(c) Construct a matrix with 10 columns and 10 rows, all filled with random numbers between 0 and 1.</p> <p>(d) Calculate the row means of the above matrix. Also calculate the standard deviation across the row mean.</p> <p>Exercise 2: Working with data structures in Pandas – data frame, series</p> <p>(a) Import the dataset chitpole.</p> <p>(b) Find the number of observations in the dataset.</p> <p>(c) Print the name of all the columns.</p> <p>(d) How many items were ordered in total?</p> <p>(e) Convert item price into a float.</p> <p>(f) What was the total revenue generated during the period of the dataset?</p> <p>(g) How many orders were made in the period?</p> <p>Exercise 3: Working with data structures in Numpy - arrays</p> <p>(a) Create an 1D array with a set of integer values.</p> <p>(b) Create an 1D, 2D and 3D Boolean array.</p> <p>(c) Extract all odd numbers from the created 1D array and replace them with -1.</p>					30

<p>(d) Reshape a 1D array to a 2D array with 2 rows and convert an array of arrays into a flat 1d array.</p> <p>(e) count the unique values in a numpy array.</p> <p>(f) create a new column from existing columns of a numpy array.</p> <p>(g) create a 2D array with a set of values and compute the row wise counts of all possible values in an array.</p> <p>(h) Get the positions of top n values from a numpy array.</p> <p>Exercise 4: Import Titanic dataset into python/R environment</p> <p>(a) Take 15 random names of passengers sort them alphabetically</p> <p>(b) What was the name of the oldest surviving male?</p> <p>(c) Make a new variable called 'Status', based on the 'Survived' variable already in the dataset. For passengers that did not survive, Status should be 'dead', for those who did, Status should be 'alive'.</p> <p>Exercise 5: Import Titanic dataset into python/R environment and perform descriptive analysis.</p> <p>Exercise 6: Load Cereals dataset into python/R environment</p> <p>(a) Print first 10 observations from the dataset and inspect the data types of the features.</p> <p>(b) Add a new variable to the dataset called 'totalcarb', which is the sum of 'carbo' and 'sugars'.</p> <p>(c) How many unique manufacturers are included in the dataset?</p> <p>(d) Rename the column 'Manufacturer' to 'Producer'.</p> <p>Exercise 7: Read Hydro dataset into python/R environment and perform the following analysis.</p> <p>(a) Change the first variable to a Date class. Are the successive measurements in the dataset always exactly one week apart?</p> <p>(b) How many weeks was the dam level equal to or lower than the value of 235 Gwh?</p>	
<p>DATA TRANSFORMATION, VISUALIZATION</p>	
<p>Data Transformation – Data cleansing, Data refactoring, Removing NA/NaN values, Dropping columns, Adding rows – Summarizing and Grouping – Data aggregation, Pivot tables and cross tabulations – Regression – Data Visualization – Charting – Line chart, Bar chart, Scatter plot, Area plot, Stacked plot, Pie chart, polar chart, Histogram, Violin chart – plotting datasets.</p>	<p>8</p>

PRACTICAL

Exercise 1: On Cereals Dataset perform

- (a) How many cereals in the dataframe are 'hot' cereals?
- (b) Take a subset of the dataframe with only the Manufacturer 'K'
- (c) Take a subset of the dataframe of all cereals that have less than 80 calories, AND have more than 20 units of vitamins.
- (d) Take a subset of the dataframe containing cereals that contain at least 1 unit of sugar, and keep only the variables 'Cereal.name', 'calories' and 'vitamins'.
- (e) For one of the above subsets, write a new CSV file to disk

Exercise 2: Use Titanic Dataset and find

- (a) How many observations of 'Age' are missing from the dataframe?
- (b) for what proportion of the passengers is the age unknown? Was this proportion higher for 3rd class than 1st and 2nd?
- (c) Count the number of passengers in each class (1st, 2nd, 3rd).

Exercise 3: Use the Hydro dataset

- (a) Make a line plot of storage versus Date
- (b) Make the line thicker, and a dot-dashed style
- (c) Make the same plot with points and change the color of the points in the following way: green if storage is over 500, orange if storage is between 235 and 500, and red if storage is below 235.

Exercise 4: Use coweeta dataset

- (a) Make a scatter plot of biomass versus height, with the symbol color varying by species.
- (b) Log-transform biomass, and redraw the plot.

Exercise 5: Using data from titanic dataset

- (a) Plot the age distribution
- (b) Break the above distribution based on survival and plot this new distribution
- (c) Plot the distribution of age based on survival and sex features
- (d) Using bar plot visualize the percentage of survivors against sex grouped by class

30

TOTAL HOURS

75

Suggested List of Students Activity:

- Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
- Select some real-world datasets from www.kaggle.com, perform EDA and apply Data transformation techniques to gain insight on those datasets and make it useful for further analysis and model building.

Textbooks for reference:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
3. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
4. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

Website link for reference:

- i. https://www.westernsydney.edu.au/hie/hie_events_/data_analysis_r
- ii. https://onlinecourses.nptel.ac.in/noc24_mg98/preview
- iii. https://onlinecourses.swayam2.ac.in/cec24_ma20/preview

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

- 30 Systems with minimum 8GB RAM, 500GB SSD, 1TB HDD, Corei5 processor.
- Internet connection to all 30 systems.

Software Requirement:

- Anaconda is a distribution of the Python and R
- R studio

Board Practical Examination

PART – A

1. Working with R Variables and basic data structures - Vector, matrix, dataframe
 - (a) Assume two vectors (2.1, 3.4, 2.5, 2.7, 2.9) and (0.3, 0.5, 0.6, 0.9, 1.1) are length and diameters of cylinders. Calculate the correlation between lengths and diameters.
 - (b) Assume the measurements are in centimeters. Recalculate the volumes so that their units are in cubic millimeters. Calculate the mean, standard deviation, and coefficient of variation of these new volumes.
 - (c) Construct a matrix with 10 columns and 10 rows, all filled with random numbers between 0 and 1.
 - (d) Calculate the row means of the above matrix. Also calculate the standard deviation across the row mean.
2. Working with data structures in Pandas – data frame, series
 - (a) Import the dataset chitpole.
 - (b) Find the number of observations in the dataset.
 - (c) Print the name of all the columns.
 - (d) How many items were ordered in total?
 - (e) Convert item price into a float.
 - (f) What was the total revenue generated during the period of the dataset?
 - (g) How many orders were made in the period?
3. Working with data structures in Numpy - arrays
 - (a) Create an 1D array with a set of integer values.
 - (b) Create an 1D, 2D and 3D Boolean array.
 - (c) Extract all odd numbers from the created 1D array and replace them with -1.
 - (d) Reshape a 1D array to a 2D array with 2 rows and convert an array of arrays into a flat 1d array.
 - (e) count the unique values in a numpy array.
 - (f) create a new column from existing columns of a numpy array.
 - (g) create a 2D array with a set of values and compute the row wise counts of all possible values in an array.
 - (h) Get the positions of top n values from a numpy array.
4. Import Titanic dataset into python/R environment
 - (a) Take 15 random names of passengers sort them alphabetically
 - (b) What was the name of the oldest surviving male?
 - (c) Make a new variable called 'Status', based on the 'Survived' variable already in the

dataset. For passengers that did not survive, Status should be 'dead', for those who did, Status should be 'alive'.

5. Import Titanic dataset into python/R environment and perform descriptive analysis.
6. Load Cereals dataset into python/R environment
 - (a) Print first 10 observations from the dataset and inspect the data types of the features.
 - (b) Add a new variable to the dataset called 'totalcarb', which is the sum of 'carbo' and 'sugars'.
 - (c) How many unique manufacturers are included in the dataset?
 - (d) Rename the column 'Manufacturer' to 'Producer'.
7. Read Hydro dataset into python/R environment and perform the following analysis.
 - (a) Change the first variable to a Date class. Are the successive measurements in the dataset always exactly one week apart?
 - (b) How many weeks was the dam level equal to or lower than the value of 235 Gwh?

PART – B

- b) On Cereals Dataset perform
 - a. How many cereals in the dataframe are 'hot' cereals?
 - b. Take a subset of the dataframe with only the Manufacturer 'K'
 - c. Take a subset of the dataframe of all cereals that have less than 80 calories, AND have more than 20 units of vitamins.
 - d. Take a subset of the dataframe containing cereals that contain at least 1 unit of sugar, and keep only the variables 'Cereal.name', 'calories' and 'vitamins'.
 - e. For one of the above subsets, write a new CSV file to disk
- c) Use Titanic Dataset and find
 - a. How many observations of 'Age' are missing from the dataframe?
 - b. for what proportion of the passengers is the age unknown? Was this proportion higher for 3rd class than 1st and 2nd?
 - c. Count the number of passengers in each class (1st, 2nd, 3rd).
- d) Use the Hydro dataset
 - a. Make a line plot of storage versus Date
 - b. Make the line thicker, and a dot-dashed style
 - c. Make the same plot with points and change the color of the points in the following way: green if storage is over 500, orange if storage is between 235 and 500, and red if storage is below 235.
- e) Use coweeta dataset
 - a. Make a scatter plot of biomass versus height, with the symbol color varying by species.

- b. Log-transform biomass, and redraw the plot.
- f) Using data from titanic dataset
 - a. Plot the age distribution
 - b. Break the above distribution based on survival and plot this new distribution
 - c. Plot the distribution of age based on survival and sex features
 - d. Using bar plot visualize the percentage of survivors against sex grouped by class

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056234540	EMBEDDED SYSTEMS AND INTERNET OF THINGS (IoT)	L	T	P	C
PRACTICUM		1	0	2	2

INTRODUCTION

COURSE OBJECTIVES

- To provide students good foundation in mathematical, scientific, engineering fundamentals and hardware-software programming intelligence.
- To develop among students, the ability to develop embedded systems based smart solutions for purpose of system automation.
- To promote student awareness, for life-long learning and introduce them to professional ethics and code of practice.
- To encourage students, to work in interdisciplinary groups.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Students should be able to demonstrate over the area as per the specialization of the program.

CO2: Design and develop Embedded system automation based on dedicated ICs that have computation, networking, and control capacity.

CO3: Work on professional software languages, standard modeling and analysis tools & commercial packages with communication protocols and computation platforms for analysis and design of system automation.

CO4: Develop an innovative smart system with automation as a consumer product through project management.

CO5: Work efficiently in teams to develop embedded program applications.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	1	-	1	-	-	-	-
CO2	1	3	2	2	1	2	2
CO3	2	3	1	3	-	2	1
CO4	-	2	2	-	-	3	2
CO5	-	2	3	-	1	2	1

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The

students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056234540	EMBEDDED SYSTEMS AND INTERNET OF THINGS (IoT)	L	T	P	C	
PRACTICUM		1	0	2	2	
UNIT 1- EMBEDDED SYSTEMS AND ARM PROCESSOR ARCHITECTURE FUNDAMENTALS						
THEORY						
<p>Definition of embedded systems – Features of embedded systems – Types of Embedded Systems – List of Embedded System Devices. Block diagram of ARM based embedded system with hardware components. Pipeline – Data Flow Model – CPU registers.</p> <p>Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS –Multiple Tasks and Processes – Arithmetic Operations: Embedded arithmetic programs involve performing basic arithmetic operations such as addition, subtraction, multiplication, and division</p> <p>Vector Interrupt controller (VIC) – Register description – External Interrupts. interrupt handling and prioritization.</p>					6	
PRACTICAL						
Exercise 1:						
<p>Install the necessary development tools and software for programming ARM-based microcontrollers. This might include installing Keil µVision, STM32CubeIDE, or other IDEs recommended by the microcontroller manufacturer.</p>					10	
Exercise 2:						
<p>(a) Write assembly language program for addition, subtraction and Multiplication and simulate.</p> <p>(b) Write code to control the LEDs (e.g., blinking patterns) and read input from the push button.</p>						
UNIT 2 UART FUNDAMENTALS AND INTRODUCTION TO ADC						
THEORY						
<p>Understanding UART data format (start bit, data bits, stop bits) UART frame structure, transmitting and receiving data using UART, Interfacing UART with microcontrollers, Configuring UART parameters (baud rate, parity, stop bits).</p> <p>Successive Approximation ADC, Flash ADC, Sigma-Delta ADC, Dual Slope ADC, Serial vs. Parallel interfacing, Communication protocols: SPI, Temperature sensing using ADC.</p>					4	

Overview of digital and analog signals, Need for DAC in embedded systems, Types of DAC: Binary Weighted, R-2R Ladder, Delta-Sigma etc	
<p>PRACTICAL</p> <p>Exercise 3:</p> <p>(a) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Interrupt method.</p> <p>(b) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Polling method.</p> <p>Exercise 4:</p> <p>(a) Write and execute C program for accessing an internal ADC and display the binary output in LEDs.</p> <p>(b) Write and execute C program to generate square wave using on chip DAC.</p>	10
UNIT 3 INTRODUCTION TO SECURITY IN IOT	
<p>THEORY</p> <p>Introduction – Security Requirements in IoT architectures – Security in Enabling Technologies – IoT Security Life Cycle – Cryptographic Fundamentals for IoT Security Engineering.</p> <p>Introduction – Security Requirements in IoT – Insufficient Authentication/Authorization – Insecure Access Control – Threads to Access Control, Privacy, and Availability – Attacks Specific to IoT – Malware Propagation and Control in Internet of Things.</p>	4
<p>PRACTICAL</p> <p>Exercise 5:</p> <p>Build a simple IoT device using a temperature and humidity sensor (e.g., DHT11 or DHT22) connected to a microcontroller (e.g., Arduino or Raspberry Pi).</p> <p>Exercise 6:</p> <p>Create a basic smart home system by connecting IoT devices such as smart bulbs, smart switches, and motion sensors to a central hub.</p>	10
UNIT 4 AUTHENTICATION AND DATA SECURITY IN IoT	
<p>THEORY</p> <p>Trust and Trust Models for IoT – Emerging Architecture Model for IoT Security and Privacy – preventing Unauthorized Access to Sensor Data – Authentication in IoT – Computational Security for the IoT – Secure Path Generation Scheme for real-Time Green IoT – Security Protocols for IoT Access Network.</p>	4

PRACTICAL Exercise 7: Test the effectiveness of secure firmware update mechanisms for ensuring the integrity and authenticity of firmware updates in IoT devices.	6
UNIT 5 IoT APPLICATIONS	
THEORY Domain specific applications of IoT Home automation, Industry applications, Surveillance applications, Other IoT applications.	2
PRACTICAL Exercise 8: Test the effectiveness of IoT-enabled predictive maintenance strategies in industrial equipment.	4
TOTAL HOURS	60

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for reference:

1. Mohamammad Ali Mazidi & Mazidi '8051 Microcontroller and Embedded Systems', Pearson Education, 2007
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education.
3. Simon Monk, "Make Action-with Arduino and Raspberry Pi", SPD ,2016.

Website link for reference:

- i. https://onlinecourses.nptel.ac.in/noc20_ee98/preview.
- ii. <https://chatgpt.com/g/g-rzi6bDI69-embedded-systems-developer>.

Board Practical Examination

PART – A

1. Install the necessary development tools and software for programming ARM-based microcontrollers. This might include installing Keil μ Vision, STM32CubeIDE, or other IDEs recommended by the microcontroller manufacturer.
2. (a) Write assembly language program for addition, subtraction and Multiplication and simulate.
(b) Write code to control the LEDs (e.g., blinking patterns) and read input from the push button.
3. (a) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Interrupt method.
(b) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Polling method.
4. (a) Write and execute C program for accessing an internal ADC and display the binary output in LEDs.
(b) Write and execute C program to generate square wave using on chip DAC.

PART – B

5. Build a simple IoT device using a temperature and humidity sensor (e.g., DHT11 or DHT22) connected to a microcontroller (e.g., Arduino or Raspberry Pi).
6. Create a basic smart home system by connecting IoT devices such as smart bulbs, smart switches, and motion sensors to a central hub.
7. Test the effectiveness of secure firmware update mechanisms for ensuring the integrity and authenticity of firmware updates in IoT devices.
8. Test the effectiveness of IoT-enabled predictive maintenance strategies in industrial equipment.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10

5	Viva Voce	5
6	Total	100

1056234640	REAL TIME MINI PROJECT	Periods	C
PROJECT		60	2

Introduction

Every student must do one mini project in the Final year of their program. Students can do their mini project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.

For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.

If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.

For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.

The final examination for project work will be evaluated based on the final report submitted by the project group **of not exceeding three students**, and the viva voce by an external examiner.

Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge:** Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development:** Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities:** Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management:** Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration:** Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.

- **Research Skills:** Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity:** Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills:** Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations:** Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development:** Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO 1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO 2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO 3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO 4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

Important points to consider to select the In-house project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.

- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.
- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.
- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor.

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.
- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.
- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.

- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project.

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and

		challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)	Model / Analysis Report (40 Marks)
External: 10 Internal: 5	External: 10 Internal: 5	External: 10 Internal: 5	External: 20 Internal: 10

Supervisor: 5	Supervisor: 5	Supervisor: 5	Supervisor: 10
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The marks scored will be converted to 60 Marks.

Students who are unable to complete the project work at the end of the semester can apply for an extension to the Head of the Department, with the recommendation from the project guide for a period of a maximum of two months. For those students who extend the project work for two months, Viva Voce will be carried out and results will be declared separately. If the project report is not submitted even beyond the extended time, then students are not eligible to appear for Project Viva Voce Examination.

SEMESTER 5

1056235110	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
THEORY		3	0	0	3

INTRODUCTION

AI is one of the newest fields in science and engineering. AI currently encompasses a huge variety of subfields, ranging from the general (learning and perception) to the specific, such as playing chess, proving mathematical theorems, writing poetry, driving a car on a crowded street, and diagnosing diseases. AI is relevant to any intellectual task; it is truly a universal field.

COURSE OBJECTIVES

- The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches.
- Develop a basic understanding of the building blocks of AI as presented in terms problem, problem space: Search, Knowledge representation, inference, logic, and learning.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Understand basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.

CO2: Understand knowledge representation using logic and rules.

CO3: Analyze various AI techniques in expert systems, artificial neural networks and other machine learning models.

CO4: Apply Min-Max Search procedures, iterative deepening, and learning in game playing.

CO5: Analyze the main approaches to natural language processing and expert systems.

PREREQUISITES

- Good Programming knowledge.
- Familiarity in various mathematical concepts such as probability, statistics, algebra, matrix, calculus, etc.
- Strong Analytical skills like ability to think critically, analyze data, decision making capability as well as solve complex problems.
- Ability to understand complex algorithms like Classification algorithms, Regression algorithms, clustering algorithms.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	3	2	2	2	2
C02	3	3	2	2	1	–	2
C03	3	3	1	–	–	–	2
C04	3	2	2	–	–	–	1
C05	3	3	2	2	2	2	1

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Understanding Learning Objectives: Understand the fundamentals of AI, including machine learning algorithms, neural networks, natural language processing.
- Incorporate case studies, examples, and real-world applications to illustrate theoretical concepts.
- Deliver traditional lectures to introduce key concepts and theories.
- Quizzes and Exams: Assess understanding of theoretical concepts through traditional tests.
- Assignments: Evaluate problem-solving abilities by assigning tasks such as algorithm design, model implementation, or analysis of AI systems.
- Presentations: Have students present research papers, case studies, or project findings to develop communication skills and deepen understanding.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056235110	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
THEORY			3	0	0
UNIT I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE (AI)				
	Definition and history of AI, Impact and Applications of AI in various domains: Speech recognition, Machine Learning, Machine Translation, Robotics, Game Playing, Autonomous planning and scheduling. Agents and Environments – Rationality – Nature of Environments – Structure of Agents.				9
UNIT II	PROBLEM SOLVING ALGORITHMS				
	Problem solving by searching: Problem solving agents, Uninformed search (blind search): Breadth-first search, Depth-first search, Informed search (Heuristic search) techniques: Greedy best-first search, A* search, Adversarial search: Games, Mini max Algorithm, Alpha-Beta pruning. Constraint Satisfaction Problem: Backtracking search for CSP.				9
UNIT III	KNOWLEDGE REPRESENTATION AND REASONING				
	Knowledge Representation: Logic, Propositional logic, First Order Predicate Logic – Unification – Forward Chaining – Backward Chaining – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.				9
UNIT IV	MACHINE LEARNING FUNDAMENTALS				
	Introduction to Learning, Supervised learning, Regression and Classification with linear Models, Artificial Neural Network: Neural network structures, Single-layer feed-forward neural networks, Multilayer feed-forward neural networks, Support vector machine.				8
UNIT V	NATURAL LANGUAGE PROCESSING (NLP)				
	Language Models, Text classification, Information Retrieval, Information extraction, Natural Language for Communication: Machine translation, Speech Recognition. Perception: Image Formation, Early Image-Processing Operations: Edge detection, Texture, Optical flow, Segmentation of images, Object Recognition by Appearance: Complex appearance and pattern elements, Pedestrian detection with HOG features, Robotics: Robot Hardware, Robot Perception.				10
TOTAL HOURS					45

Suggested List of Students Activity:

- Task students with implementing AI algorithms discussed in class, such as linear regression, decision trees, or neural networks.
- Provide case studies showcasing real-world applications of AI, such as self-driving cars, recommender systems, or medical diagnosis.
- Divide students into groups and assign each group a dilemma to research and debate, considering various perspectives and proposing solutions.
- Assign a semester-long project where students design and implement an AI system to solve a specific problem.

Textbook for reference:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education.
3. Dhee raj Mehrotra, Basics of Artificial Intelligence & Machine Learning, Notion Press, 2019
4. Venu Gopal C.K, Artificial Intelligence and Machine Learning, Pacific Books International, 2019

Web-based/Online Resources:

- <https://www.coursera.org/learn/introduction-to-ai>
- <https://nptel.ac.in/courses/106102220>
- <https://www.udemy.com/topic/artificial-intelligence>

1056235211	ESSENTIALS OF SOFTWARE ENGINEERING	L	T	P	C
THEORY		2	0	2	3

INTRODUCTION

Software Engineering deals with reliability and quality assurance of the software under development. It provides framework for development of quality software product. The course enables the students to write specifications for software system understand the importance of good software, design and develop test plans from design specifications. The course also covers other important aspects of software Engineering such as software lifecycle, requirement analysis and documentation, characteristics of good design, design techniques, testing, software implementation and maintenance etc.

COURSE OBJECTIVES

The objectives of this course are enabling the students

- To learn software project management process.
- To gain knowledge of software quality metrics.
- To understand the concept of testing and maintenance.
- To comprehend the basics of design and planning and its importance in reliability.
- To recognize the importance of risk management.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Identify the key activities in managing software project and compare different process models.

CO2: Concepts of requirements engineering and Analysis Modeling.

CO3: Apply systematic procedure for software design and deployment.

CO4: Compare and contrast the various testing and maintenance.

CO5: Manage project schedule, estimate project cost and effort required.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	3	3	3	1	1	1	2
CO2	3	3	3	3	1	1	2
CO3	3	3	2	3	2	2	2
CO4	3	3	3	2	2	3	2
CO5	3	3	2	3	2	2	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056235211	ESSENTIALS OF SOFTWARE ENGINEERING	L	T	P	C
THEORY		2	0	2	3
UNIT I	INTRODUCTION TO SOFTWARE ENGINEERING				
<p>Basics of Software Engineering: Need for Software Engineering – Definition – Software Characteristics – Software Myths – Program versus Software Products. Software Development Life Cycle Models: Introduction – Waterfall Model – Spiral Model – Iterative Enhancement model – Agile model – Object Oriented Model – Advantages and Disadvantages of above models.</p> <p>Software Requirement Analysis (SRS): Value of good SRS – Developing SRS from Business Requirements – Requirement Process – Requirement Specification – Desirable Characteristics of an SRS – Components of an SRS.</p>					12
UNIT II	SOFTWARE DESIGN AND PLANNING				
<p>Software Design: Definition of software design – Objectives of software design – Process of software design – Architectural design – Modular design – Structure chart – Coupling and Cohesion – Different types – Interface design – Design of Human Computer Interface. Software Planning: Software metrics – Definition – Types of metrics – Product and product metrics – Relevant metrics in agile – Function point and feature point metrics – Software project estimation – Steps for estimation – Reason for poor and inaccurate estimation – Project estimation guidelines – Models for estimation – COCOMO Model – Automated tools for estimation – Sprint planning in agile.</p>					12
UNIT III	SOFTWARE MAINTENANCE AND RISK MANAGEMENT				
<p>Software Maintenance: Software as an evolution entity – Software configuration management activities – Change control process – Software version control – Software configuration management – Need for maintenance – Categories of maintenance – Maintenance cost – Factors affecting the effort. Risk management: Definition of risk – Basics for different types of software risks – Monitoring of risks – Risk management – Risk avoidance – Risk detection – Risk control – Risk recovery – Sources of risks – Types of risks.</p>					11
UNIT IV	SOFTWARE TESTING				
<p>Software Testing: Introduction to testing – Testing principles – Testing objectives – Basic terms used in testing – Fault – Error – Failure – Testcases – Black box and white box testing – Advantages and disadvantages of above testing – Methods for Block box testing strategies – Methods for white box testing</p>					15

strategies – Testing activities – Test plan – Tracking defects. Levels of testing: Integration tests – System testing – Types. Software Testing strategies: Static testing strategies – Formal technical reviews – Code walkthrough – Code inspection – Debugging–Definition – Characteristics of bugs – Life cycle of a Debugging task – Debugging approaches. Software Testing Tools: Need for tools – Classification of tools – Functional/Regression Testing tools – Performance/Load Testing Tools – Testing process management Tools – Benefits of tools		
UNIT V	SOFTWARE RELIABILITY AND QUALITY ASSURANCE	
Software Quality Assurance: Verification and validation – SQA – Objectives and Goals – SQA plan – Definition of software quality – Classification of software qualities – Software quality attributes – Important qualities of software products – Importance of software quality – SEI – CMM – Five levels – ISO 9000 – Need for ISO Certification – Benefits of ISO 9000 certification – Limitation of ISO 9000 certification. Software Reliability: Definition – Reliability terminologies – Classification of failures – Reliability metrics – Reliability growth modeling – Reliability measurement process		10
TOTAL HOURS		60

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Programming assignments
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Roger S. Pressman, Software Engineering – A practitioner’s Approach, Sixth Edition, McGraw-Hill International Edition, 2005.
2. Ian Sommerville, “Software engineering”, Seventh Edition, Pearson Education Asia, 2007.
3. Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
4. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.

Website link for reference:

- i. Nptel course : https://onlinecourses.nptel.ac.in/noc20_cs68/preview

1056235212	DEEP LEARNING	L	T	P	C
PRACTICUM		2	0	2	3

INTRODUCTION

Deep learning is a subset of artificial intelligence (AI) and machine learning that mimics the workings of the human brain in processing data and creating patterns for use in decision-making. Deep learning is distinguished from traditional machine learning algorithms through its ability to automatically discover intricate patterns and representations of data, without requiring explicit programming of feature extraction. Deep learning models autonomously extract features from raw data, enabling them to perform tasks like image recognition, natural language processing, and speech recognition with remarkable accuracy and provides solutions to real world problems.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand the fundamental concepts of deep learning.
- Explore the basics of feed forward neural networks, activation functions and learning parameters.
- Learn the working of convolutional neural networks and their applications.
- Explain different types of recurrent neural networks and their applications.
- Summarize the concepts of deep reinforcement learning and deep generative models.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Define the processes in data science.

CO2: Use the Python Libraries for handling data and manipulating them.

CO3: Apply visualization Libraries in Python to interpret and explore data.

CO4: Explore graph and its hidden properties in real time applications.

CO5: Understand the basics of Natural Language Processing and Text Analytics.

PREREQUISITES: Fundamentals of Data Science

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	–	–	–	–
C02	3	3	2	2	2	–	2
C03	3	3	2	2	2	–	2
C04	3	3	2	2	–	–	2
C05	3	3	2	2	–	–	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Provide instructional content (lectures, videos, PPTs) for students to review and learn.
- Present students with real-world problems that require critical thinking and problem-solving skills.
- Incorporate a variety of instructional modalities, such as visualizations, simulations, and demonstrations.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056235212	DEEP LEARNING			L	T	P	C
THEORY				2	0	2	3
UNIT I	NEURAL NETWORKS						
Building Intelligent Machines – The Limits of Traditional Computer Programs – The Mechanics of Machine Learning.						2	
The Neuron – Expressing Linear Perceptrons as Neurons – Feed-Forward Neural Networks – Linear Neurons and Their Limitations – Sigmoid, Tanh, and ReLU Neurons – Softmax Output Layers.						3	
Training Feed – Forward Neural Networks – Gradient Descent – The Delta Rule and Learning Rates – The Back propagation Algorithm.						4	
Test Sets, Validation Sets, and Overfitting – Preventing Overfitting in Deep Neural Networks.						2	
UNIT II	CONVOLUTIONAL NEURAL NETWORKS (CNN)						
Introduction – Historical Perspective and Biological Inspiration. The Basic Structure of a Convolutional Network – Padding – Strides – Typical Settings – Use of Bias – The ReLU Layer – Pooling – Fully Connected Layers – The Interleaving Between Layers – LeNet-5.						5	
Case Studies of Convolutional Architectures – AlexNet – VGG – GoogLeNet – ResNet.						5	
Applications of Convolutional Networks – Content-Based Image Retrieval – Object Localization – Object Detection – Natural Language and Sequence Learning – Video Classification						5	
UNIT III	RECURRENT NEURAL NETWORK (RNN)						
The Architecture of Recurrent Neural Networks – Bidirectional RNNs.						4	
Encoder-Decoder Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – Long Short-Term Memory (LSTM).						4	
Applications of Recurrent Neural Networks – Automatic Image Captioning –						3	

Question-Answering Systems – Sentence-Level Classification – End-to-End Speech Recognition – Handwriting Recognition.		
UNIT IV	DEEP REINFORCEMENT LEARNING	
Reinforcement Learning – Markov Decision Processes (MDP) – Policy – Future Return – Discounted Future Return – Explore Versus Exploit – Policy Versus Value Learning – Policy Learning via Policy Gradients		6
Q-Learning and Deep Q-Networks – The Bellman Equation – Issues with Value Iteration – Approximating the Q-Function – Deep Q-Network (DQN) – Training DQN – Learning Stability – Target Q-Network – Experience Replay.		6
UNIT V	DEEP GENERATIVE MODELS	
Boltzmann Machines – Restricted Boltzmann Machines – Deep Belief Networks – Deep Boltzmann Machines (only architecture).		5
Directed Generative Nets – Sigmoid Belief Nets – Differentiable Generator Nets – Variational Auto encoders – Generative Adversarial Networks – Generative Moment Matching Networks – Convolutional Generative Networks – Auto- Regressive Networks – Linear Auto-Regressive Networks – Neural Auto- Regressive Networks.		6
TOTAL HOURS		60

Suggested List of Students Activity:

- Implement simple neural network architecture using python programming.
- Project based learning for image classification and object detection using convolutional neural network.
- Problem based learning on text processing application using recurrent neural network.
- Incorporate group discussions, case studies and collaborative problem-solving activities.

Text and Reference Books:

1. Nikhil Buduma, Nicholas Locascio, –Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms, O'Reilly Media, 2017.
2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
3. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.

Web-based/Online Resources:

- <https://www.coursera.org/specializations/deep-learning>
- <https://nptel.ac.in/courses/106106184>
- <https://www.udemy.com/course/basics-of-deep-learning/>

1056235213	DATA SCIENCE AND BIG DATA	L	T	P	C
PRACTICUM		2	0	2	3

INTRODUCTION

This course provides a comprehensive understanding of data science and data modeling. The foundation on data science is laid to understand the core concepts and the techniques that underlie today's big data computing technologies. This course helps the students in identifying and applying appropriate techniques and tools to solve problems in managing huge quantities of data.

COURSE OBJECTIVES

- Understand the fundamentals of Data Science, including its subfields, common problems with data, and the basics of Python arrays and data frames.
- Apply regression models, such as simple and multiple regression, to analyze relationships among attributes and make predictions.
- Recognize the characteristics of Big Data and its handling techniques, including data identification, acquisition, filtering, extraction, validation, cleansing, aggregation, representation and analysis.
- Describe the components and features of the Hadoop ecosystem, including its core components, distributed file system (HDFS), and tools for data processing.
- Explain the concepts of distributed data processing and the Hadoop framework, including batch processing with Map Reduce and real-time processing, and their application in handling large-scale datasets.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Gain an understanding of fundamental concepts in Data Science, including its subfields, basic programming languages, and common data problems.

CO2: Develop proficiency in regression analysis techniques, such as simple and multiple regression, to analyze and interpret relationships among attributes.

CO3: Acquire knowledge of Big Data characteristics, handling techniques, and challenges, enabling effective data management and analysis in large-scale environments.

CO4: Demonstrate comprehension of the Hadoop ecosystem, its core components, and tools for distributed data processing, facilitating efficient handling of massive datasets.

CO5: Attain competency in distributed data processing concepts and the Hadoop framework,

enabling efficient batch and real-time processing of large datasets for actionable insights.

PREREQUISITES: Database Management System

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	1	2	2	-	-	2	1
C02	2	3	2	-	-	2	2
C03	2	2	3	-	-	2	2
C04	3	3	3	-	-	2	2
C05	3	3	3	-	-	2	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Massive Open On-line Courses(MOOCs) may be used to teach various topics/subtopics.
- Different types of teaching methods such as flipped classroom, tutorials, peer to peer learning and self learning may be employed by teachers to develop the outcomes.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	-

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056235213	DATA SCIENCE AND BIG DATA			L	T	P	C
THEORY				2	0	2	3
UNIT I	INTRODUCTION TO DATA SCIENCE						
Subfields of Data Science – Data Science Road Map – Programming languages for Data Science – Problems with Data – Formatting issues – Python Arrays and Data Frames. Data Quality – Consistency and accuracy (Integrity), Noise: Outliers, Missing and Duplicate values – Data Preprocessing using Cleaning, Enrichment, Editing, Reduction, Data Formats – Loading and Saving files Loading data – Statistical functions – Text Functions – Lookup Functions – Sorting – Filtering – Data Analysis: Correlation, covariance, Descriptive statistics, Regression.							12
UNIT II	FUNDAMENTALS OF DATA MODELING						
Classification of attributes – Concept of Rank – Identify the relationship among attributes, Regression Models – Linear regression – Simple and Multiple Regression – Correlation – Mean squared Error – Testing goodness of fit – Model Equation, Two class – Multi class classification – Separability – Performance measures – Nearest Neighbors.							12
UNIT III	FUNDAMENTALS OF BIG DATA						
Web Data – Classification of Data – Big Data – Characteristics – Volume, Velocity, Variety, Veracity, Value – Big Data Types and classifications – Sources of Big Data – Big Data handling techniques – Challenges. Business Case Evaluation, Data Identification, Data Acquisition & Filtering, Data Extraction, Data Validation & Cleansing, Data Aggregation & Representation.							12
UNIT IV	BIG DATA STORAGE						
Introduction – Hadoop and its Ecosystem: Hadoop core components – Features of Hadoop – Hadoop Ecosystem components – Hadoop streaming – Hadoop pipes – Hadoop distributed File system – HDFS data storage – Hadoop Ecosystem tools.							12
UNIT V	BIG DATA PROCESSING						
Distributed data processing – Hadoop Framework – Processing workloads – cluster for processing – Batch processing with Map Reduce – Map and Reduce Tasks – Map Reduce algorithms – Processing in Real time mode – Real time processing and Map Reduce.							12
TOTAL HOURS							60

Suggested List of Students Activity:

- Give seminar on relevant topics.
- Undertake MOOC on-line course Python for Data Science - Course(nptel.ac.in)
- Conduct quiz, role play, group discussion, etc.,

Textbook for Reference:

1. Jake Vander Plas, "Python Data Science Handbook- Essential tools for working with data", O'REILLY, 2017
2. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications, 2016
3. Raj kamal, Preeti Saxena, "Big Data Analytics-Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Education(India) Pvt Ltd., 2019.

Web-based/Online Resources:

- Python for Data Science: https://www.w3schools.com/datascience/ds_python.asp

1056235320	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
PRACTICAL		0	0	6	3

INTRODUCTION

The Artificial Intelligence Laboratory is designed to provide hands-on experience and practical understanding of various concepts and techniques in artificial intelligence (AI). Through a series of 15 experiments, students will explore fundamental algorithms, methods, and tools used in AI applications. The laboratory exercises will cover areas such as machine learning, natural language processing, computer vision, and robotics.

COURSE OBJECTIVES

- To familiarize students with essential AI concepts and techniques.
- To design and implement search strategies and game playing techniques.
- To provide practical experience in implementing AI algorithms and models.
- To develop problem-solving skills in the context of AI applications.
- To encourage critical thinking and experimentation in AI research and development.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Understand the principles and theories underlying artificial intelligence.

CO2: Implement and analyze various AI algorithms and models.

CO3: Apply AI techniques to solve real-world problems in different domains.

CO4: Evaluate the performance of AI systems and make informed decisions.

CO5: Work effectively in teams to develop AI-based solutions.

PREREQUISITES

- Basic programming skills (preferably in Python).
- Understanding of data structures and algorithms.
- Familiarity with linear algebra and probability theory.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
CO1	3	-	-	-	-	-	-
CO2	2	3	-	3	-	-	-
CO3	2	2	3	3	2	-	-
CO4	1	2	-	-	-	3	1
CO5	1	1	2	-	-	3	-

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- The laboratory sessions will be conducted in a computer lab equipped with necessary software and tools.
- Each experiment will consist of a theoretical introduction followed by practical implementation and analysis.
- Students will work individually or in small groups to complete the experiments.
- Instructors will provide guidance and support as needed, fostering an environment of active learning and collaboration.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	Each Practical 10 Marks	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
1	Aim & Program	35
2	Execution & Result	15
TOTAL		50

CA3: Practical document should be maintained for every exercise / experiment immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination – Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Procedure for the experiment from Part – A (30)	35
2	Aim (05), Procedure for the experiment from Part – B (30)	35
3	Execution of any one experiment from Part – A OR Part – B	25
4	Viva Voce	05
TOTAL		100

1056235320	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
PRACTICAL		0	0	6	3
Part – A					

PRACTICAL EXERCISES		
1.	Construct a Python script for Breadth First Search and Depth First Search Algorithm.	6
2.	Implement a Python program to solve the 8- Puzzle Problem using Breadth-First Search (BFS).	6
3.	Write a Python program to solve the 8 - Queens's problem using Backtracking.	6
4.	Formulate a Python program to find the shortest path in a graph between a given start node and a goal node using the A* Heuristic search Algorithm.	6
5.	Execute a Python Program to find the shortest path in a graph between a given start node and end node using the Memory Bounded A* (MA*) algorithm.	6
6.	Implement a Python program for tic-tac-toe game playing using Minimax decision-making algorithm.	6
7.	Develop a Python program to solve Alpha-Beta Pruning optimization technique.	6
Part – B		
CONTINUOUS ASSESSMENT – 1 (PRACTICAL)		
8.	Create a Python Program to solve a Sudoku Puzzle using Constraint Satisfaction Problem (CSP) and backtracking	6
9.	Construct a Python script to solve the Water-Jug Problem using Breadth-First Search.	6
10.	Implement Python Program to solve Monkey Banana Problem using dynamic programming.	6
11.	Execute a Python Program to Construct knowledge base for any use case and apply inferences in First Order Logic.	6
12.	Implement a Python Program to solve Naïve Bayes classification Models.	6
13.	Write a Python Program to implement Forward Chaining Algorithm.	6
14.	Execute a Python Program to Implement Natural Language Processing: text pre-processing and sentiment analysis.	6
15.	Write a Python program to implement Genetic Algorithm for solving One Max problem.	6

TOTAL HOURS	90
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Suggested List of Students Activity:

- **Python Programming Practice:** Students can engage in coding exercises to reinforce their Python skills, focusing on syntax, data structures, and basic algorithms.
- **Search Algorithms Implementation:** Students work on implementing various search algorithms such as depth-first search and breadth-first search to solve maze navigation problems.
- **Text Preprocessing and Sentiment Analysis:** Students preprocess text data by tokenization and stemming, and then implement sentiment analysis algorithms to classify the sentiment of movie reviews or social media posts.
- **Clustering Techniques Experiment:** Students apply clustering algorithms like K-means to segment datasets into clusters, such as grouping customers based on purchasing behavior.
- **Q-learning Algorithm Implementation:** Students develop a simple game environment and implement Q-learning to train an agent to navigate and collect rewards efficiently.
- **Image Processing and Feature Extraction:** Students apply image processing techniques to preprocess images and extract features for further analysis or classification tasks.
- **Convolutional Neural Network (CNN) Implementation:** Students build CNN models to classify images from datasets like CIFAR-10 or ImageNet into different categories.
- **Recurrent Neural Network (RNN) Experiment:** Students use RNNs to generate text or predict the next word in a sequence based on a given input.

Textbooks for reference:

1. Stuart Russell and Peter Norvig, "**Artificial Intelligence: A Modern Approach**", Pearson Education, 2021.
2. Steven Bird, Ewan Klein, and Edward Loper, "**Natural Language Processing with Python**", O'Reilly Media, 2009.
3. David Barber, "**Bayesian Reasoning and Machine Learning**", Cambridge University Press, 2012.

Website links for reference :

- i. <https://www.jupyter.org>.
- ii. <https://www.coursera.org>.
- iii. <https://www.edx.org>.

- iv. <https://www.udacity.org>.

Equipment / Facilities required conducting the Practical Course

- **Computer Lab:** A dedicated computer lab equipped with workstations or laptops for each student, with appropriate specifications to run **AI software and tools** efficiently.
- **Software Tools:** Install necessary software tools and libraries for AI development and experimentation, including programming environments (**e.g., Python**), AI frameworks (**e.g., TensorFlow, PyTorch, OpenAI Gym library**), and development tools (**e.g., Jupyter Notebook, Anaconda, PyCharm IDEs**).
- **High-Speed Internet Access:** Ensure reliable internet connectivity in the lab to download datasets, access online resources, and facilitate collaborative learning activities.

BOARD PRACTICAL EXAMINATION (MODEL QUESTIONS)

Part-A

1. Construct a Python script for Breadth First Search and Depth First Search Algorithm.
2. Implement a Python program to solve the 8- Puzzle Problem using Breadth-First Search (BFS).
3. Write a Python program to solve the 8 - Queens's problem using Backtracking.
4. Formulate a Python program to find the shortest path in a graph between a given start node and a goal node using the A* Heuristic search Algorithm.
5. Execute a Python Program to find the shortest path in a graph between a given start node and end node using the Memory Bounded A* (MA*) algorithm.
6. Implement a Python program for tic-tac-toe game playing using Minimax decision-making algorithm.
7. Develop a Python program to solve Alpha-Beta Pruning optimization technique.

Part-B

8. Create a Python Program to solve a Sudoku Puzzle using Constraint Satisfaction Problem (CSP) and backtracking.
9. Construct a Python script to solve the Water-Jug Problem using Breadth-First Search.
10. Implement Python Program to solve Monkey Banana Problem using dynamic programming.

11. Execute a Python Program to Construct knowledge base for any use case and apply inferences in First Order Logic.
12. Implement a Python Program to solve Naïve Bayes classification Models.
13. Write a Python Program to implement Forward Chaining Algorithm.
14. Execute a Python Program to Implement Natural Language Processing: text pre-processing and sentiment analysis.
15. Write a Python program to implement Genetic Algorithm for solving One Max problem.

SCHEME OF EVALUATION

End Semester Examination – Practical Exam

PART	DESCRIPTION	MARKS
1	Aim (05), Algorithm and Program from Part-A (30)	35
2	Aim (05), Algorithm and Program from Part-B (30)	35
3	Execution of any one experiment from Part-A OR Part-B	25
4	Viva voce	05
TOTAL		100

1056235440	FUNDAMENTALS OF MACHINE LEARNING	L	T	P	C
PRACTICUM		2	0	2	3

INTRODUCTION

Machine Learning (ML) is basically that field of computer science with the help of which computer systems can provide sense to data in much the same way as human beings do. In simple words, ML is a type of artificial intelligence that extract patterns out of raw data by using an algorithm or method. The key focus of ML is to allow computer systems to learn from experience without being explicitly programmed or human intervention. This subject introduces the basics concepts of machine learning and different algorithms used in machine learning. It covers how to do exploratory data analysis before model building. Several Visualization techniques and applying machine learning algorithms in different applications is covered in this course.

COURSE OBJECTIVES

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Understand a very broad collection of machine learning algorithms and problems.

CO2: Develop an appreciation for what is involved in learning from data.

CO3: Apply structured thinking to unstructured problems.

CO4: Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.

CO5: Appreciate the importance of visualization in the data analytics solution.

PREREQUISITES

A basic course in linear algebra/probability/programming/algorithms is sufficient.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	1	–	–	–	3
C02	3	3	3	2	–	2	–
C03	3	3	3	3	–	3	–
C04	3	3	2	–	3	–	3
C05	3	2	–	–	–	3	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60

Marks	10	15	15	60
Internal Marks	40			60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week
				-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory	
DESCRIPTION	MARKS

Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056235440	FUNDAMENTALS OF MACHINE LEARNING	L	T	P	C
PRACTICUM		2	0	2	3
UNIT I	PARADIGMS OF MACHINE LEARNING				
THEORY	Machine learning: Types of Machine Learning – Supervised Learning – Unsupervised Learning – reinforcement Learning. Machine Learning Life cycle – Gathering data – Data Preparation – Data Preprocessing – Analyze data – Train the model – Test the model – Deployment.				6
PRACTICAL	Exercise 1: Write a python program to import and export data using Pandas library functions.				2
	Exercise 2: Demonstrate various data pre-processing techniques for a given dataset.				2
UNIT II	SUPERVISED LEARNING – REGRESSION				
THEORY	Linear methods –Linear regression, Lasso and Ridge Regression.				6
PRACTICAL	Exercise 3: Write a program for house rent prediction using linear regression (can use any other prediction other than house rent)				2
UNIT III	SUPERVISED LEARNING – CLASSIFICATION I				
THEORY	K- Nearest Neighbor (KNN), Decision Tree, Naïve Bayes.				6
PRACTICAL	Exercise 4: Write a program to implement K – Nearest Neighbor algorithm to classify the given data set. Print both correct and wrong predictions.				2
	Exercise 5: Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.				2
	Exercise 6: Implement Naïve Bayes Classification in Python.				4
UNIT IV	SUPERVISED LEARNING – CLASSIFICATION II				
THEORY	Logistic Regression – Perceptron – Support Vector Machines – Ensemble Methods				6
PRACTICAL	Exercise 7: Develop Logistic Regression Model for a given dataset.				4

Exercise 8: Write a program to construct a Support Vector Machine considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.		4
Exercise 9: a) Implement Random Forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset.		4
UNIT V	UNSUPERVISED LEARNING – CLUSTERING	
THEORY K – means Clustering, Principal Component Analysis (PCA)		6
PRACTICAL Exercise 10: a) Write a python program to implement K-Means clustering Algorithm. b) Implement Dimensionality reduction using Principle Component Analysis (PCA) method.		4
TOTAL HOURS		60

Suggested List of Students Activity:

Students shall work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

Textbooks for Reference:

1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, The MIT Press, 2009.
2. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.

Web-based/Online Resources:

- Introduction to Machine Learning (Tamil): <https://nptel.ac.in/courses/106106236>
- Datasets: <https://archive.ics.uci.edu/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers: 30 Nos
- Laser Printer: 1 No

Software Requirement:

- Operating System: Any Operating System which supports Python or R

- Software: Python or R.

Board Practical Examination

PART – A

1. Write a python program to import and export data using Pandas library functions.
2. Demonstrate various data pre-processing techniques for a given dataset.
3. Write a program for house rent prediction using linear regression (can use any other prediction other than house rent)
4. Write a program to implement K – Nearest Neighbor algorithm to classify the given data set. Print both correct and wrong predictions.
5. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.

PART – B

6. Implement Naïve Bayes Classification in Python.
7. Develop Logistic Regression Model for a given dataset.
8. Write a program to construct a Support Vector Machine considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
9. (a) Implement Random Forest ensemble method on a given dataset.
(b) Implement Boosting ensemble method on a given dataset.
10. (a) Write a python program to implement K-Means clustering Algorithm.
(b) Implement Dimensionality reduction using Principle Component Analysis (PCA) method.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056235541	WEB ANALYTICS	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

Web analytics is the practice of collecting, analyzing, and interpreting data related to website user activity. It provides insights into user behavior, traffic sources, and key performance metrics, enabling informed decision-making for website optimization. By leveraging tools like Google Analytics, businesses can understand their online audience, track conversions, and enhance the overall user experience. Web analytics plays a crucial role in shaping digital strategies, improving marketing effectiveness, and maximizing online performance. In essence, it transforms raw data into actionable insights for optimizing websites and achieving organizational goals.

COURSE OBJECTIVES

To equip students with the knowledge and skills necessary to effectively use web analytics tools, analyze data, and derive actionable insights to enhance the performance of websites and online platforms.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Understand the Web analytics

CO2: Identify Different Data Collection and Web Analytics Strategies

CO3: Apply Different Web Analytics Tools

CO4: Summarize Various Google Analytics and testing

CO5: Develop the knowledge and skills required to measure, monitor and optimize digital marketing activity.

PREREQUISITES

- Basic understanding of websites and online platforms
- Familiarity with basic internet concepts

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	2	3	3	1	3
C02	3	2	2	3	3	1	3
C03	3	2	2	3	3	1	3
C04	3	2	2	3	3	1	3
C05	3	2	2	3	3	1	3

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

Foundational Concepts:

- **Lectures:** Begin with interactive lectures to introduce foundational concepts of web analytics, emphasizing its significance in digital strategies.
- **Demonstrations:** Conduct live demonstrations on setting up basic analytics tools, such as Google Analytics, to give students hands-on experience.

Hands-On Practice:

- **Lab Sessions:** Organize regular lab sessions where students can practice using web analytics tools, analyze sample data, and navigate dashboards.
- **Practical Assignments:** Assign small projects or exercises that require students to apply analytics techniques to real-world scenarios.

Case Studies and Application:

- **Real- World Cases:** Present case studies illustrating how organizations have used web analytics to make informed decisions and optimize their online presence.
- **Application Exercises:** Develop exercises where students apply analytics to solve specific business challenges, fostering critical thinking.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056235541	WEB ANALYTICS	L	T	P	C
PRACTICUM			1	0	4
UNIT I	INTRODUCTION TO WEB ANALYTICS				
THEORY	Overview of Web Analytics – Importance of Data – Driven Decision Making – Key Metrics and Terminology – Evolution of Web Analytics – Commonly Used Analytics Tools.				5
PRACTICAL	Exercise 1: Conduct Stop word elimination & Stemming Preprocessing text document using NLTK of Python. Exercise 2: Conduct Lemmatization, POS tagging & Lexical analysis Preprocessing text document using NLTK of Python.				10
UNIT II	DATA COLLECTION AND SETUP				
THEORY	Basics of Data Collection Techniques – Introduction to Google Analytics – Setting Up Google Analytics Account and Properties – Configuring Views, Filters, and Goals – Integrating Tracking Codes on Websites.				5
PRACTICAL	Exercise 3: Setting Up and Configuring Web Analytics Tools. Exercise 4: Conduct Sentiment analysis on customer review on products.				10
UNIT III	ANALYZING WEB SITE TRAFFIC				
THEORY	Understanding Website Traffic Metrics (Page views, Sessions, Users) – Analyzing User Behavior (Bounce Rate, Time on Page, Exit Rate) – Conversion Metrics and Goal Tracking – Traffic Sources and Attribution Modeling – Real-time Analytics.				5
PRACTICAL	Exercise 5: Conduct Web analytics on Web usage data (web server log data, click stream analysis) Exercise 6: Conduct Web analytics on Hyperlink data.				10
UNIT IV	ADVANCED ANALYTICS TECHNIQUES				
THEORY	Segmenting Users for Deeper Insights – Cohort Analysis and User Retention – Event Tracking and Custom Dimensions – Enhanced E-commerce Tracking – A/B Testing.				5

PRACTICAL		
Exercise 7: Use Google analytics tools to implement the Conversion Statistics.		10
Exercise 8: Use Google analytics tools to implement the Visitor Profiles.		
UNIT V	APPLICATION AND OPTIMIZATION	
THEORY		
Practical Applications of Analytics Insights – User Experience Optimization – Mobile Analytics and Responsive Design – Privacy Considerations and Ethical Practices – Emerging Trends in Web Analytics.		5
PRACTICAL		
Exercise 9: Use Google analytics tools to implement the Traffic Sources.		10
Exercise 10: Use Google analytics tools to implement Real-Time Data Analysis.		
TOTAL HOURS		75

Suggested List of Students Activity:

1. Traffic Source Analysis:

Objective: Analyze the traffic sources of a given website using Google Analytics.

Activity: Students will identify and report on the proportion of traffic coming from organic search, direct, referral, and paid sources. They can explore how different traffic sources impact key metrics.

2. A/B Testing Simulation:

Objective: Simulate an A/B testing scenario for a web page element.

Activity: Students will create two variations of a webpage element (e.g., CTA button), implement A/B testing using tools like Google Optimize, and analyze the results. This hands-on exercise helps them understand the impact of changes on user behavior.

3. Real-world Analytics Project:

Objective: Conduct a comprehensive web analytics project for a chosen website.

Activity: Students will choose a real website and go through the entire process, from setting up analytics and data collection to analyzing the data and providing actionable recommendations. This activity mimics a real-world scenario and enhances practical skills.

4. Interactive Dash board Creation:

Objective: Create an interactive analytics dash board using visualization tools.

Activity: Students will use tools like Google Data Studio or Tableau to create a dashboard that visualizes key metrics from a dataset. This activity enhances their data visualization skills and prepares them for presenting insights in a clear and engaging manner.

Textbooks for reference:

1. Beasley, M. Practical web analytics for user experience: How Analytics can help you understand your users. Morgan Kaufmann Publishers. 2013
2. Avinash Kaushik. Web analytics 2.0: The art of online accountability & science of customer centricity, 1st Edition, John Wiley & Sons, Inc., 2009
3. Avinash Kaushik, Web Analytics: An Hour a Day, 1st Edition, Publisher Indianapolis, Ind. : Sybex, 2007

Website links for reference:

- i. <https://www.hotjar.com/web-analytics/tools/>
- ii. <https://www.ietf.org/policies/web-analytics/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

Desktop / Laptop Computers: 30 Nos with internet connection.

Board Practical Examination**PART – A**

1. Conduct Stop word elimination & Stemming Preprocessing text document using NLTK of Python.
2. Conduct Lemmatization, POS tagging & Lexical analysis Preprocessing text document using NLTK of Python.
3. Setting Up and Configuring Web Analytics Tools.
4. Conduct Sentiment analysis on customer review on products.
5. Conduct Web analytics on Web usage data (web server log data, click stream analysis)

PART – B

1. Conduct Web analytics on Hyperlink data.
2. Use Google analytics tools to implement the Conversion Statistics.
3. Use Google analytics tools to implement the Visitor Profiles.
4. Use Google analytics tools to implement the Traffic Sources.
5. Use Google analytics tools to implement Real-Time Data Analysis.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056235542	CLOUD COMPUTING & IOT	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

This course will introduce the emerging technology cloud computing and Internet of Things. The advantages of cloud services and IOT will give the students the much-needed exposure to the current trend and also a hands-on experience to the students in working with different cloud platform, also enables students in designing and developing Internet of Things applications and models.

COURSE OBJECTIVES

The objective of this course is to

- Introduce the concept of virtualization.
- Outline the concepts of cloud computing.
- Summarize the different types of web services and cloud service providers.
- Elaborate the security issues in cloud.
- Present the cloud applications.
- Enable the students to understand the basic concepts of Internet of Things

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Interpret the concept of virtualization.

CO2: Differentiate various cloud services.

CO3: Work with the different cloud service providers.

CO4: Describe the security issues with cloud and security policies.

CO5: Interface sensors with micro controllers.

PREREQUISITES

- The student should have taken up Computer Networks and Security.
- The student should have the basic Knowledge about network protocols.

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	2	1	1	1	3
C02	2	3	3	1	1	1	3
C03	3	2	2	1	1	1	3
C04	3	2	3	1	1	1	3
C05	3	2	3	1	1	1	3

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- The teacher can use experiential learning as an instructional strategy both in and outside the classroom.
- It may be necessary for the teacher to pre-teach the skills and processes necessary to achieve the intended learning outcomes.
- The teacher needs to encourage students to share their thoughts so that the entire class can benefit from individual insights.
- Teachers can encourage divergent thinking by asking students to transform a teacher guided image into several others of their own creation.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The

students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056235542	CLOUD COMPUTING & IOT	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	CLOUD COMPUTING				
Characteristics of Cloud – Benefits – limitations – Cloud Deployment Models – Cloud service models – Infrastructure as a service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Anything as a Service (XaaS) – SPIVs. Traditional IT Models – Cloud Data Centers.					3
UNIT II	VIRTUALIZATION				
Virtualization, Hypervisors, Types of hypervisors. Virtualization techniques – para virtualization – full virtualization – hardware assisted virtualization – hybrid virtualization.					4
UNIT III	WEB SERVICES AND CLOUD SERVICE PROVIDERS				
Web Services and its types, Google compute engine, Google App Engine, Amazon – Amazon Elastic Compute Cloud – Amazon Simple DB – Amazon Simple Storage Service (S3) – Amazon Cloud Front.					4
UNIT IV	SECURITY IN THE CLOUD				
Storage Location and Tenancy – Cloud Security Challenges – CSA Reference Model – Security Policies and Implementation – Virtualization Security Management.					4
Exercise	Name of Experiment (PART – A)				
1	Create a professional portfolio using Google Slides.				30
2	Use Google Drive as Storage as a Service to Store, Organize, Share and Collaborate.				
3	Install Virtualbox/VMware Workstation with different flavours of Linux or windows OS on top of existing OS.				
4	Install a PaaS Engine (Google App Engine / AWS / Azure or any one PaaS Engine) and create simple web applications using python/java.				
5	Protect Google Sheets and Range with various access permissions.				
6	Create/Launch an instance in AWS/OpenStack and add a security group for the created instance and connect/access the created instance from local computer using SSH.				

UNIT V	INTERNET OF THINGS (IOT)	
Internet of Things – Sensors – Actuators – Micro Controllers - Introduction to Arduino Board and Arduino IDE – Arduino Programming.		30
Exercise	Name of Experiment (PART – B)	
1	Write an Arduino program to display “Hello World” in LCD 16 × 2 Display	
2	Write an Arduino program to create different led patterns and controlling them using push button switches.	
3	Write an Arduino program to control servo motor.	
4	Write an Arduino program to calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD	
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Micro project that shall be an extension of any practical lab exercise to real-world application.

Textbook for Reference:

1. John W Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, –Mastering Cloud Computing, Tata McGraw Hill, 2013.
3. Arsheep Bahga, Vijay Madiseti, Internet of Things - A Hands-On Approach, Universities Press, First Edition, 2015.
4. Raj Kamal, Internet of Things, McGraw Hill Education; First edition, 2017

Website links for reference:

- <https://www.virtualbox.org/>
- <https://cloud.google.com/appengine/>
- <http://www.seanmcilvenna.com/2018/03/26/setting-up-a-java-development-vm-with-virtualbox/>
- Arduino IDE: <https://www.arduino.cc/en/loT/HomePage>

- Wokwi Simulator: <https://wokwi.com/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Software Requirement:

1. VirtualBox/VMWare player
2. Arduino IDE
3. Wokwi Simulator

Hardware Requirement:

1. Workstation with Intel-Core i5 Processor, 16GB RAM, 500GB SSD - 30 Numbers
2. Internet connectivity (100Mbps or more) for all 30 systems
3. Arduino kit – 10 Numbers
4. LED Lights – 10 Numbers
5. 330 K Resistor – 10 Numbers
6. Push Button – 10 Number
7. Servo Motor 5 V DC – 10 Numbers
8. Joystick – 10 Numbers
9. Ultrasonic Sensor – 10 Numbers
10. 16 × 2 LCD Display – 10 Numbers
11. PIR Sensor – 10 Numbers
12. Buzzer – 10 Numbers
13. IR Sensor – 10 Numbers
14. LDR – 10 Numbers
15. LM35 Temperature Sensor – 10 Numbers
16. 5V DC Relay – 10 Numbers
17. Mini Bread Board – 10 Numbers
18. Jumper Wires
19. Data Cables – 10 Numbers

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of the experiment from Part – A or Part – B	25
4	Viva Voce	5
TOTAL MARKS		100

1052235544	MULTIMEDIA SYSTEMS	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

Multimedia application is the combined use of text, images, graphics, animation and video which can be used for business, education and entertainment. This practicum course prepares students to use digital multimedia for communication, creativity, collaboration and critical thinking. It also enables the students to implement their creativity to produce variety of multimedia objects using different multimedia software tools.

COURSE OBJECTIVES

The objective of this course is to

- Understand the basic concepts of multimedia systems.
- Introduce various aspects of multimedia components like Images, audio, video, graphics and animation.
- Gain knowledge on Image, audio and video editing software tools.
- Provide hands-on experience through a series of practical skill building tasks and exercises.
- Develop multimedia applications using various tools.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- CO1: Analyze the key components of multimedia systems.
- CO2: Design an image and edit images using image editing tools.
- CO3: Apply audio and video editing using different editing tools.
- CO4: Create an animation using animation tools.
- CO5: Apply acquired knowledge in the relevant field for the good cause.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	2	3	3	–	–	–
C02	3	3	2	2	–	–	–
C03	3	3	3	3	–	–	–
C04	3	3	3	3	–	–	–
C05	3	3	3	2	–	–	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- In addition to traditional lecture method, different types of teaching methods and media are to be employed to develop the outcome.
- Guide students to create multimedia objects and applying it in relevant application.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60

Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-
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Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30

Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1052235544	MULTIMEDIA SYSTEMS			L	T	P	C
PRACTICUM				1	0	4	3
UNIT I	INTRODUCTION TO MULTIMEDIA						
Definition of Multimedia, Multimedia applications, Multimedia elements, Transition from conventional media to digital media, Delivering of Multimedia product, copy rights.						3	
UNIT II	TEXT						
THEORY Usage of text in multimedia, Fonts and Faces, Hypermedia documents and Hypertext, Hypermedia Structures, Hypertext Tools, Text Editing and Word Processing Tools, OCR Software.						3	
PRACTICAL Exercise 1: Design a poster with different text effects using suitable software						6	
UNIT III	IMAGES						
THEORY Introduction to image, Making Still Images, Image editing tools, Color: Understanding Natural Light and Color, Color models, Color Palettes, Dithering, 2D graphics, Image compression and file formats: GIF, JPEG, JPG, PNG, TIFF, EXIF, PS, PDF.						3	
PRACTICAL Exercise 2: Convert the given image into pencil sketch using suitable photo editing software. Exercise 3: Create a two or more partial scanned images of large poster/photo. Create a panoramic view of multiple photos by stitching together them using any panorama software. Exercise 4: Using photo editor software and/or GIF creator software create an animation such as a flying balloon.						18	
UNIT IV	SOUND						
THEORY Digital Audio, Making Digital Audio Files, MIDI Audio, MIDI vs Digital Audio, Adding Sound to Your Multimedia Project, Audio Recording, Audio file formats, Sound Editing Tools, Sound Synthesis.						3	
PRACTICAL Exercise 5: Use suitable software to (a) compress / decompress audio files. (b)							

convert audio to different formats (c) split, join, rip audio. Exercise 6: Use an audio processing software and perform the audio editing tasks – Import audio, select and edit the sound, create fade-in fade-out effects, label audio segments, use noise remove filter, mix audio, change stereoto mono tracks, export audio to different format and save.	12
UNIT V	VIDEO & ANIMATION
THEORY Video basics – How video works, Analog Video, Digital Video, Video file formats, Shooting and Editing Video. Principle of animations, animation techniques, animation file formats. Basics of multimedia authoring.	3
PRACTICAL Exercise 7: Use a video processing software to perform – Trim video clips, crop video, rotate video, join video, add subtitles, edit video dimension, bit rate, frame rate, sample rate, channel, and video/audio quality tasks on a video. Exercise 8: Create a movie from video clips to demonstrate audio-video mixing, music, video effects, video transitions and titles. Exercise 9: Sketching of cartoon characters using suitable software. Exercise 10: Create a 2D animation of an aeroplane take off using suitable software.	24
TOTAL HOURS	75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Ze- Nian Li and M.S. Drew, Fundamental of Multimedia, Second Edition, Pearson Education, 2014.
2. Tay Vaughan, Multimedia: Making It Work, Ninth Edition, Tata-McGrawHill, 2014.

Website links for reference:

- i. <https://helpx.adobe.com/in/photoshop/using/tools.html>

Equipment / Facilities required for conducting the Practical Portion

Hardware Requirement:

- Desktop Computers
- Printer

Software Requirement:

- Windows / Linux Operating System
- Software tools: open-source software or commercial software. The following list is a suggestive list of open-source software and their commercial replacement. Experiments may be done using either opens-source or commercial software. open-source software is preferred.
- List of Softwares
 1. 2D Graphics and Animation
 - a) Open-Source: OpenToonz, Pencil2D, Blender, Powtoon
 - b) Commercial software: Adobe Flash
 2. Audio Players
 - a) Open-Source: CoolPlayer, MPC-HC, Zing 4g Mp3 Player
 - b) Commercial software: Windows Media Player
 3. Audio Recorders and Editors
 - a) Open-Source: Audacity, Traverso, Qtractor, Frinika
 - b) Commercial: Sonar X1, ACID music studio, Adobe Audition
 4. Multimedia Players
 - a) Open-Source: VLC Media Player, Kodi, Mplayer, MediaPortal
 - b) Commercial: Windows Media Player
 5. Video Editing
 - a) Open-Source: OpenShot, Shotcut, Lightworks, Cinelerra, Kdenlive
 - b) Commercial: Adobe Premiere Pro CS6
 6. Video File Conversion
 - a) Open-Source: DVDStyler, DVD Flick, HandBrake, ffdshow
 - b) Commercial: Movavi Video Converter, Zamzar, Windows Movie Maker

Board Practical Examination

PART – A

1. Design a poster with different text effects using suitable software
2. Convert the given image into pencil sketch using suitable photo editing software.
3. Create a two or more partial scanned images of large poster/photo. Create a panoramic

view of multiple photos by stitching together them using any panorama software.

4. Using photo editor software and/or GIF creator software create an animation such as a flying balloon.
5. Use suitable software to (a) compress / decompress audio files. (b) convert audio to different formats (c) split, join, rip audio.

PART – B

1. Use an audio processing software and perform the audio editing tasks – Import audio, select and edit the sound, create fade-in fade-out effects, label audio segments, use noise remove filter, mix audio, change stereo to mono tracks, export audio to different format and save.
2. Use a video processing software to perform – Trim video clips, crop video, rotate video, join video, add subtitles, edit video dimension, bit rate, frame rate, sample rate, channel, and video/audio quality tasks on a video.
3. Create a movie from video clips to demonstrate audio-video mixing, music, video effects, video transitions and titles.
4. Sketching of cartoon characters using suitable software.
5. Create a 2D animation of an aeroplane take off using suitable software.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1052235546	ROBOTIC PROCESS AUTOMATION	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

In today's digital landscape, businesses are employing automation more and more to increase productivity, streamline operations and reduce cost. This technology revolution is being led by Remote Process Automation, or RPA, which offers powerful tools and techniques to automate repetitive tasks and workflows across various industries. This syllabus is designed to provide students with hands-on experience and comprehensive understanding of Remote Process Automation.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand the fundamentals of RPA tools, including their features and user interface.
- Master the concept of variables in UiPath, covering various variable types.
- Gain proficiency in basic programming concepts such as control flow, including if - else statements, loops, and advanced control flow structures, through hands-on experience in UiPath Studio.
- Develop skills in advanced automation techniques including recording, table extraction, selectors, and automation of Excel and PDF files using UiPath.
- Learn how to build and manipulate data tables both statically and dynamically using UiPath, including techniques such as data scraping for dynamic table creation.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Download, install, and activate UiPath Studio, and gain proficiency in using the tool to develop RPA solutions.

CO2: Demonstrate a deep understanding of variables in UiPath, including their types and management best practices, allowing them to handle data effectively within automation workflows.

CO3: Identify and apply Image, Text, and Data Tables Automation.

CO4: Handle User Events and various types of Exceptions effectively.

CO5: Deploy and maintain Robots efficiently.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	3	–	–	3	1
C02	3	3	3	–	–	3	2
C03	3	3	3	–	–	3	1
C04	3	3	3	–	–	3	2
C05	3	3	3	–	–	3	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Understanding RPA Concepts: Begin by introducing learners to the basic concepts of RPA, including its definition, benefits, and common use cases across different industries. Explain the difference between attended and unattended automation and introduce key RPA tools and platforms.
- Interactive Learning: Utilize interactive learning methods such as quizzes, polls, and group discussions to reinforce learning and promote engagement.
- Real-world Examples: Incorporate real-world examples and case studies to illustrate how RPA tools are used in various industries and scenarios. Showcasing practical applications will enhance understanding and highlight the relevance of RPA skills in the job market.
- Peer Learning: Encourage participants to exchange ideas, review each other's work, and provide constructive feedback.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60

Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30

Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1052235546	ROBOTIC PROCESS AUTOMATION	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	RPA TOOL INTRODUCTION				
Introduction to RPA Tools and User Interface – Overview of popular RPA tools and their features – Understanding the user interface of RPA tools. Variables: Types – Generic Value Variables – Text Variables – True or False Variables – Number Variables – Array Variables – Date and Time Variables – Data Table Variables – Naming Best Practices and Management.					15
PRACTICAL Exercise 1: Download, Install and Activate Ui-Path Studio. Learn all the basics of RPA (Variables, arguments and Control flow etc.) Exercise 2: Write a program to empty the trash folder in Gmail.					
UNIT II	BASIC PROGRAMMING CONCEPTS				
THEORY Control flow concepts – If Else Statements – Loops – Advanced Control Flow – Sequences – Flowcharts – Control Flow Activities – The Assign Activity – The Delay Activity – The Do While Activity – The If Activity – The Switch Activity – The While Activity – The For Each Activity – The Break Activity.					15
PRACTICAL Exercise 3: Write a program in UI Path that utilizes the If activity and Switch activity to find the smallest and largest numbers in an array. Exercise 4: Write a program in UI Path that utilizes the While activity, Do-While activity, and For-Each activity to increment an integer variable from 5 to 50 in increments of 5.					
UNIT III	ADVANCED AUTOMATION CONCEPTS & TECHNIQUES				
THEORY Recording Introduction – App / Web Recording – Table Extraction – Selectors - Excel Automation: Basics, Information Retrieval in Data Tables – Data Manipulation in excel – PDF Automation: Extracting Data from PDF – Extracting a single piece of data – Anchors – Using anchors in PDF.					21
PRACTICAL Exercise 5: Write a program to (i) build a data table(static) (ii) build a data table using data scraping (Dynamically). Exercise 6: Write a program to read an Excel file and creating a data table by using					

data from the Excel file.		
Exercise 7: Write a program to demonstrate the concept of dynamic elements in UIPath selectors.		
UNIT IV	HANDLING USER EVENTS & EXCEPTION HANDLING	
THEORY		
Triggers: Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - An example of monitoring email.		
Exception Handling - Strategies for handling errors and exceptions - Implementing error - catching mechanisms in RPA workflows.		9
PRACTICAL		
Exercise 8: Write a program to demonstrate email automation. (Note: use triggers and exception handling)		
UNIT V	DEPLOYING AND MANAGING THE BOT	
THEORY		
Orchestrator overview for Automation Developers – Working with Orchestrator Resources. Managing packages – Uploading packages – Deleting packages.		
PRACTICAL		
Exercise 9: Create an automation project in UiPath studio and publish and control the same using uipath orchestrator.		15
Exercise 10: Write a program to demonstrate manage package, upload package and deleting package for a reusable component.		
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018
2. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation, First Edition 2015.

3. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant”, Independently Published, First Edition 2018.

Website links for reference:

- i. <https://www.uipath.com/rpa/robotic-process-automation>
- ii. <https://www.academy.uipath.com>

Equipment / Facilities required to conduct the Practical Course

- Desktop Computers.
- UiPath Studio.

Board Practical Examination

PART – A

1. Download, Install and Activate Ui-Path Studio. Learn all the basics of RPA (Variables, arguments and Control flow etc.)
2. Write a program to empty the trash folder in Gmail.
3. Write a program in UI Path that utilizes the If activity and Switch activity to find the smallest and largest numbers in an array.
4. Write a program in UI Path that utilizes the While activity, Do-While activity, and For-Each activity to increment an integer variable from 5 to 50 in increments of 5.
5. Write a program to (i) build a data table(static) (ii) build a data table using data scraping (Dynamically).

PART – B

6. Write a program to read an Excel file and creating a data table by using data from the Excel file.
7. Write a program to demonstrate the concept of dynamic elements in UiPath selectors.
8. Write a program to demonstrate email automation. (Note: use triggers and exception handling)
9. Create an automation project in UiPath studio and publish and control the same using uipath orchestrator.
10. Write a program to demonstrate manage package, upload package and deleting package for a reusable component.

SCHEME OF VALUATION

S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056235654	INNOVATION AND STARTUP	L	T	P	C
Practicum		1	0	2	2

Introduction:

The integration of Innovation and Start-ups concept within the syllabus is testament to the forward thinking nature of educational institutions. By introducing this concept, students are provided with a solid foundation upon which they can build their skills in Innovation and Start-ups. This course can bridge the gap between theory and practice. It allows students to apply the knowledge they have acquired in a real world context, thereby enhancing their understanding and retention of the above concept. This experimental learning approach not only fosters a deeper level of engagement but also trains student with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. With necessary tools and knowledge, educational institutions are preparing the next generation of entrepreneurs to tackle the challenges and opportunities that lie ahead. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organizations

Course Objectives:

The objective of this course is to enable the students

- To understand the concept of Innovation and Start-ups
- To acquire knowledge of Prototype development, IPR, Patents and Copyrights
- To have the practical experience in preparing Business plan for Start-ups
- To visit the existing nearby industry to prepare project report about the present challenges of that industry
- To know the different funding supports available from Government and Non-Government schemes for Start-ups

Course Outcomes:

After successful completion of this course, the students should be able to

C01: Differentiate between Innovation and Start-ups

C02: Explain the importance of IPR, Patents and Copyrights.

C03: Describe the methodology to be adopted for preparing the Business Plan

C04: Gain practical experience by Industrial training and visiting the nearby industry

C05: Explore and identify various funding facilities available from Government and Non-Government Schemes for Start-ups

Pre-requisites:

There are no specific prerequisites for this course, although a basic understanding of business and technology concepts would be beneficial.

CO/PO Mapping

CO / PO	P01	P02	P03	P04	P05	P06	P07
C01	-	-	1	-	2	3	3
C02	-	-	1	-	2	3	3
C03	-	-	1	-	2	3	3
C04	-	-	1	-	2	3	3
C05	-	-	1	-	2	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Assessment Methodology

	Continuous Assessment (40 marks)			End Semester Examination (60 marks)
	CA1	CA2	CA3	
Mode	Class Assessment (Unit I,II & Unit III)	Seminar Presentations (Unit IV)	Submission of Industry Visit Project Report (Unit V)	Practical Examination (Project)
Duration	2 hours	---	---	3 hours
Exam Marks	50	20	30	100
Converted to	10	10	20	60
Marks	10	10	20	60

Continuous Assessment - 40 marks

S. No	Description	Marks
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CA1	Class Assessment (50 marks) - Unit – I,II & III Written Examination - Theory Questions i) 10 questions out of 15 questions (10 x 3 marks :30 marks) ii) 4 questions out of 6 questions (4 x 5 marks : 20 marks)	10 marks
CA 2	Seminar Presentations (20 marks- each topic carries 10 marks) - Unit IV Students should present any two topics with PPTs	10 marks
CA 3	Submission of Industry Visit Project Report - (30 marks) - Unit V	20 marks
	Total	40 marks

End Semester Examination –Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations.

Detailed Allocation of Marks

S. No	Description	Marks
Part A	Written Examination – Unit –I,II & III Theory Questions	
i)	10 questions out of 15 questions (10 x 3 marks = 30 marks)	45
ii)	3 questions either or pattern (3 x 5 marks = 15 marks)	
Part B		
i)	Presentation of Industry Visit Project Report	25
ii)	Interaction and Evaluation	30
	TOTAL	100

1056235654		INNOVATION AND STARTUP			
Practicum		L	T	P	C
		1	0	2	2
Unit I	INTRODUCTION TO INNOVATION				
An Introduction to Innovation and Creativity- Innovation in current Environment - Types of Innovation - Challenges of Innovation - Steps of Innovation Management - Divergent v/s Convergent thinking - Design thinking and Entrepreneurship					6
Unit II	INCUBATION CLUBS, IPR, PATENTS AND COPYRIGHTS				
Idea Generation - Incubation Clubs - Prototype Development - Marketing of Innovation - Management of Innovation - Creation of IPR -Types of IPR - Patents and Copyrights - Patents in India - Technological and Non-Technological Innovation Process.					6
Unit III	GOVERNMENT AND NON-GOVERNMENT FUNDING SCHEMES FOR START-UPS				
An introduction to Start-up - Start-ups in India - Procedure for registration of Start-ups - Business Model- Business Plan - Case Studies - Opportunities and Challenges - Funding supports from Government Schemes -MUDRA, TANSEED, NEEDS, PMEGP, UYEGP – Non-Government Schemes - CSR Fund - Angel Investors - Venture Capitalist					6
Unit IV	SEMINAR				
All the students have to select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation					9
1. Idea Generation					
2. Innovation Management					
3. Product Development					
4. Business Model Innovation					
5. Organizational Culture and Change Management					
6. Leadership and Innovation					
7. Barriers to Innovation					
8. Innovation Marketing					
9. E-Commerce success stories (any one)					
10. Role of Start-ups in Higher Education					

11. Professional Networking in Building Brands		
How to start a start-up in India		
Unit V	EXPOSURE TO INDUSTRY	
All the students should visit and study the nearby industries, incubation centres, start-ups etc., and select any one to prepare a project report which covers the Name of the Industry/Organization, Introduction of the Industry, Type of the Industry, Scope of the Industry, Plant Layout and Location, Details of Plant and Machineries, Process flow chart, Manufacturing Methods, Process of Manufacturing, Product Manufacturing, Quality Control, Marketing, Product selling - Conclusion		18
TOTAL HOURS		45

1056235773	INDUSTRIAL TRAINING	SUMMER	C
Theory		VACATION	2

Introduction

Industrial training is a crucial component of the diploma engineering curriculum, designed to bridge the gap between theoretical knowledge and practical application. Typically conducted during vacation periods, this two-week training program provides students with hands-on experience in their respective engineering fields. The primary objectives are to enhance practical skills, familiarize students with industry standards, and prepare them for future employment.

Two-week industrial training during vacation periods is an invaluable part of diploma engineering education. It not only equips students with practical skills but also provides a comprehensive understanding of the industry, preparing them for successful engineering careers.

Objectives

1. Practical Exposure: Students gain direct exposure to real-world engineering practices, tools, and technologies.
2. Skill Enhancement: The training helps in developing technical and soft skills that are essential for professional growth.
3. Industry Insight: Students learn about the working environment, operational procedures, and challenges faced by industries.
4. Professional Networking: The training offers opportunities to interact with industry professionals, which can be beneficial for career prospects.
5. Application of Knowledge: It allows students to apply classroom knowledge to solve practical problems, enhancing their understanding and retention of engineering concepts.

Structure of the Training Program

- Orientation: Introduction to the company, its operations, and safety protocols.
- Project Assignment: Students are assigned specific projects or tasks relevant to their field of study.
- Supervision and Mentorship: Industry professionals guide and mentor students throughout the training.
- Skill Development Workshops: Sessions on technical skills, software tools, and industry best practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive to potential employers.
- Confidence Building: Working in a real-world setting boosts confidence and professional demeanor.
- Clarified Career Goals: Exposure to various roles and responsibilities helps students define their career paths.

Course Outcomes

CO 1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO 2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO 3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO 4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO 5: Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

One faculty mentor should be assigned for every 30 students by the HOD / Principal. Faculty mentors shall play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

Pre-Training Responsibilities:

1. Orientation and Preparation:
 - Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
 - Assist students in understanding the importance of industrial training in their academic and professional development.
2. Placement Coordination:
 - Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
 - Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.
3. Training Plan Development:

- Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
- Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:

- Regularly monitor the progress of students during their industrial training. Maintain communication with both students and industry supervisors to track performance and address any issues that may arise.
- Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.

5. Technical Guidance:

- Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.

6. Problem-Solving Assistance:

- Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.

7. Feedback and Evaluation:

- Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
- Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:

- Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
- Help students articulate their learning outcomes and how these experiences contribute to their professional growth.

9. Documentation and Reporting:

- Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.

- Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.

10. Career Counseling:

- Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.

11. Continuous Improvement:

- Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.
- Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.

By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

Instructions to the students

Before Starting Industrial Training:

1. **Orientation and Preparation:**

- Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.
- Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.

2. **Setting Goals:**

- Set clear and specific goals for your industrial training period. Define what skills, knowledge, and experiences you aim to gain during this time.
- Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.

3. **Professional Attire and Conduct:**

- Dress appropriately and professionally according to the standards of the industry and host organization.
- Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. **Learning and Engagement:**

- Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
 - Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
- Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
 - Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.
6. Professionalism and Communication:
- Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
 - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
- Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
 - Follow all safety guidelines and regulations to ensure your well-being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:
- Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
 - Maintain a journal or log documenting your daily activities, achievements, and lessons learned during the training period.
9. Feedback and Evaluation:
- Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
 - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
- Use your industrial training experience to inform your career planning and decision-making process.
 - Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.

By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

Every student has to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution faculty mentor.

Training Reports

The students have to prepare reports: The report in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while awarding Internal assessment.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organisation.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 40 Marks by industry supervisor and polytechnic faculty mentor for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Self expression / communication skills. Interpersonal skills / Human Relation.	10
D	Report and Presentation.	10
Total		50

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of industrial training. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report and Attendance certificate.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

SEMESTER 6

1056236110	ARTIFICIAL INTELLIGENCE AND ROBOTICS	L	T	P	C
THEORY		4	0	0	4

INTRODUCTION

The course "Artificial Intelligence and Robotics" is designed to introduce students to the fundamental concepts, techniques, and tools that enable machines to perform tasks that require human intelligence and physical capabilities. This course covers both theoretical and practical aspects of artificial intelligence (AI) and robotics, including machine learning, computer vision, natural language processing, robot kinematics, dynamics, control, and planning.

COURSE OBJECTIVES

By the end of this course, students will be able to:

- Understand the key concepts and methodologies in artificial intelligence and their applications in robotics.
- Develop and implement algorithms for machine learning, computer vision, and natural language processing.
- Analyze and design robotic systems, including their kinematics, dynamics, and control.
- Integrate AI techniques with robotic hardware to solve real-world problems.
- Evaluate the performance of AI and robotic systems and refine them for optimal performance.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Demonstrate knowledge of AI principles and apply them to robotic systems.

CO2: Implement machine learning algorithms for perception and decision-making in robots.

CO3: Design and control robotic manipulators and mobile robots.

CO4: Apply computer vision techniques to enable robots to understand and interact with their environment.

CO5: Use natural language processing to enable human-robot interaction.

CO6: Develop and execute comprehensive projects that integrate AI and robotics concepts.

PREREQUISITES: Knowledge of basic Artificial Intelligence

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	–	–	–	–	1	–
C02	–	3	–	–	2	–	–
C03	–	3	–	2	–	–	–
C04	–	–	3	–	1	–	–
C05	–	–	–	3	–	–	2
C06	–	–	–	–	3	2	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- Guide student(s) in undertaking micro-projects.
- Different types of teaching methods such as flipped classroom, tutorials, peer-peer learning may be employed by teachers to develop the outcomes. About 10-15% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-learning, but to be assessed using different assessment methods.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test (Two Units)	Written Test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 hour	3 hours	3 hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6 th Week	12 th Week	13 – 14 th Week	16 th Week	–

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal

assessment of 15 Marks.

CA1 and CA2 Assessment test should be conducted for two units as below.

PART A: (5 × 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern: Model Examination and End Semester Examination

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. (5 × 20 Marks = 100 Marks)

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1056236110	ARTIFICIAL INTELLIGENCE AND ROBOTICS			L	T	P	C
THEORY				4	0	0	4
UNIT I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE						
Definition and scope of artificial intelligence, History and evolution of AI, Problem-solving techniques: search algorithms, heuristic methods, intelligent agent architecture.							12
UNIT II	MACHINE LEARNING						
Introduction to machine learning, Supervised learning: regression, classification, Unsupervised learning: clustering, dimensionality reduction, Reinforcement learning: Markov decision processes, Q-learning							12
UNIT III	NATURAL LANGUAGE PROCESSING						
Introduction to NLP, Text preprocessing and feature extraction, Language models and sequence modelling, Applications of NLP in robotics: speech recognition, language understanding, dialogue systems							12
UNIT IV	ROBOTICS FUNDAMENTALS AND CONTROL						
Introduction to robotics: history, components, and types of robots, Robot kinematics: forward and inverse kinematics, Robot dynamics: equations of motion, Motion planning and trajectory generation Control theory basics: PID control, state-space representation, Advanced control techniques: adaptive control, robust control, and optimal control, Implementation of control algorithms in robotic systems							12
UNIT V	ADVANCED TOPICS IN AI AND ROBOTICS						
Autonomous navigation and path planning, multi-robot systems and swarm robotics, Reinforcement learning for robotic control, Ethical and societal impacts of AI and robotics							12
TOTAL HOURS							60

Suggested List of Students Activity:

- Assignment preparation from web sources.
- ICT tools for conducting assessments.

Textbook for reference:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" Pearson Education, 2021

2. John J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson, 4th Edition, 2017
3. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modeling and Control", Wiley, 2nd Edition, 2020

Website link for reference:

- i. Udemy – Introduction to Robotics and Artificial Intelligence
<https://www.udemy.com/course/introduction-to-robotics-artificial-intelligence/>
- ii. <https://gaoyichao.com/Xiaotu/resource/refs/PR.MIT.en.pdf>
- iii. <https://www.changjiangcai.com/files/text-books/Introduction-to-Robotics-3rd-edition.pdf>

1056236241	GAME DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

Creating and developing interactive experiences, usually in the form of games, is what it means to be a game designer. The rules, mechanics, and general structure of a game are created by game designers, who also have the responsibility of influencing the player's experience and involvement. This course is designed to introduce students to the elements and structure of game design and development. The areas of major emphasis in the course are game methodology, programming, game genres, game theory and 2D interactive experiences, and immersive environments. Students will apply both creative and technical skills to design and refine in addition to implementing the adventure. The appropriate use of technology is an integral part of this course.

COURSE OBJECTIVES

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment.

COURSE OUTCOMES

CO1: Explain the concepts of 2D and 3d Graphics

CO2: Design game design documents.

CO3: Implementation of gaming engines.

CO4: Survey gaming environments and frameworks.

CO5: Implement a simple game in Pygame.

PREREQUISITES: Basics of Computer Engineering

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
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CO1	3	2	2	1	1	2	1
CO2	1	2	2	1	1	2	1
CO3	1	1	1	2	1	2	1
CO4	3	3	1	3	1	2	1
CO5	3	3	2	1	1	2	1

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- Guide student(s) in undertaking micro-projects.
- Different types of teaching methods such as flipped classroom, tutorials, peer-peer learning may be employed by teachers to develop the outcomes.
- About 10 – 15% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-learning, but to be assessed using different assessment methods.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The

marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal

assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056236241	GAME DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	INTRODUCTION TO GAME				
THEORY	Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.				6
PRACTICAL	Exercise 1: Explore various games (any 5) and identify components of each game. Exercise 2: Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game.				9
UNIT II	GAME DESIGN PRINCIPLES				
THEORY	Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.				6
PRACTICAL	Exercise 3: Character design, sprites, movement and character control. Exercise 4: Level design: design of the world in the form of tiles along with interactive and collectible objects.				9
UNIT III	GAME ENGINE DESIGN				
THEORY	Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.				6
PRACTICAL	Exercise 5: Design of interaction between the player and the world, optionally using the physics engine. Exercise 6: Study game development by exploring major genres, player dynamics, platform considerations, game concepts, and the role of storyboards in shaping narratives.				9
UNIT IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS				
THEORY					6

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.		
PRACTICAL Exercise 7: Set-up of Unity development environment and basic introduction to tools, navigation and interface. Exercise 8: Develop a game scene which contains multiple game objects, apply transform on them and do lights and camera settings. Exercise 9: Developing a 2D interactive using Pygame		9
UNIT V	GAME DEVELOPMENT USING PYGAME	
THEORY Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games		6
PRACTICAL Exercise 10: Develop a 2D game project in Unity that incorporates essential elements like scenes, game objects, lights, camera, basic 2D physics - Collider, and Rigidbody. Exercise 11: Develop any 2D game by using various features of Unity game engine. Exercise 11: Developing a 3D Game using Unreal.		9
TOTAL HOURS		75

Suggested List of Students Activity:

- Undertake micro-projects in teams.
- <https://code.org/>, an hour of code may be organized and students are encouraged to participate
- Students are encouraged to register themselves in various MOOCs such as: Swayam, edX, Coursera, Udemy etc. to further enhance their learning.
- List the applications which are developed using Unity IDE and other Game developing IDE Tool.
- Encourage students to participate in different coding competitions like hackathon, online competitions on code chef etc.
- Encourage students to form a coding club at institute level and can help the slow learners.

Textbook for reference:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley, 2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress, 2007.
3. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press, 2006.

Website link for reference:

- i. <https://docs.unity3d.com/Manual/UnityManual.html>
- ii. <https://www.udemy.com/course/game-design-fundamentals/>
- iii. <https://www.udemy.com/course/unitycourse2/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)**Hardware Requirement:**

- Desktop Computers / Laptop – 30 Nos
- Laser Printer – 1 Nos

Software Requirement:

- Windows 7 or higher Ver., / Linux Operating System with 4GB or higher RAM
- Unity IDE

BOARD PRACTICAL EXAMINATION**PART – A**

1. Explore various games (any 5) and identify components of each game.
2. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game.
3. Character design, sprites, movement and character control
4. Level design: design of the world in the form of tiles along with interactive and collectible objects.
5. Design of interaction between the player and the world, optionally using the physics engine.
6. Study game development by exploring major genres, player dynamics, platform considerations, game concepts, and the role of storyboards in shaping narratives.

PART – B

1. Set-up of Unity development environment and basic introduction to tools, navigation and interface.

2. Develop a game scene which contains multiple game objects, apply transform on them and do lights and camera settings.
3. Developing a 2D interactive using Pygame.
4. Develop a 2D game project in Unity that incorporates essential elements like scenes, game objects, lights, camera, basic 2D physics- Collider, and Rigid body.
5. Develop any 2D game by using various features of Unity game engine.
6. Developing a 3D Game using Unreal.

SCHEME OF EVALUATION		
SNO.	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part A or Part B)	15
4	Output	10
5	Viva voce	05
6	Total	100

1056236242	APPLIED ARTIFICIAL INTELLIGENCE	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

This course serves as the gateway to the exciting world of Applied Artificial Intelligence (AI). In this course, we will embark on a journey to explore the foundational concepts, theories, and practical applications that underpin the field of AI and Machine Learning (ML). Understanding AI and its practical applications is not only crucial for staying relevant in today's job market but also for contributing to the advancement of society through innovative solutions.

COURSE OBJECTIVES

The primary objective of this course is to provide students with a comprehensive understanding of Applied AI and its integration with Machine Learning techniques. By the end of this course, students will:

- Gain insight into the fundamental principles and concepts of Artificial Intelligence.
- Develop proficiency in programming languages commonly used in AI and ML applications, such as Python.
- Acquire hands-on experience in implementing AI algorithms and models using popular libraries and frameworks.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Demonstrate a comprehensive understanding of the foundational concepts, principles, and techniques of Artificial Intelligence (AI) and its subfields, including Machine Learning (ML), Neural Networks, and Deep Learning.

CO2: Develop proficiency in programming languages commonly used in AI and ML applications, particularly Python, and will be able to apply programming skills to implement AI algorithms and models.

CO3: Apply a variety of AI techniques, including supervised and unsupervised learning, neural networks, and deep learning, to solve real-world problems across diverse domains such as healthcare, finance, and cybersecurity.

CO4: Cultivate critical thinking and problem-solving skills necessary for analyzing complex datasets, designing AI solutions, evaluating model performance, and iteratively improving AI algorithms.

CO5: Develop an awareness of the ethical, social, and legal implications of AI technologies.

PREREQUISITES: Basics of Computer Engineering, Artificial Intelligence

CO/PO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	2	2	1
CO2	3	2	2	1	2	1	2
CO3	3	2	1	3	1	2	2
CO4	2	2	1	1	2	1	1
CO5	2	3	1	2	1	1	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

INSTRUCTIONAL STRATEGY

Throughout this course, a variety of instructional strategies will be employed to cater to different learning styles and preferences. These may include:

- Lectures: To provide theoretical foundations and conceptual understanding.
- Hands-on Coding Workshops: To reinforce learning through practical implementation of AI algorithms and models.
- Case Studies and Real-world Applications: To showcase how AI is being used to solve real-world problems across various industries.
- Group Discussions and Collaborative Projects: To foster collaboration and peer learning.
- Guest Lectures and Industry Insights: To expose students to the latest trends and developments in the field of AI from industry experts.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60

Marks	10	15	15	60
Internal Marks	40			60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week
				-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION			MARKS
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30

Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1056236242	APPLIED ARTIFICIAL INTELLIGENCE	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	FOUNDATIONS OF APPLIED AI				
THEORY	<p>1.1 Introduction to Applied AI: Definition of applied AI and its significance in various domains and Overview of course objectives and structure for the session</p> <p>1.2 Fundamentals of Machine Learning: Explanation of machine learning concepts: Examples of machine learning applications in real-world scenarios.</p> <p>1.3 Introduction to Deep Learning: Definition and Scope of Deep Learning, Deep Learning vs. Traditional Machine Learning, Basic Neural Network Components.</p>				6
PRACTICAL	<p>Exercise 1: Write a program to implement DFS and BFS using Python.</p> <p>Exercise 2: Data cleaning process using filters in Python.</p>				9
UNIT II	AI IN HEALTH CARE, BUSINESS AND FINANCE				
THEORY	<p>2.1 AI in Health care: Medical Imaging and Diagnostics, Health Monitoring and Predictive Analytics.</p> <p>2.2 AI in Finance: Fraud Detection and Risk Management, Algorithmic Trading and Portfolio Management, Credit Scoring and Loan Approval Systems.</p> <p>2.3 AI in Business Operations: Supply Chain Optimization and Demand Forecasting, Predictive Maintenance and Quality Control.</p>				6
PRACTICAL	<p>Exercise 3: K-Means cluster Algorithm - application and usage in Python.</p> <p>Exercise 4: Image pre-processing techniques using python image libraries.</p>				9
UNIT III	AI IN TRANSPORTATION AND SMART CITIES				
THEORY	<p>3.1 AI in Transportation: Autonomous Vehicles and Self-Driving Technology, Traffic Management and route Optimization & scheduling, Predictive Maintenance for Vehicles and Infrastructure.</p> <p>3.2 AI in Smart Cities: AI in managing utilities, Smart buildings and energy efficiency, Environmental Monitoring and management, Public Safety and Emergency Response Systems.</p>				6

PRACTICAL		
Exercise 5: Image noise removal and Quality improvement using Python.		
Exercise 6: Develop a program for feature selection and feature extraction in Python.		9
UNIT IV	AI IN INDUSTRY	
THEORY		
4.1 Manufacturing: Fundamentals of Manufacturing Processes, AI Applications in Predictive Maintenance, AI for Quality Control and Inspection, Supply Chain Management.		
4.2 Agriculture: Introduction to AI in Agriculture, Fundamentals of Agricultural Systems, Crop Monitoring and Management, Disease Detection and Pest Management, Irrigation Management.		6
4.3 Retail: Fundamentals of Retail Operations, Personalized Marketing and Customer Insights, Price Optimization and Dynamic Pricing, Customer Service and Chat bots.		
PRACTICAL		
Exercise 7: Write a program for developing linear regression model using Python.		
Exercise 8: Develop a program for logistics regression model using Python.		
Exercise 9: Write a Program to find the solution for travelling salesman problem using Python.		12
UNIT V	EMERGING TRENDS AND FUTURE DIRECTIONS	
THEORY		
5.1 Advances in AI Research and Development: Advances Research and Development in AI, Current AI Research Challenges and Directions.		
5.2 Edge AI and Internet of Things (IoT): Introduction to IoT and Edge Computing, Edge AI Architectures and Frameworks, Real-world Applications of Edge AI and IoT.		6
5.3 AI Ethics and Responsible AI Development: Introduction to AI Ethics, Ethical Issues in AI, Ethical Decision Making in AI, Accountability and Responsibility.		
PRACTICAL		
Exercise 10: Develop ANN/CNN framework for an application using Python.		6
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments

based on the course.

- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.
- Micro project that shall be extension of any practical lab exercise to real world application.
- Conduct of Ideathon to generate innovative solutions to real life problems.

Text and Reference Books:

- Jeff Prosser, Applied Machine Learning and AI for Engineers: Solve Business problems that can't be solved Algorithmically (Gray scale Indian edition), First Edition, shroff/O' reilly, 2022.
- Lavika Goel, Artificial Intelligence (Concepts and Applications).
- Pethuru Ray & G Nagarajan, Applied Edge AI, First Edition, Auer Bach Publications, 2022.

Web-based/Online Resources:

- <https://chatgpt.com/>
- <https://www.tandfonline.com/toc/uaii20/38/1?nav=toCList>
- <https://www.geeksforgeeks.org/introduction-to-applied-ai/>

Equipment/Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

Hardware Requirement:

- Desktop Computers / Laptop – 30 Nos
- Laser Printer – 1 Nos

Software Requirement:

- Windows 7 or higher Ver., / Linux Operating System with 4GB or higher RAM
- Python Programming

Board Practical Examination

PART – A

1. Write a program to implement DFS and BFS using Python.
2. Data cleaning process using filters in Python.
3. K-Means cluster Algorithm - application and usage in Python.
4. Image preprocessing techniques using python image libraries .
5. Image noise removal and Quality improvement using Python.

PART – B

1. Develop a program for feature selection and feature extraction in Python.
2. Write a program for developing linear regression model using Python.
3. Develop a program for logistics regression model using Python.
4. Write a Program to find the solution for travelling salesman problem using Python.
5. Develop an ANN/CNN frame work for an application using Python.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1052236245	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

This course is concerned with the development of applications on mobile and wireless computing platforms. Android will be used as a basis for teaching programming techniques. Students will work at all stages of the software development life-cycle from inception through to implementation and testing.

COURSE OBJECTIVES

The objective of this course is to

- To facilitate students to understand android SDK.
- To help students to gain a basic understanding of Android application development.
- To inculcate working knowledge of Android Studio development tool.
- To test Android applications.
- To deploy Android applications.

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Identify various concepts of mobile programming that make it unique from programming for other platform.

CO2: Critique mobile applications on their design pros and cons.

CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.

CO4: Test Android applications.

CO5: Deploy applications to the Android marketplace for distribution.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	2	1	1	1	–
C02	3	3	2	1	1	1	–
C03	3	3	2	1	1	1	–
C04	3	3	2	1	1	1	–
C05	3	3	2	1	1	1	–

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real- world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability-based.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where they could be the source of error, if any.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				60
Tentative Schedule	7 th Week	14 th Week	15 th Week	16 th Week	-

Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION		MARKS	
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1052236245	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT				
THEORY	Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building First Android application.				3
PRACTICAL	Exercise 1: Implement "Hello World" Android example. Exercise 2: Develop an application that uses GUI components, Font and Colours.				12
UNIT II	INTRODUCTION TO ANDRIOD				
THEORY	Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Android Manifest File and its common settings.				3
PRACTICAL	Exercise 3: Develop an application that uses Layout Managers and event listeners. Exercise 4: Write an application that draws basic graphical primitives on the screen.				12
UNIT III	ANDROID USER INTERFACE DESIGN				
THEORY	Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts.				3
PRACTICAL	Exercise 5: Develop an application that makes use of Notification Manager. Exercise 6: Implement an application that writes data to the SD card.				12
UNIT IV	TESTING AND MANAGING ANDROID APPLICATIONS				
THEORY	Testing Android applications, Publishing Android application, Using Android preferences.				6
PRACTICAL	Exercise 7: Develop a native application that uses GPS location information. Exercise 8: Develop an application for sending & receiving SMS.				12
UNIT V	ANDROID APIs AND DEPLOYING ANDROID APPLICATION				
THEORY					3

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Using Android Networking APIs, Using Android Web and Telephony APIs, Deploying Android Application to the World.	
PRACTICAL Exercise 9: Develop an application that makes use of SQLite databases. Exercise 10: Write an application that creates alarm clock.	12
TOTAL HOURS	75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- Micro project that shall be an extension of any practical lab exercise to real-world application

Textbook for Reference:

1. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", 1st edition, O'Reilly, 2017.
2. John Horton, Android Programming for Beginners, 2nd edition, Packt Publishing, 2018.
3. Barry Burd, Android Application Development All-in-One For Dummies, 2nd edition, For Dummies, 2020.

Website links for reference:

1. <https://developer.android.com/get-started/overview>
2. <https://developer.android.com/courses/>

Board Practical Examination

PART – A

1. Implement "Hello World" Android example.
2. Develop an application that uses GUI components, Font and Colours.
3. Develop an application that uses Layout Managers and event listeners.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of Notification Manager.

PART – B

6. Implement an application that writes data to the SD card.
7. Develop a native application that uses GPS location information.
8. Develop an application for sending & receiving SMS.
9. Develop an application that makes use of SQLite databases.
10. Write an application that creates alarm clock.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1052236246	UI AND UX DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

User Interface (UI) and User Experience (UX) Design play key roles in the experience users have when interacting with digital products and applications. In this course, student will learn the theory and methodologies behind UI and UX design. Student will learn design their own wireframes and interactive prototypes. Learning UI and UX basics can help to student collaborate better on team projects and create new career opportunities.

COURSE OBJECTIVES

The objectives of this course are enabling the students

- To learn problem solving skills.
- To gain knowledge of UI and UX Design.
- To understand the concept of functions and their role in UX Design.
- To comprehend the basics of interaction structures and its importance in application development.
- To recognize the importance of visual design.

COURSE OUTCOMES

At the end of the course, students will be able

CO1: Demonstrate knowledge on UI and UX design concepts.

CO2: Develop and performing a competitive analysis in UX design.

CO3: Design user personas using persona UXPressia's online builder tool.

CO4: Develop interaction design and functional layout.

CO5: Creating web and mobile app applications using visual design tools.

PREREQUISITES: NIL

CO/PO MAPPING

CO/PO	P01	P02	P03	P04	P05	P06	P07
C01	3	3	3	1	1	1	2
C02	3	3	3	3	1	1	2
C03	3	3	3	3	2	2	2
C04	3	3	3	2	2	3	2
C05	3	3	3	3	2	2	2

Legend: 3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

INSTRUCTIONAL STRATEGY

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

ASSESSMENT METHODOLOGY

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Part A Exercises	Part B Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Internal Marks	40				60
Tentative	7 th Week	14 th Week	15 th Week	16 th Week	-

Schedule					
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Note:

CA1 and CA2: All the exercises / experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before commencement of next exercise. The detailed date of the practices and its evaluations should be maintained in the log book and should be submitted for the verification.

SCHEME OF EVALUATION		
PART	DESCRIPTION	MARKS
A	Aim (5), Program (30)	35
B	Execution and Output	15
C	Practical Documents (As per the portions)	10
TOTAL		60

CA3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory			
DESCRIPTION			MARKS
Part – A	Answer any ten questions out of twelve. Each carries three marks.	10 × 3	30
Part – B	Answer any seven questions out of ten. Each carries ten marks.	7 × 10	70
TOTAL			100

CA4: All the exercises / experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION		
Model Practical Examination and End Semester Examination Practical Exam		
S.NO	DESCRIPTION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Execution of any one Program Part – A OR Part – B	15
4	Output	10
5	Viva Voce	05
Total		100

1052236246	UI AND UX DESIGN	L	T	P	C
PRACTICUM		1	0	4	3
UNIT I	INTRODUCTION TO UI AND UX DESIGN				
THEORY	Introduction to UI and UX Design and the Key Methodologies such as Product Design Life Cycle.				3
PRACTICAL	Exercise 1: Identifying interface connectivity and establishing interface connectivity between two different program modules. Exercise 2: Understand front end and backend interfacing and Implementation of both interfacing.				12
UNIT II	UX DESIGN				
THEORY	User Centred Design – Design Thinking – Activity Based Design – Agile Process.				3
PRACTICAL	Exercise 3: Create and performing a competitive analysis in UX design helps companies identify competitors strengths and weaknesses relative to their own business, product, and design. Exercise 4: Designing a Responsive layout for a societal application				12
UNIT III	USER RESEARCH				
THEORY	Stakeholder & User Interviews – Creating Personas – Empathy Mapping – Information Architecture – Building User Journey.				3
PRACTICAL	Exercise 5: Hands on Design Thinking Process for a new product. Exercise 6: Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.				12
UNIT IV	INTERACTION DESIGN				
THEORY	Ideation Methods – Interaction & Prototyping – Paper & Digital Prototyping – Design a Web / Mobile App.				6
PRACTICAL	Exercise 7: Identifying interaction design and functional layout. Practical implementation of interaction design and functional layout.				12

Exercise 8: Exploring various UI Interaction Patterns.		
UNIT V	VISUAL DESIGN	
THEORY		
Web & Mobile App Design – Grid Systems – Colors Theory and Palette – Understanding Typography.		3
PRACTICAL		
Exercise 9: Create Social media advertisement using online tools and applications.		12
Exercise 10: Design super market special offer sales poster using online tools and applications.		
TOTAL HOURS		75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Programming assignments.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Textbook for Reference:

1. Tom Green, Joseph Labrecque, A Guide to UX Design and Development: Developer’s Journey Through the UX Process (Design Thinking), First Edition, APress, 2023
2. Jon Yablonski, Laws of UX: Using Psychology to Design Better Products & Services, First Edition, O’Reilly, 2020.
3. Donald Chesnut, Kevin P. Nichols, UX for Dummies, First Edition, Wiley, 2014.

Website links for reference:

- i. NPTEL User Interface Design:
<https://archive.nptel.ac.in/courses/124/107/124107008/>
- ii. MIT OpenCourseWare: <https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/pages/lecture-notes/>

Board Practical Examination

PART – A

1. Identifying interface connectivity and establishing interface connectivity between two

different program modules.

2. Understand front end and backend interfacing and implementation of both interfacing.
3. Create and performing a competitive analysis in UX design helps companies identify competitors strengths and weaknesses relative to their own business, product, and design.
4. Designing a Responsive layout for a societal application.
5. Hands on Design Thinking Process for a new product.

PART – B

6. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.
7. Identifying interaction design and functional layout. Practical implementation of interaction design and functional layout.
8. Exploring various UI Interaction Patterns.
9. Create Social media advertisement using online tools and applications.
10. Design super market special offer sales poster using online tools and applications.

SCHEME OF VALUATION		
S.NO	ALLOCATION	MARKS
1	Aim (05), Program from Part – A (30)	35
2	Aim (05), Program from Part – B (30)	35
3	Executing any one program (Part – A or Part –B)	15
4	Output	10
5	Viva Voce	5
6	Total	100

1056236351	INTERNSHIP	Periods	C
PROJECT		540	12

Introduction

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

Objectives

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization, teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus.
- Offer a realistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first hand experience.
- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.
- Foster personal growth by challenging interns to step out of their comfort zones and take on new responsibilities.
- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.

- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

Course Outcomes

CO 1: Demonstrate improved skills.

CO 2: Exhibit increased professional behavior.

CO 3: Apply theoretical knowledge and principles in real-world practices.

CO 4: Develop and utilize assessment tools to evaluate the learning and practices.

CO 5: Engage in reflective practice to continually improve their learning and professional growth.

Facilitating the Interns by an Internship Provider.

- Orient intern in the new workplace. Give interns an overview of the organization, Explain the intern's duties and introduce him or her to co-workers.
- Develop an internship job description with clear deliverables and timeline.
- Allow the interns in meetings and provide information, resources, and opportunities for professional development.
- The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.
- Daily progress report of Intern is to be evaluated by industry supervisor. Examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

- To facilitate the placement of students for the internship
- To liaison between the college and the internship provider
- To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.

- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.
- The interns shall work on live projects assigned by the internship provider.
- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.
- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.
- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly report in the form of diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of

plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training.

Any data, drawings etc. should be incorporated with the consent of the Organisation.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 3rd Month and 5th Month. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period (June - May). The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20

B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

1056236353	FELLOWSHIP	Periods	C
PROJECT		540	12

Introduction

The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.

Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.

In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.

By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.

The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

Objectives

After completing students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.
- Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.

- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross-cultural experiences.

Course Outcomes

CO 1: Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.

CO 2: Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.

CO 3: Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.

CO 4: Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.

CO 5: Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project.

Selecting the right fellowship project is crucial for maximizing the educational and

professional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans:** Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance:** Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.
- **Access to Facilities:** Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.
- **Mentorship and Guidance:** Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope:** Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility:** Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.
- **Technical Skills:** Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
- **Soft Skills:** Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking:** Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact:** Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.

- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.
- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program's connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counseling, mentorship programs, and assistance with job placement after graduation.
- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings.
- Research the success of the program's alumni. High employment rates and successful careers of past graduates can indicate the program's effectiveness in preparing students for the engineering field.

Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairman Board of Examinations with the recommendations of the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.
- Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.

- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.

- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student to offer fellowship.

- **Completed Application Form:** This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume:** A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.
- **Personal Statement:** A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.
- **Recommendation Letters:** Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description:** A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification:** Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information:** Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work:** Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter:** A letter from your current academic institution endorsing your application for the fellowship, if required.
- **Ethical Approval Documents:** If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents:** Any other documents requested by the fellowship program required by the institution.

Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Rubrics for Fellowship.

Sl. No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.
3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.
5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project effectively.
7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.

8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem-Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

INTERNAL MARKS - 40 Marks

As per the rubrics each topic should be considered for the Review 1 and Review 2. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 40 Marks.

Scheme of Evaluation

PART	DESCRIPTION	MARKS
A	Assessment as per the rubrics.	30
B	Attendance	10
Total		40

END SEMESTER EXAMINATION - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report of the Fellowship Work.	30

C	Presentation by the student.	30
D	Viva Voce	20
Total		100

1056236374	IN HOUSE PROJECT	Periods	C
PROJECT		540	12

Introduction

Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.

For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.

If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.

For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.

The final examination for project work will be evaluated based on the final report submitted by the project group **of not exceeding four students**, and the viva voce by an external examiner.

Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge:** Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development:** Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities:** Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management:** Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration:** Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.

- **Research Skills:** Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity:** Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills:** Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations:** Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development:** Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO 1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO 2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO 3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO 4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

Important points to consider to select the In-house project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.

- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.
- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.
- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor.

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.
- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.
- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development .
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.

- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project.

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and

		challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)	Model / Analysis Report (40 Marks)
External: 10 Internal: 5	External: 10 Internal: 5	External: 10 Internal: 5	External: 20 Internal: 10

Supervisor: 5	Supervisor: 5	Supervisor: 5	Supervisor: 10
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The marks scored will be converted to 60 Marks.

Students who are unable to complete the project work at the end of the semester can apply for an extension to the Head of the Department, with the recommendation from the project guide for a period of a maximum of two months. For those students who extend the project work for two months, Viva Voce will be carried out and results will be declared separately. If the project report is not submitted even beyond the extended time, then students are not eligible to appear for Project Viva Voce Examination.