DATA STRUCTURE USING C **Course Code : 313301**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH**
Semester	**: Third**
Course Title	**: DATA STRUCTURE USING C**
Course Code	**: 313301**

I. RATIONALE

One of the most important courses in information and communication technology is data structures. Data organization or structuring is essential for developing effective algorithms and programs. Students will get the ability to develop logic to solve problem using principles of data structure with the aid of this course.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Implement algorithm using relevant Data Structures.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Perform basic operations on Arrays.
- CO2 - Apply different Searching and Sorting methods.
- CO3 - Implement basic operations on Linked List.
- CO4 - Perform operations on Stack using Array and Linked List Implementations.
- CO5 - Perform operations on Queue using Array and Linked List Implementations.
- CO6 - Create and Traverse Tree to solve problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313301	DATA STRUCTURE USING C	DSU	DSC	3	1	4	-	8	4	3	30	70	100	40	50	20	25#	10	-	-	175

DATA STRUCTURE USING C **Course Code : 313301**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify the given type of Data Structures based on their characteristics and space. TLO 1.2 Perform operations on the given type of Data Structure.	**Unit - I Introduction to Data Structures** 1.1 Introduction: Concept and Need of Data Structure, Definition, Abstract Data Type 1.2 Types of Data Structures: (i) Linear Data Structures (ii) Non-Linear Data Structures 1.3 Operations on Data Structures: (i) Traversing (ii) Insertion (iii) Deletion	Lecture Using Chalk-Board Presentations
2	TLO 2.1 Develop algorithm to search the given key using different Searching Techniques. TLO 2.2 Create algorithm to sort data using a given method.	**Unit - II Searching and Sorting** 2.1 Searching: Searching for an item in a data set using the following methods: (i) Linear Search (ii) Binary Search 2.2 Sorting: Sorting of data set in an order using the following methods: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort (iv) Quick Sort (v) Merge Sort	Lecture Using Chalk-Board Demonstration Presentations Hands-on
3	TLO 3.1 Differentiate between Static and Dynamic Memory Allocation. TLO 3.2 Create a suitable structure using a Linked List to represent a Node. TLO 3.3 Create Algorithm to add or remove a specified item from a Linear Linked List.	**Unit - III Linked List** 3.1 Difference between Static and Dynamic Memory Allocation. 3.2 Introduction to Linked List, Terminologies: Node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty List. 3.3 Type of Lists: Linear List, Circular List, Representation of Doubly Linked List. 3.4 Operations on a Singly Linked List: Creating a Linked List, Inserting a new node in a Linked List, Deleting a node from a Linked List, Searching a key in Linked List, Traversing a Singly Linked List. 3.5 Applications of Linked List.	Lecture Using Chalk-Board Demonstration Presentations Hands-on

DATA STRUCTURE USING C **Course Code : 313301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Represent Stack using Array and Linked List. TLO 4.2 Create Algorithm to carry out the PUSH and POP operations in a Stack. TLO 4.3 Use Stack to transform the given expression from Infix to Postfix. TLO 4.4 Evaluate Postfix Expression.	**Unit - IV Stack** 4.1 Introduction to Stack: Definition, Stack as an ADT, Operations on Stack-(Push, Pop), Stack Operation Conditions – Stack Full / Stack Overflow, Stack Empty /Stack Underflow. 4.2 Stack Implementation using Array and representation using Linked List. 4.3 Applications of Stack: Reversing a List, Polish Notations, Conversion of Infix to Postfix Expression, Evaluation of Postfix Expression. 4.4 Recursion: Definition and Applications.	Lecture Using Chalk-Board Demonstration Presentations Hands-on
5	TLO 5.1 Represent Queue using Array and Linked List. TLO 5.2 Explain the characteristics of different types of Queue. TLO 5.3 Create Algorithm to carry out the INSERT and DELETE Operations on a Queue.	**Unit - V Queue** 5.1 Introduction to Queue: Queue as an ADT, Queue representation in memory using Array and representation using a Linked List. 5.2 Types of Queues: Linear Queue, Circular Queue, Concept of Priority Queue, Double-Ended Queue. 5.3 Queue Operations: INSERT, DELETE, Queue Operation Conditions: Queue Full, Queue Empty. 5.4 Applications of Queue.	Lecture Using Chalk-Board Demonstration Presentations Hands-on
6	TLO 6.1 Describe the given Tree Terminology. TLO 6.2 Create a Binary Search Tree based on the provided data. TLO 6.3 Create Algorithms to Traverse the Tree using the given method. TLO 6.4 Create an Expression Tree. TLO 6.5 Create Heap.	**Unit - VI Tree** 6.1 Introduction to Trees Terminologies: Tree, Degree of a Node, Degree of a Tree, Level of a node, Leaf Node, Depth / Height of a Tree, In-Degree and Out-Degree, Path, Ancestor and Descendant Nodes. 6.2 Tree Types and Traversal methods, Types of Trees: General Tree, Binary Tree, Binary Search Tree (BST). Binary Tree Traversal: In-Order Traversal, Preorder Traversal, Post-Order Traversal. 6.3 Expression Tree, Heap	Lecture Using Chalk-Board Demonstration Presentations Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement Array Operations.	1	* Write a ‘C’ program to perform following Operations on Array: Create, Insert, Delete, Display.	4	CO1
LLO 2.1 Implement Linear Search Method on Numbers.	2	Write a ‘C’ Program to Search a particular data from the given Array of numbers using: Linear Search Method.	2	CO2
LLO 3.1 Implement Linear Search Method on Strings.	3	* Write a ‘C’ Program to Search a particular data from the given Array of Strings using Linear Search Method.	2	CO2
LLO 4.1 Implement Binary Search Method on Numbers.	4	* Write a ‘C’ program to Search a particular data from the given Array of numbers using Binary Search Method.	2	CO2

DATA STRUCTURE USING C **Course Code : 313301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Implement Binary Search Method on Strings.	5	Write a 'C' Program to Search a particular data from the given Array of Strings using Binary Search Method.	2	CO2
LLO 6.1 Apply Bubble Sort method for Sorting Numbers.	6	* Write a 'C' Program to Sort an Array of numbers using Bubble Sort Method.	2	CO2
LLO 7.1 Apply Bubble Sort method for Sorting Strings.	7	Write a 'C' Program to Sort an Array of Strings using Bubble Sort Method.	2	CO2
LLO 8.1 Apply Selection Sort for Sorting Numbers.	8	* Write a 'C' Program to Sort an Array of numbers using Selection Sort Method.	2	CO2
LLO 9.1 Apply Selection Sort for Sorting Strings.	9	Write a 'C' Program to Sort an Array of Strings using Selection Sort Method.	2	CO2
LLO 10.1 Apply Insertion Sort for Sorting Numbers.	10	* Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method.	2	CO2
LLO 11.1 Apply Insertion Sort for Sorting Strings.	11	Write a 'C' Program to Sort an Array of Strings using Insertion Sort Method.	2	CO2
LLO 12.1 Create Singly Linked List.	12	* Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at beginning, (ii) Search, (iii) Display	2	CO3
LLO 13.1 Perform given Operations on Singly Linked List.	13	* Write a C Program to Implement Singly Linked List with Operations: (i) Insert at end, (ii) Insert After, (iii) Delete (iv) Display	2	CO3
LLO 14.1 Create Polynomials using Linked List.	14	Write a C Program to Create Two Polynomials using a Linked List.	2	CO3
LLO 15.1 Perform the Addition of Two Polynomials using a Linked List.	15	* Write a 'C' Program to add Two Polynomials using a Linked List.	2	CO3
LLO 16.1 Perform Operations on the Stack using the Array.	16	* Write a 'C' Program to perform PUSH and POP Operations on Stack using an Array.	2	CO4
LLO 17.1 Perform Operations on the Stack using a Linked List.	17	* Write a 'C' Program to perform PUSH and POP Operations on a Stack using a Linked List.	2	CO4
LLO 18.1 Apply recursive procedure to multiply two numbers.	18	* Write a 'C' program to perform multiplication of two numbers using recursion.	2	CO4
LLO 19.1 Apply recursive procedure to reverse the string.	19	Write a 'C' program to print given string in reverse using recursion.	2	CO4
LLO 20.1 Apply recursive procedure to display linked list in reverse.	20	Write a 'C' program to create a Singly Linked List and traverse in reverse order using recursion.	4	CO3 CO4
LLO 21.1 Perform Operations on Linear Queue using Array.	21	* Write a 'C' Program to perform INSERT and DELETE Operations on Linear Queue using an Array.	2	CO5
LLO 22.1 Perform Operations on Linear Queue using Linked List.	22	* Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Linked List.	2	CO5

DATA STRUCTURE USING C **Course Code : 313301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 Perform Operations on Circular Queue using Array.	23	* Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using an Array.	2	CO5
LLO 24.1 Perform Operations on Circular Queue using a Linked List.	24	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using a Linked List.	2	CO5
LLO 25.1 Implement Priority Queue using Linked List.	25	Write a 'C' Program to Create a Priority Queue using a Linked List.	4	CO5
LLO 26.1 Implement Binary Search Tree and perform In-Order Traversal.	26	* Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order.	2	CO6
LLO 27.1 Implement Tree Traversal Operations.	27	Write a 'C' Program to Traverse BST in Preorder, and Post-Order.	2	CO6

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System with all necessary Peripherals and Internet Connectivity. ‘C’ Compiler / GCC Compiler/ Online ‘C’ Compiler	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Data Structures	CO1	2	2	2	0	4
2	II	Searching and Sorting	CO2	8	2	2	8	12
3	III	Linked List	CO3	12	2	4	10	16
4	IV	Stack	CO4	8	2	4	6	12
5	V	Queue	CO5	6	2	2	6	10
6	VI	Tree	CO6	9	2	4	10	16
Grand Total				**45**	**12**	**18**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous Assessment based on Process and Product related Performance Indicators. Each practical will be assessed considering 60% weightage to Process and 40% weightage to Product

Summative Assessment (Assessment of Learning)

- End semester Examination, Lab performance, Viva-Voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	1	-	-	1			
CO2	2	2	2	1	-	-	1			
CO3	2	2	2	1	1	1	1			
CO4	2	2	2	1	-	1	1			
CO5	2	2	2	1	-	1	1			
CO6	2	2	2	1	-	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Lipschutz	Data Structures with 'C' (SIE) (Schaum's Outline Series)	McGraw Hill Education, New Delhi ISBN: 978-0070701984
2	Balgurusamy, E.	Data Structures using 'C'	McGraw Hill Education, New Delhi 2013, ISBN: 978-1259029547
3	ISRD Group	Data Structures using 'C'	McGraw Hill Education, New Delhi 2013, ISBN: 978-12590006401
4	Yashwant Kanetkar	Understanding Pointers in C	BPB ISBN 8170298911

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/data-structure-introduction	For All Content
2	https://www.geeksforgeeks.org/introduction-to-data-structures/	For All Content
3	https://studytonight.com/data-structures/	For All Content
4	https://www.tutorialspoint.com/data_structures_algorithms/	For All Content
5	https://www.w3schools.in/data-structures/	For All Content
6	https://www.mygreatlearning.com/blog/data-structure-tutorial-for-beginners/	For All Content
7	https://byjus.com/gate/introduction-to-data-structure-notes/	For All Content

DATA STRUCTURE USING C **Course Code : 313301**

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ TE**
Semester	**: Third**
Course Title	**: DATABASE MANAGEMENT SYSTEM**
Course Code	**: 313302**

I. RATIONALE

This course focuses on fundamentals of relational database management system and enables students to design and manage database for various software applications. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in Information Technology applications.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

To design database and use any RDBMS package as a backend for developing database applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain concept of database management system.
- CO2 - Design the database for given problem.
- CO3 - Manage database using SQL.
- CO4 - Implement PL/SQL codes for given application.
- CO5 - Apply security and backup methods on database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313302	DATABASE MANAGEMENT SYSTEM	DMS	DSC	3	1	4	2	10	5	3	30	70	100	40	50	20	25#	10	25	10	200

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain given database concept. TLO 1.2 Explain Overall structure of DBMS TLO 1.3 Describe architecture of database.	**Unit - I Introduction To Database System** 1.1 Database concepts:-Data, Database, Database management system, File system Vs DBMS, Applications of DBMS, Data Abstraction, Data Independence, Database Schema, The Codd's rules, Overall structure of DBMS 1.2 Architecture:- Two tier and Three tier architecture of database. 1.3 Data Models:- Hierarchical, Networking, Relational Data Models.	Presentations, Hands-on, Chalk-Board.
2	TLO 2.1 Explain relational structure of database. TLO 2.2 State types of keys with example. TLO 2.3 Draw ER diagrams for given problem. TLO 2.4 Explain different normalization forms.	**Unit - II Relational Data Model** 2.1 Relational Structure :- Tables (Relations), Rows (Tuples), Domains, Attributes, Entities 2.2 Keys :- Super Keys, Candidate Key, Primary Key, Foreign Key. 2.3 Data Constraints :- Domain Constraints ,Referential Integrity Constraints 2.4 Entity Relationship Model : - Strong Entity set, Weak Entity set, Types of Attributes, Symbols for ER diagram, ER Diagrams 2.5 Normalization:- Functional dependencies, Normal forms: 1NF, 2NF, 3NF	Presentations, Hands-on, Chalk-Board.

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Write SQL queries using DDL, DML, DCL and TCL. TLO 3.2 Write SQL queries to join relations. TLO 3.3 Write SQL queries for ordering and grouping data. TLO 3.4 Use various class of operators in SQL. . TLO 3.5 Create schema objects for performance tunning.	**Unit - III Interactive SQL and Performance Tuning** 3.1 SQL: -Data-types, Data Definition Language (DDL), Data Manipulation language (DML), Data Control Language (DCL), Transaction Control Language (TCL). 3.2 Clauses & Join:- Different types of clauses - Where, Group by ,Order by, Having. Joins: Types of Joins, Nested queries. 3.3 Operators:- Relational, Arithmetic, Logical, Set operators. 3.4 Functions:- Numeric , Date and time, String functions, Aggregate Functions. 3.5 Views, Sequences, Indexes: -Views : Concept ,Create ,Update, Drop Views. Sequences :- Concept ,Create, Alter , Drop, Use of Sequence in table, Index: Concept ,Types of Index , Create ,Drop Indexes	Presentations, Hands-on, Chalk-Board.
4	TLO 4.1 Use control Structures in PL-SQL. TLO 4.2 Handle different types of exceptions. TLO 4.3 Explain various types of cursors. TLO 4.4 Create Procedure, Function on given problem. TLO 4.5 Explain types of triggers with examples	**Unit - IV PL/SQL Programming** 4.1 Introduction of PL/SQL: -Advantages of PL/SQL,The PL/SQL Block Structure, PL/SQL Data Types, Variable , Constant 4.2 Control Structure:- Conditional Control, Iterative Control, Sequential Control. 4.3 Exception handling: -Predefined Exception, User defined Exception. 4.4 Cursors:- Implicit and Explicit Cursors, Declaring, opening and closing cursor, fetching a record from cursor ,cursor for loops, parameterized cursors 4.5 Procedures:- Advantages, Create, Execute and Delete a Stored Procedure 4.6 Functions:- Advantages, Create, Execute and Delete a Function 4.7 Database Triggers :- Use of Database Triggers, Types of Triggers, Create Trigger, Delete Trigger	Presentations, Hands-on, Chalk-Board.
5	TLO 5.1 Implement SQL queries for database administration. TLO 5.2 Explain concept of various types database backup processes. TLO 5.3 Describe various terms related to advanced database concepts.	**Unit - V Database Administration** 5.1 Introduction to database administration:- Types of database users, Create and delete users, Assign privileges to users 5.2 Transaction: Concept, Properties & States of Transaction 5.3 Database Backup: Types of Failures, Causes of Failure, Database backup introduction, types of database backups: Physical & Logical 5.4 Data Recovery – Recovery concepts , recovery techniques- roll forward ,Rollback 5.5 Overview of Advanced database concepts:- Data Warehouse ,Data lakes , Data mining, Big data ,Mongo DB , DynamoDB,	Presentations, Hands-on, Chalk-Board.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install database software	1	* Install the provided database software	2	CO1
LLO 2.1 Create Database schema for given application	2	*Note :- Ensure to Carry out following activities before creating database: - Draw ER diagram for given problem - Normalize the relation up to 3NF 1) Create Database for given application 2) Create tables for the given application 3)Assign Primary key for created table 4) Modify the table as per the application needs	4	CO1
LLO 3.1 Execute DDL Commands to manage database using SQL	3	* Write queries using DDL Statements for following operations – 1)Create, alter, truncate, drop ,rename table 2) Apply Key Constraints for suitable relation.	2	CO3
LLO 4.1 Execute DML Commands to manipulate data using SQL	4	* Write queries using DML Statements for following operations – 1) Select, Insert, delete, update, table 2) Apply Key Constraints for suitable relation.	2	CO3
LLO 5.1 Execute DCL Commands to control the access to data using SQL .	5	* Write queries using DCL Statements for following operations – 1)Grant, Revoke	2	CO3
LLO 6.1 Execute TCL Commands to control transactions on data using SQL .	6	* Write queries using TCL Statements for following operations – 1) Commit, Rollback, Savepoint	2	CO3
LLO 7.1 Implement Queries using Arithmetic operators	7	Write Queries using built-in Arithmetic operators.	2	CO3
LLO 8.1 Implement Logical operators to apply various conditions in query.	8	Apply built-in Logical operators on given data	2	CO3
LLO 9.1 Implement Relational operators to apply various conditions in query.	9	Apply built-in relational operators on given data	2	CO3
LLO 10.1 Write Queries to implement SET operations using SQL .	10	* Use following Set operators to perform different operations.	2	CO3
LLO 11.1 Execute queries using String functions	11	Write SQL Queries using built-in String functions	2	CO3
LLO 12.1 Execute queries using Arithmetic functions	12	Write SQL Queries using built-in Arithmetic functions	2	CO3

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Implement queries using Date and Time functions	13	Write Queries using built-in Date and Time functions	4	CO3
LLO 14.1 Implement queries using Aggregate functions	14	Write Queries using SQL built-in Aggregate functions	2	CO3
LLO 15.1 Execute Queries for ordering and grouping data.	15	* Implement Queries Using different Where, Having, Group by, & Order by clauses .	2	CO3
LLO 16.1 Execute the queries based on Inner & outer join	16	* Implement SQL queries for Inner and Outer Join	2	CO3
LLO 17.1 Create and manage Views for faster access on relations.	17	* Create and Execute Views ,Seqeuence and Index in SQL.	4	CO3
LLO 18.1 Implement PL/SQL program using Conditional Statements	18	* Write a PL/SQL program using Conditional Statements- if, if then else ,nested if, if elseif else	2	CO4
LLO 19.1 Implement PL/SQL program using Iterative Statements	19	* Write a PL/SQL program using Iterative Statements- loop,for, do-while, while	2	CO4
LLO 20.1 Implement PL/SQL program using Sequential Control	20	Write a PL/SQL program using Sequential Control-switch, continue,goto	2	CO4
LLO 21.1 Create implicit & explicit cursors	21	* Write a PL/SQL code to implement implicit & explicit cursors	2	CO4
LLO 22.1 Implement PL/SQL program based on Exception Handling (Pre-defined exceptions)	22	* Write a PL/SQL program based on Exception Handling (Pre-defined exceptions)	2	CO4
LLO 23.1 Implement PL/SQL program based on Exception Handling (user defined exceptions)	23	* Write a PL/SQL program based on Exception Handling (user defined exceptions)	2	CO4
LLO 24.1 Create Procedures and stored procedures for modularity.	24	* Write a PL/SQL code to create Procedures and stored procedures	2	CO4
LLO 25.1 Create function for given database	25	* Write a PL/SQL code to create functions.	2	CO4
LLO 26.1 Implement triggers for given database.	26	* Write a PL/SQL code to create triggers for given database.	2	CO4
LLO 27.1 Implement SQL queries for database administration.	27	Execute DCL commands using SQL 1) Create Users 2) Grant Privileges to users 3)Revoke Privileges to users	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

- Implement PL/SQL code for relevant topics suggested by the teacher.

- Complete any one course related to Database Management System on Infosys Springboard platform.

Assignment

- Solve an assignment on any relevant topic given by the teacher.

Micro project

- Develop a database for restaurant management system. The restaurant maintain catalogue for the list of food items and generate bill for the ordered food.
- Prepare Invoice management system for electricity bill generation. Accept meter reading as inputs and generate respective bill amount for the same.
- Design a database for registration and admission of patient for Hospital management system, draw ER diagram and normalize the database up to 3NF.
- Any topic suggested by teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system - (Any computer system with basic configuration)	All
2	Any RDBMS software (MySQL/Oracle/SQL server/ or any other)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction To Database System	CO1	6	4	6	2	12
2	II	Relational Data Model	CO2	8	2	4	6	12
3	III	Interactive SQL and Performance Tuning	CO3	12	2	6	10	18
4	IV	PL/SQL Programming	CO4	12	4	4	10	18
5	V	Database Administration	CO5	7	2	4	4	10
Grand Total				**45**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	-	1	-	1			
CO2	2	2	3	2	1	2	1			
CO3	1	2	2	2	-	2	1			
CO4	1	3	3	2	1	3	2			
CO5	1	1	2	2	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Henry F. Korth	Database System Concepts	McGraw Hill Education ISBN : 9780078022159
2	Ivan Bayross	SQL, PL/SQL – The Programming Language of Oracle	BPB Publication ISBN 10: 8170298997 BPB Publication ISBN 13: 9788170298991
3	ISRD Group	Introduction to Database Management Systems	McGraw Hill Education ISBN 10: 0070591199 McGraw Hill Education ISBN-13 : 978-0070591196

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/106105175	Data Base Management System
2	https://www.w3schools.com/sql/	SQL Tutorial
3	https://www.tutorialspoint.com/sql/index.htm	SQL Programming Language

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

DIGITAL TECHNIQUES **Course Code : 313303**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ AO/ CM/ CO/ CW/ DE/ DS/ EJ/ ET/ EX/ HA/ IC/ IE/ IS/ MU/ TE**
Semester	**: Third**
Course Title	**: DIGITAL TECHNIQUES**
Course Code	**: 313303**

I. RATIONALE

Digitization implies use of digital circuits in most of automation and industrial systems. The knowledge of logic gates, combinational and sequential circuits using discrete gates and digital ICs will enable students to interpret working of digital equipment and test their functionality.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences:
Student will able to test the functionality of the digital circuits/system.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply number system and codes concept to interprete working of digital systems.
- CO2 - Apply Boolean laws to minimize complex Boolean function.
- CO3 - Develop combinational logic circuits for given applications.
- CO4 - Develop sequential logic circuits using Flip-flops.
- CO5 - Interpret the functions of data converters and memories in digital electronic systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313303	DIGITAL TECHNIQUES	DTE	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

DIGITAL TECHNIQUES **Course Code : 313303**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Convert the given number from one number system to another number system. TLO 1.2 Perform arithmetic operations on binary numbers. TLO 1.3 Subtract given binary numbers using 1’s and 2’s compliment method. TLO 1.4 Convert the given coded number into the other specified code. TLO 1.5 Write the application of the given code. TLO 1.6 Perform BCD addition and subtraction for the given Decimal numbers .	**Unit - I Number Systems** 1.1 Number Systems: Types of Number Systems (Binary, Octal, Decimal, Hexadecimal), conversion of number systems 1.2 Binary Arithemetic: Addition, Subtraction, Multiplication and Division 1.3 Subtraction using 1's and 2's complement method 1.4 Codes: BCD, Gray code, Excess-3 and ASCII code,Code conversions, Applications of codes. 1.5 BCD Arithemetic: BCD Addition, Subtraction using 9's and 10's complement	Lecture Using Chalk-Board

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Define the given characteristics parameters of the digital logic families. TLO 2.2 Draw symbol and truth table of given logic gates. TLO 2.3 Explain the concept of Buffer and Tristate logic . TLO 2.4 Implement basic gates and other gates with the help of universal gate. TLO 2.5 Simplify the given expression using Boolean laws and develop logic circuits .	**Unit - II Logic Gates and Boolean Algebra** 2.1 Logic Families: Characteristics Parameters of logic Families- Noise margin, Power dissipation, Figure of merit ,Fan in, Fan out, Speed of operation, maximum clock frequency supply voltage requirement ,power per gate , Comparison of TTL, CMOS and ECL logic family 2.2 Introduction to positive and negative logic systems, Logic Gates: Symbol ,Truth table of Basic logic gates(AND,OR,NOT),Universal gates(NAND,NOR) and Special purpose gates(EX-OR,EX-NOR) 2.3 Buffer: Tristate logic, Unidirectional and Bidirectional 2.4 Boolean algebra : Laws of Boolean algebra, Duality Theorem ,De-Morgan's theorem	Flipped Classroom Lecture Using Chalk-Board
3	TLO 3.1 Develop logic circuits for standard SOP/POS form of the given logic expression. TLO 3.2 Minimize the given logic expression using K-map (up to 4 variables). TLO 3.3 Design Adder and subtractor using K-map. TLO 3.4 Describe working of specified Encoder and Decoder with help of block diagram and truth table. TLO 3.5 Describe the working of Multiplexer and Demultiplexer.	**Unit - III Combinational Logic Circuits** 3.1 Standard Boolean expression: Sum of products [SOP] and Products of Sum [POS], Min-term and Max-term, SOP-POS form conversion, realisation using NAND/NOR gates 3.2 Boolean Expression reduction using K-map: Minimization of Boolean expressions (upto 4 variables) using SOP and POS form 3.3 Arithemetic circuits : design Half and Full Adder using K-maps, design Half and Full Subtractor using K-maps , n bit adder and n bit subtractor . 3.4 Encoder and Decoder: Functions of Encoder and Decoder, Block Diagram and Truth table, Priority Encoder (4:2, 8:3), BCD to 7 segment Decoder/Driver, Keyboard Encoder / decoder 3.5 Multiplexer and Demultiplexer: Working, Truth table and applications of MUX and DEMUX. MUX tree, DEMUX tree, DEMUX as Decoder	Flipped Classroom Presentations Lecture Using Chalk-Board

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Differentiate between Latch and Flip Flop. TLO 4.2 Explain basic memory cell and use relevant triggering technique for the given digital circuit. TLO 4.3 Describe the truth tables for the given Flip flops, applications of Flip flops. TLO 4.4 Use the given type of flip flop and its excitation table to design specific type of counter. TLO 4.5 Describe the working of specified shift register with the help of timing diagram. TLO 4.6 Design specified modulo-N counter using Flip flops . TLO 4.7 Design Ring /Twisted ring counter using given Flip-Flop.	**Unit - IV Sequential Logic Circuits** 4.1 Difference between Combinational and Sequential Logic circuits, Time independent (un-clocked)and Time dependent (Clocked) logic system , Flips- Flops and Latch, Basic memory cell ,RS-Latch using NAND and NOR, Triggering methods- Edge trigger and Level Trigger 4.2 Flip-Flops: S-R, J-K, T and D, Truth table and logic circuits of each flip-flop, Excitation table, applications 4.3 Race around condition in JK flip-flop, Master- Slave JK Flip Flop 4.4 Shift registers- Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out ,Parallel In Parallel Out,Bi-directional Shift register, 4-bit Universal Shift register 4.5 Counters- Synchronous and Asynchronous counters, Modulus of counter, Ripple counter, Ring Counter, Twisted Ring Counter, Up – down counter, Decade Counter, MOD-N counter, Timing Diagram	Video Demonstrations Lecture Using Chalk-Board Simulation
5	TLO 5.1 Describe the working of the given type of DAC. TLO 5.2 Calculate the output voltage for the given digital input for specified DAC. TLO 5.3 Describe the working of the given type of ADC. TLO 5.4 Compare working of ROM,EPROM, EEPROM and Flash Memory .	**Unit - V Data Converters and Memories** 5.1 Digital to Analog Data Converter (DAC)- circuit diagram and working of Weighted resistor DAC and R-2R Ladder DAC, DAC Specification/Selection factors 5.2 Analog to Digital Data Converter (ADC) : Block Diagram, Types and Working of Dual Slope ADC, Successive Approximation, Flash Type ADC, ADC selection factors/ specifications 5.3 Memories: Types- Primary memory , Secondary Memory, Organization, Dimension, Memory Bank, Features , Applications: RAM (SRAM, DRAM), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash Memory, Comparison of RAM and ROM,EPROM and Flash Memory, SIMM: Features, SSD memory: Features,	Video Demonstrations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

DIGITAL TECHNIQUES **Course Code : 313303**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test the functionality of basic gates. LLO 1.2 Test the functionality of special purpose gates.	1	* Test the functionality of AND, OR, NOT, Ex-OR and EX-NOR logic Gates using equivalent 74 series or CMOS Devices [CD] series.	2	CO1 CO2
LLO 2.1 Test the functionality of NAND and NOR gate using breadboard.	2	* Test the functionality of the given Universal Gates using equivalent 74 series /CD series.	2	CO2
LLO 3.1 Test the functionality of the constructed Basic gates using universal gates.	3	* Construct Basic Gates using Universal Gates.	2	CO2
LLO 4.1 Construct Ex-OR, EX-NOR gates using universal gates.	4	Construct Exclusive Gates using Universal Gates.	2	CO2
LLO 5.1 Build the logic circuit on breadboard to verify the De - Morgan's theorems.	5	* Verify De-Morgan's Theorem (1 and 2).	2	CO2
LLO 6.1 Verify the truth table of Half and Full adder circuits for the given input.	6	* Implement 2 input, 3 input Adder Circuit.	2	CO3
LLO 7.1 Verify the truth table of Half and Full subtractor using Boolean expressions.	7	Implement 2 input, 3 input Subtractor Circuit.	2	CO3
LLO 8.1 Construct and test BCD to 7 segment decoder using Digital IC.	8	Test the output of BCD to 7 Segment Decoder using Digital IC for the given inputs.	2	CO3
LLO 9.1 Build/Test 2 or 4 bit Magnitude comparator using Digital IC.	9	Check the output of comparator circuit consisting of Digital IC.	2	CO3
LLO 10.1 Build / test function of MUX Digital IC.	10	* Build and test the functionality of 4:1/8:1 Multiplexer.	2	CO3
LLO 11.1 Build / test function of DEMUX Digital IC.	11	Build and test the functionality of 1:4/1:8 De-Multiplexer.	2	CO3
LLO 12.1 Test functionality of RS flip flop using NAND Gate .	12	Implement and verify the truth table of RS Flip flop.	2	CO4
LLO 13.1 Test functionality of Master Slave (MS) JK flip-flop using Digital IC.	13	Implement and test the functionality of master slave- JK Flip Flop using Digital IC.	2	CO4
LLO 14.1 Test functionality and truth table for D and T Flip flop.	14	Use Digital IC to construct and test the functionality of D and T flip flop.	2	CO4
LLO 15.1 Interpret timing diagram of 4 bit Universal Shift Register.	15	Build 4- bit Universal Shift register and observe the timing diagram.	2	CO4
LLO 16.1 Interpret timing diagram of 4-bit ripple counter using Digital IC.	16	Implement Ripple Counter using Digital IC.	2	CO4
LLO 17.1 Interpret timing diagram of Decade counter (Mod-10).	17	* Implement Decade Counter Using Digital IC.	2	CO4
LLO 18.1 Build R-2R resistive network on breadboard to convert given digital data into analog.	18	* Test the output of given R-2R type Digital to Analog Converter for the given input.	2	CO5

DIGITAL TECHNIQUES **Course Code : 313303**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Implement 1:8 DEMUX using 1:4 /1:2 DE-MUX.
- Build a circuit to implement 4 Bit adder.
- Build a 4bit parity generator and parity tester.
- Implement 16:1 MUX using 8:1/4:1 MUX.
- Build a circuit to test 7 bit segment display.
- Build a LED display bar.
- Develop a project on Burglar alarm.
- Light Detector circuit using NAND gate.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Storage Oscilloscope 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace CRT / TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	15,16,17
2	Trainer kit for 4 bit Counter using Flip Flops 4 bit ripple counter synchronous counter IC 7476 based circuit, Input given by switches and output indicated on LED, Facility to select MOD 8 or MOD 16 mode, Built in DC power supply and manual pulser with indicator	16,17
3	Trainer kit IC DAC IC 0800 Trainer based on IC 0800, 8 bit digital input selected by switches and provision for measurement of analog output. Facility to study effect of change in reference voltage, Built in buffer amplifier, Built in DC power supply	18

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
4	Digital multimeter 3.5 digit with R , V, I measurements, diode and BJT testing	All
5	Digital IC Tester Tests a wide range of Analog and Digital ICs such as 74 series /CD series	All
6	Bread Board Development System Bread Board system with DC power output 5V,+/-12V and 0-5V variable , digital voltmeter ,ammeter , LED indicators 8 no , logic input switches 8 no, 7 segment display 2 no, clockgenerator	All
7	Trainer kits for digital ICs Trainer kit should consists of digital ICs for logic gates, flop flop, shift registers, counter alongwith toggle switches for inputs and bi-colourLED at outputs, built in power supply	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Number Systems	CO1	5	2	4	2	8
2	II	Logic Gates and Boolean Algebra	CO2	8	2	4	6	12
3	III	Combinational Logic Circuits	CO3	12	4	6	8	18
4	IV	Sequential Logic Circuits	CO4	12	4	6	8	18
5	V	Data Converters and Memories	CO5	8	4	6	4	14
Grand Total				**45**	**16**	**26**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two unit test marks will be consider for out of 30 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- For formative assessment of laboratory learning 25 marks

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester summative assessment of 25 marks for laboratory learning

XI. SUGGESTED COS - POS MATRIX FORM

DIGITAL TECHNIQUES **Course Code : 313303**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	1	-	-	-	3			
CO2	2	-	2	-	-	-	2			
CO3	3	2	3	2	-	1	2			
CO4	3	2	3	2	-	1	2			
CO5	2	-	2	2	1	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Jain R.P	Modern Digital Electronics	McGraw-Hill Publishing, New Delhi,2009 ISBN:9780070669116
2	Anand Kumar	Fundamentals of Digital Circuits	PHI learning Private limited, ISBN:978-81-203-5268-1
3	Salivahanan S, Arivazhagan S.	Digital Circuits and Design	Vikas Publishing House, New Delhi,2013 ISBN: 9789325960411
4	Puri.V.K	Digital Electronics	McGraw-Hill Publishing, New Delhi,2016 ISBN:97800746331751
5	Malvino A.P Donald .P. Leach	Digital Principles	McGraw-Hill Education, New Delhi ISBN:9789339203405
6	Anil.K.Maini	Digital Electronics: Principles, Devices and Applications	Wiley India, Delhi, 2007, ISBN:9780470032145
7	Floyd, Thomas	Digital Fundamentals	Pearson Education India, Delhi 2014,ISBN:9780132737968
8	G.K.Kharate	Digital Electronics	Publisher: Oxford University Press, ISBN: 9780198061830

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://studytronics.weebly.com/digital-electronics.html	Basics of Digital Electronics
2	https://www.udemy.com/course/basics-of-digital-techniques/	Introduction To Digital Number System & Logic Gates
3	https://www.geeksforgeeks.org/synchronous-sequential-circuits-in-digital-logic/	Boolean Algebra and Logic Gates, Combinational and Sequential Logic Circuits
4	https://onlinecourses.nptel.ac.in/noc19_ee51/preview	Digital Circuits
5	https://de-iitr.vlabs.ac.in/	Virtual Labs for Digital Systems

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Link / Portal	Description
6	https://www.tutorialspoint.com/digital_circuits/digital_circuits_sequential_circuits.htm	Sequential Circuits

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg./**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH/ TE**
Semester	**: Third**
Course Title	**: OBJECT ORIENTED PROGRAMMING USING C++**
Course Code	**: 313304**

I. RATIONALE

In the modern world of Information Technology, Object Oriented Programming provides the most preferred approach for software development. It offers a powerful way to cope up with real world problems. C++ helps to develop fundamental understanding of object oriented concepts. This course enables to implement object oriented approach to solve a given programming problem.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using concepts of OOP in C++.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Write C++ programs using classes and objects.
- CO2 - Develop C++ programs using constructors.
- CO3 - Implement Inheritance in C++.
- CO4 - Implement Polymorphism in C++.
- CO5 - Develop C++ programs to perform file operations.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313304	OBJECT ORIENTED PROGRAMMING USING C++	OOP	SEC	3	2	4	1	10	5	3	30	70	100	40	50	20	25@	10	25	10	200

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare POP vs OOP approach of programming. TLO 1.2 Describe the different features of Object Oriented Programming. TLO 1.3 Write programs to solve arithmetic expressions. TLO 1.4 Write programs to demonstrate use of special operators in C++. TLO 1.5 Develop C++ program to show the use of Classes and Objects.	**Unit - I Principles of Object Oriented Programming** 1.1 Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP) 1.2 Features of Object Oriented Programming, Examples of Object Oriented languages, Applications of OOP 1.3 Data types, Type compatibility, Declaration of variable, Dynamic initialization of variable, Reference variable, Type casting 1.4 Special Operators in C++: Scope resolution operator, Memory management operators, Manipulators 1.5 Structure of C++ program, Basic Input /Output operators and functions in C++, Simple C++ Program 1.6 Class & Object: Introduction, Specifying a class, Access specifiers, Defining member functions: Inside class and Outside class, Creating objects, Memory allocations for objects	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Develop a program using inline function. TLO 2.2 Develop friend function to solve given problem. TLO 2.3 Write C++ programs using array of objects. TLO 2.4 Write C++ program to initialize the object using constructor. TLO 2.5 Write C++ program to delete object using destructor.	**Unit - II Functions and Constructors** 2.1 Inline function, Static data members, Static member function, Friend function: Using two different classes , Using non-member function 2.2 Array of Objects, Object as function arguments 2.3 Concepts of Constructors, Types of constructors 2.4 Constructor overloading and Constructors with default arguments 2.5 Destructors	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
3	TLO 3.1 Explain the given type of inheritance based on its characteristics. TLO 3.2 Implement given type of inheritance in C++ program. TLO 3.3 Write C++ program using virtual base class. TLO 3.4 Use constructor in given derived class.	**Unit - III Extending classes using Inheritance** 3.1 Introduction to Inheritance, Defining a derived class, Visibility modes and effects 3.2 Types of Inheritance : Single, Multilevel, Multiple, Hierarchical, Hybrid 3.3 Virtual base class, Abstract class, Constructor in derived class	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
4	TLO 4.1 Create C++ program to perform given arithmetic operations using pointers. TLO 4.2 Use 'pointer to object' to solve the given problem. TLO 4.3 Use compile time polymorphism to solve the given problem. TLO 4.4 Use run time polymorphism to solve the given problem.	**Unit - IV Pointers and Polymorphism in C++** 4.1 Concept of Pointer: Pointer declaration, Pointer operator, Address operator, Pointer arithmetic 4.2 Pointer to Object: Pointer to object, 'this' pointer, Pointer to derived class 4.3 Introduction of Polymorphism, Types of polymorphism 4.4 Compile time Polymorphism: Function overloading, Revision of constructor overloading, Operator overloading: Rules for operator overloading, Overloading of unary and binary operators 4.5 Run time polymorphism: Virtual function, Rules for virtual function, Pure virtual function	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.
5	TLO 5.1 Identify relevant class to perform the given file operations. TLO 5.2 Describe different file modes. TLO 5.3 Develop C++ program to perform read/write operations from/to the given file.	**Unit - V File operations** 5.1 C++ stream classes, Classes for file stream operations 5.2 Detection of end of file, File modes 5.3 Opening files: Using constructors and open(), Closing files, Reading from and writing to files, Formatted Input/output functions in file 5.4 Types of file: Random access, Sequential access	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Develop program to evaluate expressions using various operators and Input/output functions.	1	*Write programs to evaluate any expression using Input / Output functions	2	CO1
LLO 2.1 Develop C++ program using special type of operators.	2	*Write programs using- • Scope resolution operator • Memory management operator • Manipulators	4	CO1
LLO 3.1 Develop programs to implement type casting.	3	Write programs to demonstrate use of- • Implicit type casting • Explicit type casting	2	CO1
LLO 4.1 Implement classes and objects to define the function inside class.	4	Write programs to show use of classes and objects to define the function inside the class	2	CO1
LLO 5.1 Implement classes and objects to define the function outside class.	5	*Write programs to define the function outside the class	2	CO1
LLO 6.1 Implement programs using inline function.	6	*Write programs to implement inline function	2	CO2
LLO 7.1 Implement friend function using different classes. LLO 7.2 Implement friend function using external function.	7	*Write programs to implement friend function using- • Two different classes • External function	2	CO2
LLO 8.1 Develop program using static data member. LLO 8.2 Develop program using static member function.	8	*Write programs to implement- • Static data member • Static member function	2	CO2
LLO 9.1 Implement programs to show the use of array of objects.	9	*Write programs to create array of objects	2	CO2
LLO 10.1 Implement the concept of constructor and destructor.	10	*Write programs for- • Default constructor • Parameterized constructor • Copy constructor • Multiple constructor in one class	4	CO2
LLO 11.1 Implement Single level inheritance. LLO 11.2 Implement multilevel inheritance.	11	Write programs using- • Single level inheritance • Multilevel inheritance	2	CO3
LLO 12.1 Develop program using multiple inheritance.	12	*Write programs to implement multiple inheritance	2	CO3
LLO 13.1 Develop program using hierarchical inheritance.	13	Write programs to implement hierarchical inheritance	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Implement virtual base class in a program.	14	*Write programs to implement virtual base class.	2	CO3
LLO 15.1 Implement constructors in derived class in a program.	15	Write programs which show the use of constructors in derived class	2	CO3
LLO 16.1 Implement pointer arithmetic in a program. LLO 16.2 Implement pointer to object in a program. LLO 16.3 Implement 'this' pointer in a program.	16	*Write programs to implement- • Pointer to object • 'this' pointer	2	CO4
LLO 17.1 Implement program to use pointer to derived class.	17	*Write programs for- • Pointer to derived class in single inheritance • Pointer to derived class in multilevel inheritance	4	CO4
LLO 18.1 Implement function overloading in a program.	18	Write programs which show the use of function overloading	2	CO4
LLO 19.1 Implement unary operator overloading using member function. LLO 19.2 Implement unary operator overloading using friend function.	19	*Write programs to overload unary operator using- • Member function • Friend function	4	CO4
LLO 20.1 Implement binary operator overloading using member function. LLO 20.2 Implement binary operator overloading using friend function.	20	Write programs to overload binary operator using- • Member function • Friend function	2	CO4
LLO 21.1 Develop program using virtual function.	21	*Write programs to implement virtual function	2	CO4
LLO 22.1 Develop program using pure virtual function.	22	Write programs to implement pure virtual function	2	CO4
LLO 23.1 Implement read and write operations from/to file using constructor. LLO 23.2 Implement read and write operations from/to file using open().	23	*Write programs to read and write from/to file using- • Constructor • open()	2	CO5
LLO 24.1 Use formatted Input / Output functions to format the contents.	24	*Write programs to copy the content of one file into another file using formatted input/output functions	2	CO5
LLO 25.1 Implement get() and put() functions on file.	25	Write file programs to implement sequential input and output operations on file	2	CO5
LLO 26.1 Implement input/ output operations on binary file.	26	Write programs to perform input / output operations on binary files	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop Student Grading System. Accept student data and marks for 5 subjects for 5 students. Calculate the percentage and finalize grade awarded to the student. Write the records in to file.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in file along with student credentials.
- Develop advanced calculator for the following function: Binary to Decimal, Decimal to Binary etc..
- Develop Hotel Management Application. It should accept room reservation for 10 rooms. Find number of empty rooms. Display relevant information and write maximum 5 records into file.
- Develop Employee Management System using Inheritance. Collect following information from user: Employee_ID ,Employee_Name, Basic_Salary, Leave taken in the month Calculate Net Salary assuming applicable deductions and display. Write maximum 5 records into file.
- Any other micro project as suggested by subject faculty.

Assignment

- Solve assignment covering all COs given by teacher

Other

- Complete the course object oriented concepts using C++ on Infosys Springboard

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System (Any computer system with basic configuration)	All
2	“C++” Compiler (Any)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification

Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Principles of Object Oriented Programming	CO1	8	2	4	6	12
2	II	Functions and Constructors	CO2	12	2	4	10	16
3	III	Extending classes using Inheritance	CO3	9	2	4	10	16
4	IV	Pointers and Polymorphism in C++	CO4	10	2	4	10	16
5	V	File operations	CO5	6	0	4	6	10
Grand Total				**45**	**8**	**20**	**42**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process and 40% weightage to product
- A continuous assessment-based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	2	1	1	1			
CO2	2	1	1	2	1	1	1			
CO3	2	2	2	2	2	2	1			
CO4	2	2	2	2	2	2	1			
CO5	2	2	2	2	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Object Oriented Programming with C++	McGraw-Hill Education ISBN-10:0070669074, ISBN-13:9780070669079

Sr.No	Author	Title	Publisher with ISBN Number
2	D Ravichandran	Programming with C++	McGraw-Hill Education ISBN-10: 0070681899, ISBN-13: 978-0070681897
3	Stroustrup B.	The C++ Programming Language	Pearson Education New Delhi ISBN-10: 0275967301, ISBN-13: 978-0275967307
4	Robert Lafore	Object Oriented Programming in C++	Pearson Education India ISBN-10: 8131722821, ISBN-13: 978-8131722824

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.w3schools.com/cpp/	C++ Tutorial for all topics
2	https://www.javatpoint.com/cpp-tutorial	C++ Tutorial for all topics
3	https://www.javatpoint.com/cpp-files-and-streams	C++ File Streams
4	https://www.programiz.com/cpp-programming	Inheritance in C++
5	https://www.programiz.com/cpp-programming/online-compiler/	Online Compiler for C++
6	https://www.onlinegdb.com/online_c++_compiler	Online compiler for C++

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : **Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/**

Programme Code : **CM/ CO/ CW/ HA**

Semester : **Third**

Course Title : **COMPUTER GRAPHICS**

Course Code : **313001**

I. RATIONALE

Computer Graphics is the discipline of generating images with the aid of computers. This course provides an introduction to the principles of Computer Graphics. In particular, the course will consider methods for Object Design, Transformation, Scan Conversion, Visualization and Modelling of real world and enables student to create impressive graphics easily and efficiently.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain following Industry Identified Competency through various Teaching Learning Experiences:

Develop programs using Graphics concepts.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Manipulate Visual and Geometric information of Images.
- CO2 - Develop programs in C applying standard graphics algorithms.
- CO3 - Perform and Demonstrate basic and composite graphical transformations on given object.
- CO4 - Implement various Clipping algorithms.
- CO5 - Develop programs to create Curves.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313001	COMPUTER GRAPHICS	CGR	DSC	1	-	2	1	4	2	-	-	-	-	-	25	10	-	-	25	10	50

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe coordinate system. TLO 1.2 Select and use various graphics file formats. TLO 1.3 Use different graphics functions and standards.	**Unit - I Basics of Computer Graphics** 1.1 Coordinate system 1.2 Graphics file formats: Basics, advantages, disadvantages – BMP – GIF – JPEG – TIFF – PCX 1.3 Graphics functions & standards: Text mode, Graphic mode, Shapes, Colors, Graphics standards.	Lecture Using Chalk-Board Demonstration Hands-on
2	TLO 2.1 Apply Line Drawing algorithms to generate Line. TLO 2.2 Apply Circle Drawing algorithms to generate Circle. TLO 2.3 Apply Polygon Filling algorithms to Fill Polygon.	**Unit - II Raster Scan Graphics** 2.1 Line Drawing Algorithms : Digital Differential Analyzer algorithm, Bresenham's algorithm. 2.2 Circle Generation- Symmetry of Circle, Bresenham's algorithm 2.3 Polygon Filling : Seed Fill algorithms- Flood Fill algorithm, Boundary Fill algorithm.	Lecture Using Chalk-Board Demonstration Hands-on
3	TLO 3.1 Perform various transformations on given graphics object. TLO 3.2 Use composite transformations. TLO 3.3 Write need of homogeneous coordinates.	**Unit - III Overview of 2D And 3D Transformations** 3.1 Basic Transformations: Translation, Scaling, Rotation. 3.2 Matrix representations & homogeneous coordinates. 3.3 Composite transformations. 3.4 Three-dimensional transformation. 3.5 Other transformations: Reflection, Shear.	Lecture Using Chalk-Board Demonstration Hands-on

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Define: Windowing and Clipping. TLO 4.2 Apply Clipping algorithms for Line and Polygon.	**Unit - IV Windowing and Clipping Techniques** 4.1 Windowing concepts. 4.2 Line Clipping: Cohen Sutherland Line Clipping algorithm, Mid-Point Subdivision Line clipping algorithm. 4.3 Polygon Clipping: Sutherland Hodgeman Polygon clipping algorithm.	Lecture Using Chalk-Board Demonstration Hands-on
5	TLO 5.1 Draw various Curves using Curve generation algorithms. TLO 5.2 Identify different types of Projections.	**Unit - V Introduction to Curves and Projections** 5.1 Bezier and B-Spline Curves. 5.2 Projections: Perspective and Parallel Projection and its types.	Lecture Using Chalk-Board Demonstration Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement a C program using different graphics functions.	1	*Write a C program to draw various graphics objects (Pixel, Circle, Line, Ellipse, Rectangle, Triangle, Polygon) using graphics functions.	2	CO1
LLO 2.1 Implement a C program to draw line using DDA algorithm.	2	*Write a C program to draw line using DDA algorithm.	2	CO2
LLO 3.1 Implement a C program to draw line using Bresenham's algorithm.	3	Write a C program to draw line using Bresenham's algorithm.	2	CO2
LLO 4.1 Implement a C program to draw circle using Bresennham's algorithm.	4	*Write a C program to draw circle using Bresenham's algorithm.	2	CO2
LLO 5.1 Implement a C program for Flood fill algorithm.	5	*Write a C program for Flood fill algorithm of polygon filling.	2	CO2
LLO 6.1 Implement a C program for Boundary fill algorithm.	6	Write a C program for Boundary fill algorithm of polygon filling.	2	CO2
LLO 7.1 Implement a C program for 2D Translation and Scaling	7	*Write a C program for 2D Translation and Scaling.	4	CO3
LLO 8.1 Implement a C program for 2D Rotation.	8	Write a C program for 2D Rotation.	2	CO3
LLO 9.1 Implement a C program for 2D Reflection and Shear.	9	*Write a C program for 2D Reflection and Shear.	4	CO3
LLO 10.1 Implement a C program for 3D Translation and Scaling.	10	*Write a C program for 3D Translation and Scaling .	4	CO3
LLO 11.1 Implement a C program for 3D Rotation	11	Write a C program for 3D Rotation.	2	CO3
LLO 12.1 Implement a C program for Line Clipping using Cohen-Sutherland algorithm.	12	*Write a C program for Line Clipping using Cohen-Sutherland algorithm.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Implement a C program for Line Clipping using Midpoint Subdivision algorithm.	13	Write a C program for Line Clipping using Midpoint Subdivision algorithm.	2	CO4
LLO 14.1 Implement C program for Sutherland Hodgeman Polygon Clipping.	14	Write a C program for Sutherland Hodgeman Polygon Clipping.	2	CO4
LLO 15.1 Implement a C program for Bezier Curve.	15	Write a C program for Bezier Curve.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Implement Snake Game
- Design Smile Face
- Design Digital Clock
- Any other micro projects suggested by subject teacher.
- Develop program for moving Car

Self learning

- Develop C language code for relevant topics suggested by the teacher
- Any computer graphics course suggested by teacher (NPTEL, MOOCs courses etc.)

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System with basic configuration.	All
2	'C' Compiler	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification

Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Computer Graphics	CO1	2	0	0	0	0
2	II	Raster Scan Graphics	CO2	4	0	0	0	0
3	III	Overview of 2D And 3D Transformations	CO3	4	0	0	0	0
4	IV	Windowing and Clipping Techniques	CO4	3	0	0	0	0
5	V	Introduction to Curves and Projections	CO5	2	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous Assessment based on Process and Product related performance indicators. Each practical will be assessed considering
60% weightage to Process
40% weightage to Product

Summative Assessment (Assessment of Learning)

- -

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	2	1	1	1			
CO2	2	2	2	2	-	1	1			
CO3	2	2	2	2	-	1	1			
CO4	2	2	2	2	-	1	1			
CO5	2	2	2	2	-	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Donald Hearn , M Pauline Baker	Computer Graphics	Prentice-Hall • ISBN-10 : 0131615300 • ISBN-13 : 978-0131615304
2	William M. Newman Robert F. Sproull	Principles of Interactive Computer Graphics	McGraw-Hill • ISBN: 978-0-07-046338-7
3	Zhigang Xiang, Roy Plastock	Computer Graphics	Schaum O Series • ISBN: 9789389538847 • ISBN: 938953884X
4	Atul P. Godse, Dr. Deepali A. Godse	Computer Graphics	Technical Publications ISBN 933322338X, 9789333223386

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/computer-graphics-programs	Basic graphics programs
2	https://www.tutorialspoint.com/computer_graphics/index.htm	Basics of computer graphics
3	https://www.educba.com/line-drawing-algorithm/	Line drawing algorithm
4	https://www.javatpoint.com/computer-graphics-clipping	Clipping Algorithms
5	https://www.tutorialspoint.com/computer_graphics/computer_graphics_curves.htm	Curves in computer graphics
6	https://www.tutorialspoint.com/computer_graphics/2d_transformation.htm	2D and 3D Transformation
7	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842008941903872103 61_shared/overview	Project on Computer Graphics

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ TC/ TE/ TR/ TX**
Semester	**: Third**
Course Title	**: ESSENCE OF INDIAN CONSTITUTION**
Course Code	**: 313002**

I. RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

- CO1 - List salient features and characteristics of the constitution of India.
- CO2 - Follow fundamental rights and duties as responsible citizen of the country.
- CO3 - Analyze major constitutional amendments in the constitution.
- CO4 - Follow procedure to cast vote using voter-id.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313002	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the meaning of preamble of the constitution. TLO 1.2 Explain the doctrine of basic structure of the constitution. TLO 1.3 List the salient features of constitution. TLO 1.4 List the characteristics of constitution.	**Unit - I Constitution and Preamble** 1.1 Meaning of the constitution of India. 1.2 Historical perspectives of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble of the Constitution of India.	Presentations Blogs Hand-outs Modules Flipped classrooms Case studies

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Enlist the fundamental rights. TLO 2.2 . Identify fundamental duties in general and in particular with engineering field. TLO 2.3 Identify situations where directive principles prevail over fundamental rights.	**Unit - II Fundamental Rights and Directive Principles** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance under part-IV-A. 2.3 Relevance of Directive Principles of State Policy under part-IV A.	Presentations Blogs Hand-outs Modules Case Study Flipped Classroom
3	TLO 3.1 Enlist the constitutional amendments. TLO 3.2 Elaborate the elements of Centre-State Relationship TLO 3.3 Analyze the purposes of various amendments.	**Unit - III Governance and Amendments** 3.1 3.1 Amendment procedure of the Constitution and their types - simple and special procedures. 3.2 The Principle of Federalism and its contemporary significance along with special committees that were setup. 3.3 Major Constitutional Amendment procedure - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd	Cases of Federal disputes with relevant Supreme court powers and Judgements Presentations Blogs Hand-outs Problem based learning
4	TLO 4.1 Explain the importance of electoral rights. TLO 4.2 Write the step by step procedure for process of registration TLO 4.3 Explain the significance of Ethical electoral participation TLO 4.4 Explain the steps to motivation and facilitation for electoral participation TLO 4.5 Enlist the features of the voter's guide TLO 4.6 Explain the role of empowered voter TLO 4.7 Write the steps of voting procedure TLO 4.8 Write steps to create voter awareness TLO 4.9 Fill the online voter registration form TLO TLO 4.10 Follow procedure to cast vote using voter-id.	**Unit - IV Electoral Literacy and Voter's Education** 4.1 Electoral rights , Electoral process of registration 4.2 Ethical electoral participation 4.3 Motivation and facilitation for electoral participation 4.4 Voter's guide 4.5 Prospective empowered voter 4.6 Voting procedure 4.7 Voter awareness 4.8 Voter online registration https:/ /www.ceodelhi.gov.in/ELCdetails.aspx	Presentations Hand-outs Modules Blogs Problem based Learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Outline the procedure to submit application for Voter-id
- Assignments are to be provided by the course teacher in line with the targeted COs.

A1. Prepare an essay on Constitution of India .
A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

- Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies. LGBTQIA+

Micro project

- 1. Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

2. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
3. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- 1 Differences in the ideals of Social democracy and Political democracy.

2 Democracy and Women's Political Participation in India.
3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

-

- Art 356 and its working in Post-Independent India.
- Women's Resrvation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

- Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.
i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

Cases: Suggestive cases for usage in teaching:

- A.K. Gopalan Case (1950) :SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.

Shankari Prasad Case (1951) : This case dealt with the amendability of Fundamental Rights (the First Amendment’s

validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
Minerva Mills case (1980) :This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
Maneka Gandhi case (1978) :A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."
Other cases:
1. Kesavananda Bharati Case (1973) : In this case the Hon. SC laid down a new doctrine of the 'basic structure' (or 'basic features') of the Constitution. It ruled that the constituent power of Parliament under Article 368 does not enable it to alter the 'basic structure' of the Constitution. This means that the Parliament cannot abridge or take away a Fundamental Right that forms a part of the 'basic structure' of the Constitution.
2. Mathura Rape Case(1979) : A tribal woman Mathura (aged 14 to 16 years) was raped in Police Custody. The case raised the questions on the idea of 'Modesty of Woman' and here it was was a tribal woman who succumbs to multiple pattiarchies. Custodial rape was made an offence and was culpable with the detainment of 7 years or more under Section 376 of Indian Penal Code. The weight of proofing the allegations moved from the victim to the offender, once sexual intercourse is established. The publication of the victim's identity was banned and it was also held that rape trials should be conducted under the cameras.
3. Puttswamy vs Union of India (2017) : In this landmark case which was finally pronounced by a 9-judge bench of the Supreme Court on 24th August 2017, upholding the fundamental right to privacy emanating from Article 21. The court stated that Right to Privacy is an inherent and integral part of Part III of the Constitution that guarantees fundamental rights. The conflict in this area mainly arises between an individual's right to privacy and the legitimate aim of the government to implement its policies and a balance needs to be maintained while doing the same.
4. Navtej Singh Johar & Ors. v. Union of India (2018) : Hon. SC Decriminalised all consensual sex among adults, including homosexual sex by scrapping down section 377 of the Indian penal code (IPC). The court ruled that LGBTQ community are equal citizens and underlined that there cannot be discrimination in law based on sexual orientation and gender.
5. Anuradha Bhasin Judgement (2020) : The Supreme Court of India ruled that an indefinite suspension of internet services would be illegal under Indian law and that orders for internet shutdown must satisfy the tests of necessity and proportionality. The Court reiterated that freedom of expression online enjoyed Constitutional protection, but could be restricted in the name of national security. The Court held that though the Government was empowered to impose a complete internet shutdown, any order(s) imposing such restrictions had to be made public and was subject to judicial review.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification

Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Constitution and Preamble	CO1	4	0	0	0	0
2	II	Fundamental Rights and Directive Principles	CO2	4	0	0	0	0
3	III	Governance and Amendments	CO3	4	0	0	0	0
4	IV	Electoral Literacy and Voter's Education	CO4	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	-	-	2	-	-			
CO2	1	-	-	-	2	-	-			
CO3	1	2	-	-	2	-	1			
CO4	-	-	-	1	-	-	-			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Author	Title	Publisher with ISBN Number
4	MORE READS :	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan,Agra, 2017, ISBN:8193413768

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf	Parts of constitution
7	https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-constitution	Parts of constitution

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name : Diploma In Computer Technology / Computer Engineering / Computer Science & Engineering / Computer Hardware & Maintenance

Programme Code : CM / CO / CW / HA **With Effect From Academic Year** : 2023-24

Duration Of Programme : 6 Semester **Duration** : 16 WEEKS

Semester : Third **NCrF Entry Level : 3.5** **Scheme** : K

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																							
1	DATA STRUCTURE USING C	DSU	DSC	313301	-	3	1	4	-	8	4	3	30	70	100	40	50	20	25#	10	-	-	175
2	DATABASE MANAGEMENT SYSTEM	DMS	DSC	313302	-	3	1	4	2	10	5	3	30	70	100	40	50	20	25#	10	25	10	200
3	DIGITAL TECHNIQUES	DTE	DSC	313303	-	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175
4	OBJECT ORIENTED PROGRAMMING USING C++	OOP	SEC	313304	-	3	2	4	1	10	5	3	30	70	100	40	50	20	25@	10	25	10	200
5	COMPUTER GRAPHICS	CGR	DSC	313001	-	1	-	2	1	4	2	-	-	-	-	-	25	10	-	-	25	10	50
6	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	313002	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total					**0**	**14**	**4**	**16**	**6**		**20**		**120**	**280**	**400**		**200**		**100**		**150**		**850**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) : 4, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 0, Skill Enhancement Course (SEC) : 1, GenericElective (GE) : 0

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX**
Semester	**: Fourth**
Course Title	**: ENVIRONMENTAL EDUCATION AND SUSTAINABILITY**
Course Code	**: 314301**

I. RATIONALE

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary approach to study the environmental systems and sustainability approach to the diploma engineers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant Environmental issues in specified locality.
- CO2 - Provide the green solution to the relevant environmental problems.
- CO3 - Conduct SWOT analysis of biodiversity hotspot
- CO4 - Apply the relevant measures to mitigate the environmental pollution.
- CO5 - Implement the environmental policies under the relevant legal framework.

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ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314301	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the need of studying environment and its components. TLO 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions TLO 1.3 Explain the Concept of 5 R w.r.t. the given situation TLO 1.4 Elaborate the relevance of Sustainable Development Goals in managing the climate change TLO 1.5 Explain the concept of zero carbon-footprint with carbon credit	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 1.4 Impact of Climate change, Factors contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Justify the importance of natural resources in sustainable development TLO 2.2 Explain the need of optimum use of natural resources to maintain the sustainability TLO 2.3 Differentiate between renewable and non-renewable sources of energy TLO 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**Unit - II Sustainability and Renewable Resources** 2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS-Concepts of Panchmahabhuta) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 2.3 Energy forms (Renewable and non-renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations
3	TLO 3.1 Explain the characteristics and functions of ecosystem TLO 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability TLO 3.3 Describe biodiversity assessment initiatives in India TLO 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India TLO 3.5 Explain the need of conservation of biodiversity in the given situation	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstrations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Classify the pollution based on the given criteria TLO 4.2 Justify the need of preserving soil as a resource along with the preservation techniques TLO 4.3 Maintain the quality of water in the given location using relevant preventive measures TLO 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms TLO 4.5 Compare the noise level from different zones of city with justification TLO 4.6 Describe the roles and responsibilities of central and state pollution control board	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man- made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city 4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations
5	TLO 5.1 Explain Constitutional provisions related to environmental protection TLO 5.2 Explain importance of public participation (PPP) in enacting the relevant laws TLO 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem TLO 5.4 Explain the role of information technology in environment protection	**Unit - V Enviornmental legislation and sustainable practices** 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

•

Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution

Draft an article on India's Strategies to progress across the Sustainable Development Goals

Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each

source
Conduct the SWOT analysis of biodiversity hotspot in India
Prepare a mind-mapping for the zero carbon footprint process of your field
Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions
Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

- Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below: -

Unit 1: Living with climate change
Unit 2 : Water Management and Climate Action
Unit 3: Energy Management and Climate Action
Unit 4 : Waste Management and Climate Action
Unit 5 : Bio-cultural Diversity and Climate Action
If students complete all the five Units they are not required to undertake any other assignment /Microproject/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

-

Technical analysis of nearby commercial RO plant.
Comparative study of different filters used in Household water filtration unit
Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainabilityand cost-benefit
IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion
Visit a local polluted water source and make a report mentioning causes of pollution
Any other activity / relevant topic related to the course suggested by the facilitator

Activities

-

Prepare a report on the working and functions of the PUC Center machines and its relavance in pollution control.
Prepare and analyse a case study on any polluted city of India
Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority
Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool
Watch a video related to air pollution in India and present the summary
Any other assignment on relevant topic related to the course suggested by the facilitator

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	8	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	10	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	8	4	4	4	12
4	IV	Environmental Pollution	CO4	12	4	8	6	18
5	V	Enviornmental legislation and sustainable practices	CO5	7	4	4	4	12
Grand Total				**45**	**20**	**24**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignment/activities. (60 % weightage to process and 40 % to product)

Summative Assessment (Assessment of Learning)

- Online MCQ type Exam

XI. SUGGESTED COS - POS MATRIX FORM

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi
3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://sdgs.un.org/goals	United Nation’s website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-fo r-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Intiative for youth leadership for climate action

28-11-2024 12:53:20 PM

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Link / Portal	Description
6	https://eepmoefcc.nic.in/index1.aspx?lsid=297&lev=2&lid=1180&langid=1	GOI Website for public awareness on enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India’s Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analysis-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal conservation

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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28-11-2024 09:49:01 AM

JAVA PROGRAMMING **Course Code : 314317**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/ Electronics & Computer Engg./**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE/ TE**
Semester	**: Fourth**
Course Title	**: JAVA PROGRAMMING**
Course Code	**: 314317**

I. RATIONALE

Java is platform independent, open-source object-oriented programming language and used for web applications. Java has the broad industry support and is prerequisite with many allied technologies like Java Server Pages, Android Application Development. This course will enable students to develop applications using java.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop standalone and network-based applications using Java.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop java program using classes and objects.
- CO2 - Develop java program for implementing code reusability concept.
- CO3 - Develop program to implement multithreading and exception handling.
- CO4 - Develop java program for implementing event handling using window-based application components.
- CO5 - Implements network programming in java.
- CO6 - Develop java program for managing database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314317	JAVA PROGRAMMING	JPR	AEC	4	-	4	2	10	5	3	30	70	100	40	25	10	50#	20	25	10	200

JAVA PROGRAMMING **Course Code : 314317**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Write programs to create classes and objects for the given problem. TLO 1.2 Describe characteristics of the given java token. TLO 1.3 Write program to evaluate given expressions. TLO 1.4 Write programs using relevant control structure to solve the given problem. TLO 1.5 Develop programs using vectors and wrapper classes for the given problem. TLO 1.6 Use constructors for the given programming problem.	**Unit - I Basic Syntactical Constructs in Java** 1.1 Java features and the Java programming environment 1.2 Defining a class, creating object, accessing class members 1.3 Java tokens and data types, symbolic constant, scope of variable, typecasting, and different types of operators and expressions, decision making and looping statements 1.4 Arrays, strings, string buffer classes, vectors, wrapper classes 1.5 Constructors and methods, types of constructors, method and constructor overloading, nesting of methods, command line arguments, garbage collection, visibility control: public, private, protected, default, private protected	Chalk-Board Demonstration Flipped Classroom Presentations

JAVA PROGRAMMING **Course Code : 314317**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Apply identified type of inheritance for the given programming problem. TLO 2.2 Differentiate between overloading and overriding with the help of examples. TLO 2.3 Develop program using interface. TLO 2.4 Create user defined package for the given problem.	**Unit - II Inheritance, Interface and Packages** 2.1 Inheritance: concept of inheritance , types of Inheritance: single inheritance, multilevel inheritance, hierarchical inheritance, method overriding, final variables, final methods, use of super, abstract methods and classes 2.2 Interfaces: Define interface, implementing interface, accessing interface variables and methods, extending interfaces 2.3 Package: Define package, types of package, naming and creating package, accessing package, import statement, static import, adding class and interfaces to a package	Lecture Using Chalk-Board Presentations Hands-on Flipped Classroom
3	TLO 3.1 Distinguish the errors and exceptions with example. TLO 3.2 Develop program for handling the given exception. TLO 3.3 Create threads to run multiple processes in a program. TLO 3.4 Develop program using different thread life cycle methods.	**Unit - III Exception Handling and Multithreading** 3.1 Errors and Exception: Types of errors and exceptions, try and catch statement, throws and finally statement, built-in exceptions, throwing our own exception 3.2 Multithreaded programming : creating a thread: By extending to thread class and by implementing runnable Interface, Life cycle of thread: Thread methods, thread exceptions, thread priority and methods, synchronization	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
4	TLO 4.1 Write steps to develop Graphical User Interface (GUI) using AWT components with frame for the given problem. TLO 4.2 Develop program using menu and dialog boxes for the given problem. TLO 4.3 Write steps to develop Graphical user interface (GUI) using advanced swing components for the given problem. TLO 4.4 Use delegation event model to develop event driven program for the given problem. TLO 4.5 Use relevant AWT/ Swing component(s) to handle the given event.	**Unit - IV Event handling using Abstract Window Toolkit (AWT) & Swings Components** 4.1 Component, container, window, frame, panel, use of AWT controls: labels, buttons, checkbox, checkbox group, textfield, textarea 4.2 Use of layout managers: flowLayout, borderLayout, gridLayout, gridBagLayout, menubars, menus, file dialog 4.3 Introduction to swing: Swing features, difference between AWT and Swing. 4.4 Swing components: Icons and Labels, TextField, ComboBox, Button, Checkbox, RadioButton 4.5 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips 4.6 Introduction to Event Handling: The delegation Event Model: Event sources, Event listeners 4.7 Event classes: The action event class, the Item event class, the Key event class, the mouse event class, text event 4.8 Event listener interfaces: ActionListener , ItemListener , KeyListener , MouseListener , MouseMotion , TextListener	Lecture Using Chalk-Board Presentations Demonstration Hands-on

JAVA PROGRAMMING **Course Code : 314317**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe the concepts of sockets in java. TLO 5.2 Use networking classes to retrieve host details. TLO 5.3 Develop program for Client/Server communication through TCP/IP Server sockets for the given problem.	**Unit - V Basics of Network Programming** 5.1 Socket Overview: Client/Server , reserved Sockets , proxy servers , Internet Addressing 5.2 Java and the Net: The networking classes and interfaces, InetAddress : Factory Methods , Instance Methods 5.3 TCP/IP Client and Server Sockets, datagram sockets, datagram packets 5.4 The URL Class, URLConnection class	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
6	TLO 6.1 Choose relevant database connectivity methods. TLO 6.2 Describe two tier and three tier architecture of JDBC. TLO 6.3 Choose relevant type of JDBC driver for the specified environment. TLO 6.4 Elaborate steps with example to establish connectivity with the specified database.	**Unit - VI Interacting with Database** 6.1 Introduction to JDBC, ODBC 6.2 JDBC architecture: Two tier and three tier models 6.3 Types of JDBC drivers, Class Class , DriverManager class, Connection interface, Statement interface, PreparedStatement interface, ResultSet Interface	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install any IDE software application.	1	* Setup Java Programming development environment using: • Command prompt.(Classpath and path setup) • Any IDE (Eclipse, Netbeans, VScode, Jcreator etc.).	2	CO1
LLO 2.1 Implement programs to evaluate different types of Expressions.	2	Write programs to evaluate different types of expressions.	2	CO1
LLO 3.1 Develop program to implement different control structures.	3	Write programs to demonstrate use of: • if statements (all forms of if statement • Switch – Case statement • Different types of Loops(for,while and do..while).	2	CO1
LLO 4.1 Develop program to implement different control structures.	4	*Write programs for implementation of different methods of: • String class. • StringBuffer class.	2	CO1

JAVA PROGRAMMING **Course Code : 314317**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Implement array and vectors in Java.	5	* Write programs to demonstrate: • Use of Array. • Use of Vectors .	2	CO1
LLO 6.1 Convert primitive data types into object and vice-versa.	6	Write programs using Wrapper Class : • to convert primitive into object. • to convert object into primitive.	2	CO1
LLO 7.1 Initialize objects using constructors.	7	Develop a program for implementation of different types of constructors.	2	CO1
LLO 8.1 Implement concepts of inheritance for code reusability.	8	Develop program to implement: • Single inheritance. • Multilevel inheritance.	2	CO2
LLO 9.1 Implement multiple inheritance.	9	* Develop program for implementation of interface.	2	CO2
LLO 10.1 Implement packages in Java.	10	*Write programs to demonstrate use of : • Built in packages • User defined packages.	2	CO2
LLO 11.1 Identify the different types of errors using exception handling.	11	Write programs for implementation of try, catch and finally block.	2	CO3
LLO 12.1 Manage different types of user defined exceptions.	12	*Write programs for implementation of throw, throws clause.	2	CO3
LLO 13.1 Execute different processes simultaneously using multithreading.	13	*Write programs using multithreading.	2	CO3
LLO 14.1 Design GUI using different AWT components.	14	* Write program to design any type of form using AWT components.	2	CO4
LLO 15.1 Design GUI using different menu class.	15	Write program to create a menu bar with various menu items and sub menu items.	2	CO4
LLO 16.1 Design GUI using border layout manager.	16	Write program to demonstrate the use of border layout. The layout shows four buttons at four sides with captions “left”, “right”, “top” and “bottom” using Swing Components.	2	CO4
LLO 17.1 Design GUI using grid layout manager.	17	*Write program to design a calculator to demonstrate the use of grid layout using swing components.	2	CO4
LLO 18.1 Implement swing components in a frame.	18	Write program using swing to display a JComboBox in a JFrame .	2	CO4
LLO 19.1 Design tree and table using advanced swing components in a frame.	19	Write program to create JTree and JTable.	2	CO4

JAVA PROGRAMMING **Course Code : 314317**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 20.1 Implement various keys and mouse events.	20	* Write program to handle key events and mouse events.	2	CO4
LLO 21.1 Implement action event in java.	21	*Write program to implement action event in frame using swing components.	2	CO4
LLO 22.1 Implement text event in java.	22	Write program to handle text event on swing components.	2	CO4
LLO 23.1 Extract the hostname and IP address using InetAddress class.	23	Write program to retrieve hostname and IP address using InetAddress class.	2	CO5
LLO 24.1 Retrieve various components of URL using different methods of URL and URLConnection class.	24	*Write program to demonstrate various methods of: • URL class. • URLConnection.	2	CO5
LLO 25.1 Implement client-server TCP based communication.	25	*Write program that demonstrates connection oriented communication using socket.	2	CO5
LLO 26.1 Implement client-server UDP based communication.	26	Write program to demonstrate sending and receiving data through datagram.	2	CO5
LLO 27.1 Make database connectivity using appropriate JDBC driver.	27	*Write program to: • Create sample database. • Make connectivity with database.	2	CO6
LLO 28.1 Manage database using JDBC.	28	*Write program to implement following operations on database: • Insert record. • Update record. • Delete record.	2	CO6
LLO 29.1 Manage database using JDBC.	29	Write program to demonstrate the use of PreparedStatement.	2	CO6
LLO 30.1 Implement dynamic query.	30	*Write program to retrieve data from table using ResultSet interface.(Use various methods of navigation methods).	2	CO6

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Other

- Complete any course of Java Programming on Infosys Springboard/Spoken Tutorial/NPTEL
- Develop java code for given problem suggested by course teacher.

JAVA PROGRAMMING **Course Code : 314317**

Micro project

- Develop mini-ATM machine system. It should accept account_no, account_holder_name, account_balance and perform operations such as withdrawal, Deposit and balance check.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in table along with student credentials.
- Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.
- Develop Employee Management System. Insert employee details such as employee_name, emp_id,emp_salary etc.. into database and retrieve data from table.
- Any other micro project as suggested by course teacher.

Assignment

- Solve assignment covering all COs given by course teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Databases like MySQL, Oracle, MS-Access or any other.	27,28,29,30
2	Computer System (Any computer system with basic configuration).	All
3	Computer with JDK1.8 or above, any IDE for Java Programming such as Eclipse, Jcreator, NetBeans,VScode .	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Syntactical Constructs in Java	CO1	8	4	4	4	12
2	II	Inheritance, Interface and Packages	CO2	10	2	4	6	12
3	III	Exception Handling and Multithreading	CO3	12	2	4	6	12
4	IV	Event handling using Abstract Window Toolkit (AWT) & Swings Components	CO4	14	4	4	8	16
5	V	Basics of Network Programming	CO5	8	2	4	4	10
6	VI	Interacting with Database	CO6	8	2	2	4	8
Grand Total				**60**	**16**	**22**	**32**	**70**

JAVA PROGRAMMING **Course Code : 314317**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process 40% weightage to product
- A continuous assessment based on term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	2	--	1	1			
CO2	2	2	2	2	--	1	1			
CO3	2	2	2	2	--	1	1			
CO4	2	2	2	2	1	2	2			
CO5	2	2	3	2	1	2	2			
CO6	2	2	3	3	1	2	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Programming with JAVA	Mcgraw Hill Education (India) Private Limited, New Delhi . ISBN-13: 978-93-5134-320-2
2	Schildt Herbert	Java Complete Reference	Mcgraw Hill Education, New Delhi . ISBN:9789339212094
3	Holzner, Steven et al	Java 8 Programming Black Book	Dreamtech Press, New Delhi. ISBN: 978-93-5119-758-4

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/java-tutorial	All content
2	https://www.w3schools.com/java/	All content
3	https://www.tutorialspoint.com/java/index.htm	All content

28-11-2024 09:49:01 AM

JAVA PROGRAMMING **Course Code : 314317**

Sr.No	Link / Portal	Description
4	https://www.programiz.com/java-programming/online-compiler/	Online compiler for java
5	https://onecompiler.com/java	Online compiler for java
6	https://www.odbms.org/wp-content/uploads/2013/11/009.01-Arlow-JDBC-Tutorial-July-2005.pdf	Database Connectivity
7	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview	All content
8	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842009554911232973 0_shared/overview	All content
9	https://onlinecourses.nptel.ac.in/noc22_cs47/preview	All content

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE**
Semester	**: Fourth**
Course Title	**: DATA COMMUNICATION AND COMPUTER NETWORK**
Course Code	**: 314318**

I. RATIONALE

Data communication and computer networks are essential components of modern computing infrastructure, enabling seamless exchange of information and facilitating collaboration across various devices and locations. By considering various applications, students should be able to choose, classify, install, troubleshoot, and maintain various data communication networks. This course provides the important concepts and techniques related to networking and offer students to have valuable insights into technology behind network communication.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified Outcome through various teaching learning experiences:

• Manage Data Communication and Computer Network

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Analyze the functioning of Data Communication and Computer Network.
- CO2 - Select relevant Transmission Media and Switching Techniques as per need.
- CO3 - Analyze the Transmission Errors with respect to IEEE standards.
- CO4 - Configure different TCP/IP services.
- CO5 - Implement relevant Network Topology using Networking Devices.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314318	DATA COMMUNICATION AND COMPUTER NETWORK	DCN	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the role of the given component in the process of data communication. TLO 1.2 Compare the characteristics of analog and digital signals on the given parameter. TLO 1.3 Explain the process of data communication using the given mode. TLO 1.4 Classify computer networks on the specified parameter.	**Unit - I Fundamentals of Data Communication and Computer Network** 1.1 Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol 1.2 Protocols, Standards, Standard organizations, Bandwidth, Data Transmission Rate, Baud Rate and Bits per second 1.3 Modes of Communication (Simplex, Half duplex, Full Duplex) 1.4 Analog Signal and Digital Signal, Analog and Digital Transmission: Analog To Digital, Digital To Analog Conversion 1.5 Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits 1.6 Classification Of Network: LAN, WAN,MAN	Lecture Using Chalk-Board, Presentations, Video Demonstrations

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain with sketches the construction of a given type of cable. TLO 2.2 Explain with sketches the characteristics of the given type of unguided transmission media. TLO 2.3 Explain with sketches the working of the given Multiplexing technique. TLO 2.4 Describe with sketches the working principle of the given Switching technique. TLO 2.5 Compare different Switching techniques on the given parameter.	**Unit - II Transmission Media And Switching** 2.1 Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable 2.2 Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite 2.3 Line-of-Sight Transmission, Point-to-Point, Broadcast 2.4 Multiplexing: Frequency-Division Multiplexing ,Time - Division Multiplexing 2.5 Switching: Circuit-switched network, Packet switched network	Lecture Using Chalk-Board, Presentations, Video Demonstrations
3	TLO 3.1 Explain working of the given error detection and correction method. TLO 3.2 Explain features of the given IEEE communication standard. TLO 3.3 Explain characteristics of the given layer in IEEE 802.11 architecture. TLO 3.4 Explain with sketches the process of creating a Bluetooth environment using the given architecture. TLO 3.5 Compare the specified generations of mobile telephone systems on the given parameter.	**Unit - III Error Detection and Correction** 3.1 Types of Errors, Forward Error Correction Versus Retransmission 3.2 Framing: Fixed Sized and Variable Sized Framing 3.3 Error Detection: Repetition codes, Parity bits, Checksums, CRC 3.4 Error Correction: Automatic Repeat Request (ARQ), Hamming Code 3.5 Wireless LAN IEEE 802.11 standard Architecture, Features of IEEE 802.11 versions: 802.11,802.11a,802.11b,802.11g,802.11n,802.11p 3.6 Bluetooth Architecture: Piconet, Scatternet 3.7 Mobile Generations: 3G, 4G and 5G	Lecture Using Chalk-Board, Presentations, Video Demonstrations, Flipped Classroom

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Identify functions and features of the given layer of OSI Reference model. TLO 4.2 Compare the specified service on the given parameters. TLO 4.3 Classify IP Addresses on the basis of its class from the given set of addresses. TLO 4.4 Distinguish between IPv4 and IPv6 on the given parameters. TLO 4.5 Describe with sketches the procedure to configure the given TCP/IP service.	**Unit - IV Network Communication Models** 4.1 THE OSI MODEL: Layered Architecture, Encapsulation 4.2 Layers in OSI Model(Functions of each layer)-Physical Layer,Data-Link Layer,Network Layer,Transport Layer,Session Layer,Presentation Layer,Application Layer 4.3 TCP/IP Layers and their functions: Host To Network Layer,Internet Layer,Transport Layer,Application Layer 4.4 Protocols: Host To Network Layer-SLIP,PPP, Internet Layer-IP,ARP,RARP,ICMP, Transport Layer-TCP and UDP, Application Layer-FTP,HTTP,SMTP,TELNET,BOOTP,DHCP 4.5 Addressing: Physical Address, Logical Address, Port Address 4.6 IP Address-Concept, Notation, Address Space 4.7 IPv4 Addressing: Classful and Classless Addressing ,subnet mask,supernetting,subnetting 4.8 IPV6 Addressing scheme and basic structure	Lecture Using Chalk-Board, Presentations, Case Study, Flipped Classroom
5	TLO 5.1 Compare different computing models on the given parameter. TLO 5.2 Identify relevant network topology for the given situation. TLO 5.3 Compare different topologies on the given parameter. TLO 5.4 Select network connecting device for the given situation. TLO 5.5 Describe with sketches the procedure to configure the given networking device.	**Unit - V Network Topologies And Network Devices** 5.1 Network Computing Model: Peer To Peer, Client Server 5.2 Network Topologies: Introduction, Definition, Selection criteria, Types of Topology- Star ,Mesh, Tree, Hybrid 5.3 Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement Amplitude Shift Keying(ASK)	1	* Amplitude Shift Keying(ASK) using any simulator	2	CO1
LLO 2.1 Implement Frequency Shift Keying(FSK)	2	Frequency Shift Keying(FSK) using any simulator	2	CO1
LLO 3.1 Implement Phase Shift Keying(PSK)	3	Phase Shift Keying(PSK) using any open source simulation software	2	CO1

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Create standard network straight cable by using cable tester.	4	*Create and Test standard straight network cable(Universal Colour Code) using crimping tool	2	CO2
LLO 5.1 Create standard Cross network cable by using cable tester.	5	Create and Test standard Cross network cable(Universal Colour Code) using crimping tool	2	CO2
LLO 6.1 Use basic programming skills to simulate communication systems. LLO 6.2 Debug and execute the program for Time Division Multiplexing(TDM).	6	* Generate a Time Division Multiplexing(TDM) signal using relevant simulation software	2	CO2
LLO 7.1 Transfer data using Bluetooth.	7	*Create a Hybrid Network Using Bluetooth	2	CO3
LLO 8.1 Identify different error detection methods. LLO 8.2 Detect errors using Checksum.	8	*Locate the error bit in the given data string by applying checksum error detection method	2	CO3
LLO 9.1 create WI-FI environment.	9	*Implement Wireless network	2	CO3
LLO 10.1 Draw block diagram for parity check. LLO 10.2 Implement parity check with examples.	10	Write a ‘C’ program for parity check error detection	2	CO3
LLO 11.1 Implement C Program for CRC	11	*Write a ‘C’ program for Cyclic Redundancy Check(CRC) error detection	2	CO3
LLO 12.1 Implement Hamming code in any suitable programming language.	12	*Write a ‘C’ program for error correction using Hamming code	2	CO3
LLO 13.1 Use IP address and appropriate subnet mask for given problem statement.	13	*Configure static IP address in operating system along with appropriate subnet mask for given problem	2	CO4
LLO 14.1 Implement IP addresses for intranet in Class A, Class B, Class C.	14	* Implement Classful Address in a given network node i)Identify range of IP Address in various classes ii)Justify the reason to choose various IP address classes for creating given network	2	CO4
LLO 15.1 Troubleshoot computer network using commands.	15	*Execute TCP/IP network commands:ipconfig,ping,tracert	2	CO4
LLO 16.1 Troubleshoot computer network using commands.	16	*Execute TCP/IP network commands: netstat, pathping, route	2	CO4
LLO 17.1 Use wireshark packet sniffer software.	17	*1) Install Wireshark and configure as packet sniffer- i)Capture IP,TELNET, FTP packets using Wireshark	2	CO4
LLO 18.1 Measure various types of Delay by using Wireshark.	18	Capture TCP and UDP packet using Wireshark	2	CO4

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Filter ARP and ICMP packet Traffic using Wireshark.	19	Capture ARP and ICMP packet Traffic using Wireshark	2	CO4
LLO 20.1 Install server operating system	20	Install Operating System Linux/Windows/Any other Server	2	CO4
LLO 21.1 Create FTP Server	21	Use FTP protocol to transfer file from one system to another system	2	CO4
LLO 22.1 Implement IPv6 addressing scheme on a network.	22	Create IPv6 environment in a small network using simulator	2	CO4
LLO 23.1 Configure HTTP server on given operating system.	23	*Create HTTP server	2	CO5
LLO 24.1 Use star topology for a given situation.	24	*Create computers using Star topology with wired media	2	CO5
LLO 25.1 Use Network simulator CISCO packet tracer.	25	Create Tree topology using CISCO packet tracer software	2	CO5
LLO 26.1 Implement remote login feature.	26	Configure TELNET for remote login	2	CO5
LLO 27.1 Survey existing network infrastructure.	27	*Visit your computer laboratory- i)Identify the type of topology ii)Identify types of connecting devices with specifications iii)Identify types of cables with specifications iv)List the type of network applications commonly used in the laboratory iv)Draw the layout of installed network	4	CO5
LLO 28.1 Transfer a file from one computer to another. LLO 28.2 Print documents from remote system in a network.	28	Share folder and printer in a network	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Solve an assignment on any relevant topic given by the Teacher
- For a trading firm an organization with 10users, draw network architecture design of wireless LAN.
- Identify appropriate network topology and network connecting devices for following requirement. Draw network design for proposed network. An organization having its office in a building of 5 floor. Each floor it needs 20

machines. There is one File server. Each floor has 2 print servers to facilitate printer capacity using Tree topology.

Micro project

- Install and configure NIC and find MAC Address of Device
- Design a network using any topology and do fault identification
- Create a tool that monitors network bandwidth usage in real-time

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Desktop Computer with basic configuration	All
2	Network Tool Kit: Crimping Tool for RJ-45 connector ,3in 1 modular crimping tool for RJ-45 UTP CAT-5/CAT-6 Networking Cable,LAN Cutter 8P/6pP/4P All-in-One or similar,Cable Tester/LAN Tester(Specification: Network Cable Tester for LAN RJ-45/CAT5/CAT6 UTP Wire Test Tool or similar)	All
3	Network Accessories: RJ45 connector, UTP cable, optical fibre cable, Coaxial cable, various connectors,1000Mbps NIC	All
4	UPS 6 KVA online	All
5	Ethernet Switch- 4/8/16/24/32	All
6	Router-256MB Memory storage capacity, compatible with Desktop and Laptop, Rack Mountable, Wireless Connectivity	All
7	Printer	All
8	Wireshark(https://www.wireshark.org/download.html)or any other Packet Analyzer Tool	All
9	Simulation Software: CISCO Packet Tracer, CORE Network Emulator or Similar	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Data Communication and Computer Network	CO1	10	4	8	4	16
2	II	Transmission Media And Switching	CO2	10	4	4	6	14
3	III	Error Detection and Correction	CO3	8	4	4	6	14
4	IV	Network Communication Models	CO4	12	4	6	8	18

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
5	V	Network Topologies And Network Devices	CO5	5	2	2	4	8
Grand Total				**45**	**18**	**24**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	2	1	-	-	1			
CO2	1	1	2	1	-	1	1			
CO3	1	2	1	1	-	-	1			
CO4	1	2	2	1	-	1	1			
CO5	-	2	2	1	1	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Behrouz A. Forouzan	Data Communication and Networking	McGraw-Hill Higher Education ISBN-13 978-0-07-296775-3
2	Behrouz A. Forouzan:	TCP/IP Protocol Suit	McGraw Hill Education ISBN-13 978-0073376042
3	A.S. Tanenbaum	Computer Networks	PRENTICE HALL ISBN-10: 0-13-212695-8 ,ISBN-13:978-0-13-212695-3
4	Godbole Achyut	Data Communication and Networks	McGraw Hill Education ISBN-10 9780071077705,ISBN-13 978-0071077705

DATA COMMUNICATION AND COMPUTER NETWORK **Course Code : 314318**

Sr.No	Author	Title	Publisher with ISBN Number
5	Comer Douglas E.	TCP/IP Principles, Protocols and Architectures	PEARSON ISBN 10: 0-13-608530-X ISBN 13: 978-0-13-608530-0

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/	Data Communication-Definition, Components,Types,Channels
2	https://www.tutorialspoint.com/data_communication_computer_network/index.htm	Data Communication and Computer Network
3	https://nptel.ac.in/courses/106105081	Computer Networks
4	https://nptel.ac.in/courses/106105183	Computer Networks and Internet Protocol
5	Introduction To Computer Networks | Studytonight	Introduction To Computer Networks

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Computer Science/**
Programme Code	**: AI/ AN/ CM/ CO/ CW/ DS/ HA/ SE**
Semester	**: Fourth**
Course Title	**: MICROPROCESSOR PROGRAMMING**
Course Code	**: 314321**

I. RATIONALE

The microprocessor is the most vital component of a computer system and is considered be its' brain and heart. This course will cover the basics of 8086 and its architecture along with instruction set, data types, assembly language programming with effective use of procedure and macro. This course will enable the students to inculcate assembly language programming concepts and methodology to solve problems related with microprocessor-based systems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

This course aims to help the student to attain the following industry expected outcomes through various teaching-learning experiences:
*Develop assembly language programs using 8086.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Analyze the functional block diagram of 8086 microprocessor.
- CO2 - Use program development tools and assembler directives.
- CO3 - Use instructions in different addressing modes.
- CO4 - Develop an assembly language program for a given task using assembler.
- CO5 - Use procedures and macros to develop an assembly language program for a given problem.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
314321	MICROPROCESSOR PROGRAMMING	MIC	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175	

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the function of the given pin of 8086. TLO 1.2 Explain function of Bus Interface Unit and Execution Unit in 8086 Microprocessor. TLO 1.3 State functions of the given Register of 8086 Microprocessor. TLO 1.4 Calculate the physical address for the given segmentation of 8086 Microprocessor.	**Unit - I 8086-16 Bit Microprocessor** 1.1 8086 Microprocessor: Salient features, pin descriptions 1.2 Architecture of 8086: Functional block diagram, register organization 1.3 Concept of pipelining 1.4 Memory segmentation, Physical memory addresses generation	Lecture using chalk-board Presentations Hands-on
2	TLO 2.1 Describe the given steps of program development and execution. TLO 2.2 Write steps to develop a code for the given problem using assembly language. TLO 2.3 Use relevant command of debugger to correct the specified programming error. TLO 2.4 Describe function of the given assembler directives with example.	**Unit - II The Art of Assembly Language Programming** 2.1 Program development steps: Problem definition, Algorithm, Flowchart, Initialization checklist, Choosing instructions, Converting algorithm into assembly language program 2.2 Assembly Language Programming Tools: • Editor • Assembler • Linker • Debugger 2.3 Assembler directives	Lecture using chalk-board Presentations Hands-on Collaborative learning

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Determine the length of the given instruction. TLO 3.2 Describe the given addressing modes with examples. TLO 3.3 Explain the operation performed by the given instruction during its execution. TLO 3.4 Identify the addressing mode of the given instruction.	**Unit - III Instruction Set of 8086 Microprocessor** 3.1 Machine language instruction format 3.2 Addressing modes 3.3 Instruction set: • Arithmetic instructions • Logical Instructions • Data transfer instructions • Flag manipulation instructions • String operation instructions • Program control transfer or branching instructions • Process control instructions	Lecture using chalk-board Presentations Hands-on Collaborative learning
4	TLO 4.1 Use the given model of assembly language program for the given problem. TLO 4.2 Develop ALP for the given problem. TLO 4.3 Apply relevant control loops in the program for the given problem. TLO 4.4 Use string instruction to manipulate the elements of the given block of data.	**Unit - IV Assembly Language Programming** 4.1 Models of 8086 assembly language program 4.2 Programming using assembler: • Arithmetic operations on hexadecimal and BCD numbers • Sum of series • Smallest and largest numbers from array • Sorting numbers in ascending and descending order • Check whether given number is odd or even • Check whether given number is positive or negative • Block transfer • String operations - Length, Reverse, Compare, Concatenation, Copy • Count numbers of '1' and '0' in 16 bit number	Lecture using chalk-board Presentations Hands-on Collaborative learning
5	TLO 5.1 Apply the relevant 'parameter- passing' method in the given situation. TLO 5.2 Develop an assembly language program using the relevant procedure for the given problem. TLO 5.3 Develop an assembly language program using macros for the given problem. TLO 5.4 Compare procedures and macros on the basis of the given parameter.	**Unit - V Procedure and Macro** 5.1 Procedure: Defining and calling procedure - PROC, ENDP, FAR and NEAR Directives; CALL and RET instructions; Parameter passing methods, Assembly language programs using procedure 5.2 Macro: Defining macro, MACRO and ENDM Directives, Macro with parameters, Assembly language programs using macro	Lecture using chalk-board Presentations Hands-on Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify the functions of various blocks in 8086 architecture. LLO 1.2 Identify the use of registers of 8086.	1	* Identification of various blocks in 8086 microprocessor architecture	2	CO1

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Identify the function of given assembly language tool. LLO 2.2 Use assembler directives in a given situation.	2	* Use assembly language programming (ALP) tools and directives	2	CO2
LLO 3.1 Use different addressing mode instructions in program. LLO 3.2 Write an assembly language program for addition and subtraction using different addressing mode instruction.	3	* ALP to perform addition and subtraction of two given numbers	2	CO3
LLO 4.1 Write an assembly language program for multiplication of two 16 bit unsigned numbers. LLO 4.2 Write an assembly language program for multiplication of two 16 bit signed numbers.	4	ALP for multiplication of two signed and unsigned numbers	2	CO3
LLO 5.1 Write an assembly language program for division of two unsigned numbers. LLO 5.2 Write an assembly language program for division of two signed numbers.	5	ALP to perform division of two unsigned and signed numbers	2	CO3
LLO 6.1 Use DAA and DAS instructions to perform arithmetic operations on BCD numbers. LLO 6.2 Write an ALP to perform arithmetic operations on BCD numbers.	6	ALP to add, subtract, multiply and divide two BCD numbers	2	CO3
LLO 7.1 Implement loop in assembly language program. LLO 7.2 Use string instruction to perform block transfer operation. LLO 7.3 Write an ALP to perform block transfer data without using string instruction. LLO 7.4 Write an ALP to perform block transfer data with using string instruction.	7	* ALP to perform block transfer operation	2	CO4
LLO 8.1 Implement loop in assembly language program to find sum of series. LLO 8.2 Write an assembly language program to find sum of series of n Hexadecimal numbers. LLO 8.3 Write an assembly language program to find sum of series of n BCD numbers.	8	ALP to find sum of series	2	CO4
LLO 9.1 Implement loop in assembly language program to find smallest and largest number from the array of n numbers. LLO 9.2 Use decision making branching instruction to find smallest or largest number. LLO 9.3 Write an assembly language program to find smallest number from the array of n numbers. LLO 9.4 Write an assembly language program to find largest number from the array of n numbers.	9	* ALP to find smallest and largest number from array of numbers	2	CO4

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Apply iterative method to arrange numbers in array in ascending or descending order. LLO 10.2 Write an assembly language program to arrange numbers in array in ascending order. LLO 10.3 Write an assembly language program to arrange numbers in array in descending order.	10	ALP to arrange numbers in an array in ascending or descending order	2	CO4
LLO 11.1 Write an assembly language program to find length of string. LLO 11.2 Write an assembly language program to concatenate two strings.	11	* ALP to find the length of string and concatanate two strings	2	CO4
LLO 12.1 Write an assembly language program to copy string. LLO 12.2 Write an assembly language program to copy string in reverse order.	12	ALP for string operations such as string reverse and string copy	2	CO4
LLO 13.1 Write an assembly language program to compare two strings without string instruction. LLO 13.2 Write an assembly language program to compare two strings using string instruction.	13	ALP to compare two strings	2	CO4
LLO 14.1 Use div and rotate instructions to check the given number is odd or even. LLO 14.2 Write an assembly language program to count odd and even from the array of n numbers.	14	* ALP to check a given number is odd or even	2	CO4
LLO 15.1 Use rotate instructions to check the given number is positive or negative. LLO 15.2 Write an assembly language program to count positive and negative numbers in given array.	15	ALP to check a given number is positive or negative	2	CO4
LLO 16.1 Use rotate instructions to count '0' and '1' in the given number. LLO 16.2 Write an assembly language program to count number of' ‘0' and '1's in a given number.	16	ALP to count number of' ‘0' and '1's in a given number	2	CO4
LLO 17.1 Use CALL and RET instructions to call procedures using different parameter passing methods.. LLO 17.2 Use assembler directives: PROC and ENDP to write the procedure. LLO 17.3 Write an assembly language program using procedure to perform for addition, subtraction, multiplication and division. LLO 17.4 Write an assembly language program using procedure to solve equation such as Z = (A+B)*(C+D).	17	* ALP to perform arithmetic operations on given numbers using procedure	2	CO5

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 18.1 Use assembler directives MACRO and ENDM to write the macros using parameters. LLO 18.2 Write an assembly language program using macro to perform for addition, subtraction, multiplication and division. LLO 18.3 Write an assembly language program using macro to solve equation such as Z = (A+B)* (C+D).	18	ALP to perform arithmetic operations on given numbers using macro	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- The micro project has to be laboratory-based developed in assembly language as suggested by teacher. Each microproject should encompass of two or more CO's which are in fact, an integration of laboratory experiments and LLO's. Some of the suggested microprojects are given below.

a. Conversion of number system-(Any one):
1. Convert hexadecimal number to equivalent BCD.
2. Convert BCD number to equivalent hexadecimal number

b. Array-(Any one):
1. Separate odd and even number from given array, store them in separate array and find the sum.
2. Separate odd and even number from given array, store them in separate array and find the smallest and largest among them.
3. Separate odd and even number from given array, store them in separate array and sort numbers in ascending and descending order.

c. Basic mathematical functions-(Any one):
1. Generate fibonacci series.
2. Calculate a factorial of given number.

d. String manipulation-(Any one):
1. Convert given lower case string to upper case string and vice-versa.
2. Check the given string for palindrome.
3. Search given character and its position in a string; i.e. find how many times character is present in a string and its position in a string.

Assignment

- Prepare a comparative survey report of 8086 microprocessor with i3, i5, i7, i9 or AMD Ryzen processor.

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	**Hardware:** Personal computer, (Processor i3 onwords preferable), RAM minimum 2GB Operating system: Windows-7 onwards	All
2	**Software:** a) Assembler: Borland Turbo (TASM) / Microsoft Assembler (MASM) b) Linker: Borland Turbo (TLINK) / Microsoft (LINK) c) Debugger: Borland Turbo (TD) / Microsoft debugger (CS or Debug) d) Editor: DOS-Edit / Notepad	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	8086-16 Bit Microprocessor	CO1	6	2	6	6	14
2	II	The Art of Assembly Language Programming	CO2	6	2	2	4	8
3	III	Instruction Set of 8086 Microprocessor	CO3	12	2	8	8	18
4	IV	Assembly Language Programming	CO4	15	0	4	16	20
5	V	Procedure and Macro	CO5	6	2	4	4	10
Grand Total				**45**	**8**	**24**	**38**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva-voce

MICROPROCESSOR PROGRAMMING **Course Code : 314321**

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	-	-	1	1			
CO2	2	1	1	2	-	1	1			
CO3	3	2	2	2	-	1	1			
CO4	3	3	3	2	-	1	1			
CO5	3	3	3	2	-	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Douglas V. Hall	Microprocessor and Interfacing (Programming and Hardware)	McGraw Hill Education, New Delhi ISBN-13: 978-0070257429
2	Walter A. Triebel, Avtar Singh	The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications	Pearson Publications, New Delhi ISBN-13: 978-0131228047
3	Sunil Mathur	Microprocessor 8086: Architecture, Programming and Interfacing	PHI, New Delhi ISBN-13: 978-8120340879
4	K. R. Venugopal and Raj Kumar	Microprocessor X86 Programming	BPB Publications, Delhi ISBN-13: 978-8170294580

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.htm	Architecture of 8086
2	https://www.geeksforgeeks.org/architecture-of-8086/	Architecture of 8086
3	https://www.javatpoint.com/8086-microprocessor	Pin description and Architecture of 8086
4	https://electronicsdesk.com/assembler-directives.html	Assembler directives
5	https://www.geeksforgeeks.org/addressing-modes-8086-microprocessor/	Addressing modes of 8086

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MICROPROCESSOR PROGRAMMING **Course Code : 314321**

Sr.No	Link / Portal	Description
6	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_addressing_modes.htm	Addressing modes of 8086
7	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_instruction_sets.htm	Instruction set of 8086
8	https://www.javatpoint.com/instruction-set-of-8086	Instruction set of 8086
9	https://nptel.ac.in/courses/108103157	NPTEL Course on Microprocessors and Interfacing

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024 **Semester - 4, K Scheme**

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PYTHON PROGRAMMING **Course Code : 314004**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH/ SE**
Semester	**: Fourth**
Course Title	**: PYTHON PROGRAMMING**
Course Code	**: 314004**

I. RATIONALE

Python is an open source, general-purpose and most versatile programming language. Python code is simple, readable, short, intuitive, and powerful, and thus it is effective for introducing computing and problem solving for beginners. This course covers basic fundamentals of Python programming, which also provides a foundation for further exploration of its more advanced applications in a variety of domains, including application development, data science, artificial intelligence, machine learning, and more.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using python to solve given problem.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop python programs using control flow statements.
- CO2 - Perform operations on various data structures in Python.
- CO3 - Develop packages to solve given problem using python.
- CO4 - Apply object-oriented approach to solve given problem using python.
- CO5 - Use relevant built-in python package to develop application.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
314004	PYTHON PROGRAMMING	PWP	AEC	2	-	4	-	6	3	-	-	-	-	-	50	20	50#	20	-	-	100	

MSBTE Approval Dt. 21/11/2024 **Semester - 4, K Scheme**

PYTHON PROGRAMMING **Course Code : 314004**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain given feature of python. TLO 1.2 Write python program to perform basic input output operations. TLO 1.3 Write python program to solve given expression. TLO 1.4 Implement given decision making statements and looping statements in python program.	**Unit - I Introduction to Python and Control flow statements** 1.1 Introduction: Features, History and Applications of Python, Python IDE’s 1.2 Python building blocks: Indentation, Identifiers, Variable, Comments, Keywords 1.3 Basic input output operations: input(), print() 1.4 Operators: Arithmetic, Relational, Assignment, Logical, Bitwise, Membership and Identity operator 1.5 Control flow statements: Conditional statements (if, if-else, if-elif-else, nested if), Loops in python (while, for, nested loops), Loop manipulation statements (continue, pass, break, else)	Chalk-Board Demonstration Presentations

PYTHON PROGRAMMING **Course Code : 314004**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Write python program to manipulate lists. TLO 2.2 Write python program to manipulate tuples. TLO 2.3 Write python program to manipulate sets. TLO 2.4 Write python program to manipulate dictionaries.	**Unit - II Data Structures in Python** 2.1 List: a) Defining lists, accessing values from list, deleting list values, updating lists b) Basic list operations c) Built-in list functions/methods 2.2 Tuple: a) Defining Tuple, accessing values from Tuple b) Basic Tuple operations c) Built in Tuple functions/methods 2.3 Set: a) Defining Sets, accessing values from set, deleting set values b) Basic set operations c) Built in set functions/methods 2.4 Dictionary: a) Defining Dictionary, accessing values from Dictionary, deleting Dictionary values, updating Dictionary b) Basic Dictionary operations c) Built in Dictionary functions/methods	Chalk-Board Demonstration Presentations Hands-on
3	TLO 3.1 Write relevant user defined functions for the given problem. TLO 3.2 Write relevant user defined module for the given problem. TLO 3.3 Write packages for the given problem.	**Unit - III Functions, Modules and Packages in Python** 3.1 Functions: Defining function, Calling function, Function arguments, Return statement, Scope of Variable, Lambda functions 3.2 Modules: Create user defined Module, Importing a module, Using python built-in modules, Namespace and scoping 3.3 Python Packages: Create user defined Package, Importing a Package, Using python built-in Packages, Installing packages using PIP	Chalk-Board Demonstration Presentations Hands-on
4	TLO 4.1 Write python program using classes and objects to solve given problem. TLO 4.2 Implement python program using different types of constructors. TLO 4.3 Write program to demonstrate polymorphism. TLO 4.4 Write python code using data abstraction for given problem. TLO 4.5 Apply inheritance for the given problem.	**Unit - IV Object Oriented Programming in Python** 4.1 Object oriented Concepts: Creating class, Creating object 4.2 Constructors in python (Parameterized & Non-Parameterized), the self parameter 4.3 Polymorphism: Method Overloading and Overriding 4.4 Data Hiding / Abstraction 4.5 Inheritance: Single Inheritance, Multiple Inheritance, Multilevel Inheritance	Chalk-Board Demonstration Presentations Hands-on

PYTHON PROGRAMMING **Course Code : 314004**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Write python program to use pandas package for the given problem. TLO 5.2 Create GUI application using tkinter package for the given problem. TLO 5.3 Create a python application to connect with database.	**Unit - V Introduction to Built-in Packages in Python** 5.1 Pandas: Use of pandas, pandas series, pandas DataFrames, pandas Read CSV 5.2 Creating GUI using tkinter: Introduction to tkinter, Widgets (Entry, Label, Button, RadioButton, Checkbutton), Creating a simple GUI application 5.3 Connecting to Database using MySQL: Installing mysql-connector, cursor() object, execute() method, fetchall() method, Creating simple program to connect database	Lecture Using Chalk-Board Flipped Classroom Demonstration Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install the given Python IDE.	1	Install given Python IDE.	2	CO1
LLO 2.1 Write python program for performing basic input and output operation in given problem.	2	*1. Write python program to display welcome message on screen. 2. Implement the python program to read data from user and display data on screen.	2	CO1
LLO 3.1 Write python program to solve given expression.	3	*Implement a python programs using following operators: 1. Arithmetic 2. Relational & logical 3. Assignment 4. Bitwise 5. Membership 6. Identity	2	CO1
LLO 4.1 Write python program for solving given problem using various if statements.	4	*Implement a python program to demonstrate the use of following conditional statements: 1. if statement 2. if..else statement 3. if..elif..else statement 4. nested if statement	2	CO1
LLO 5.1 Write python program for solving given problems using a while loop. LLO 5.2 Write python program for solving given problem using for loop.	5	*Implement a python program to demonstrate the use of following looping statements: 1. while loop 2. for loop 3. nested loop	2	CO1
LLO 6.1 Use loop control statements in python for solving given problem.	6	Implement python program to demonstrate the use of loop control statements. [continue, pass, break, else]	2	CO1

PYTHON PROGRAMMING **Course Code : 314004**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Write python program to perform operations on list.	7	*Implement a python program to perform following operations on the List: 1. Create a List 2. Access List 3. Update List 4. Delete List	2	CO2
LLO 8.1 Write python program to use built-in functions on list.	8	Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods)	2	CO2
LLO 9.1 Write python program to perform operations on tuple.	9	*Implement python program to perform following operations on the Tuple: 1. Create a Tuple 2. Access Tuple 3. Print Tuple 4. Delete Tuple 5. Convert tuple into list and vice-versa	2	CO2
LLO 10.1 Write python program to manipulate the set.	10	*Implement a python program to perform following operations on the Set: 1. Create a Set 2. Access Set 3. Update Set 4. Delete Set	2	CO2
LLO 11.1 Use built-in functions/methods on sets in python for solving given problems.	11	Implement a python program to perform following functions on Set: 1. Union 2. Intersection 3. Difference 4. Symmetric Difference	2	CO2
LLO 12.1 Write python program to perform operations on dictionary.	12	*Implement a python program to perform following operations on the Dictionary: 1. Create a Dictionary 2. Access Dictionary 3. Update Dictionary 4. Delete Dictionary 5. Looping through Dictionary 6. Create Dictionary from list	2	CO2
LLO 13.1 Write function to solve given problem.	13	Write a user define function to implement following features: 1. Function without argument 2. Function with argument 3. Function returning value	2	CO3
LLO 14.1 Write python program to create function by selecting appropriate type of argument.	14	*Implement user defined function for given problem: 1. Function positional/required argument 2. Function with keyword argument 3. Function with default argument 4. Function with variable length argument	2	CO3

PYTHON PROGRAMMING **Course Code : 314004**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 15.1 Write python program using anonymous function. LLO 15.2 Write python program to use function in argument.	15	Write Python program to demonstrate use of following advanced functions: 1. lambda 2. map 3. reduce	2	CO3
LLO 16.1 Write user defined module to solve given problem.	16	Write a python program to create and use a user defined module for a given problem.	2	CO3
LLO 17.1 Select appropriate module to solve given problem. LLO 17.2 Use given module to solve problem.	17	Write a python program to demonstrate the use of following module: 1. math module 2. random module 3. os module	2	CO3
LLO 18.1 Write user defined package to solve given problem.	18	*Write python program to create and use a user defined package for a given problem.	2	CO3
LLO 19.1 Use numpy and matplotlib package to solve given problem. LLO 19.2 Select appropriate methods from numpy and matplotlib package to solve given problem.	19	Write a python program to use of numpy package to perform operation on 2D matrix. Write a python program to use of matplotlib package to represent data in graphical form.	2	CO4
LLO 20.1 Write python program using classes and objects to solve a given problem.	20	*Develop a python program to perform following operations: 1. Creating a Class with method 2. Creating Objects of class 3. Accessing method using object	2	CO4
LLO 21.1 Write a python program to initialize objects of class using various types of constructors.	21	*Write a python program to demonstrate the use of constructors: 1. Default 2. Parameterized 3. Constructor Overloading	2	CO4
LLO 22.1 Write a python program to implement polymorphism.	22	*Implement a python program to demonstrate 1. Method Overloading 2. Method Overriding	2	CO4
LLO 23.1 Write a python program to use data hiding concept in python.	23	Write python program to demonstrate data hiding.	2	CO4
LLO 24.1 Select appropriate type of inheritance to solve given problem. LLO 24.2 Write python program using inheritance to solve given problem.	24	*Write a python program to implement 1. Single inheritance 2. Multiple Inheritance 3. Multilevel inheritance	2	CO4
LLO 25.1 Use panda package and its appropriate functions/methods to solve a given problem.	25	*Implement Python program to perform following operations using panda package: 1. Create Series from Array 2. Create Series from List 3. Access element of series 4. Create DataFrame using List or dictionary	2	CO5
LLO 26.1 Write python program to read CSV file using the panda package.	26	Implement python program to load a CSV file into a Pandas DataFrame and perform operations.	2	CO5

PYTHON PROGRAMMING **Course Code : 314004**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 27.1 Use appropriate packages in a python program to create GUI applications.	27	*Write python GUI program to import Tkinter package and create a window and set its title.	2	CO5
LLO 28.1 Write python program to create GUI based python applications using appropriate python packages.	28	Write python GUI program that adds labels and buttons to the Tkinter window.	2	CO5
LLO 29.1 Write python program to connect database.	29	Write program to create a connection between database and python.	2	CO5
LLO 30.1 Write python program to display the content from database.	30	Implement python program to select records from the database table and display the result.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Activities

- Students are encouraged to use online tools to improve their learning, such as the e-Kumbh from AICTE and the Virtual Labs from IIT.
- Students should be encouraged to participate in various coding competitions, such as hackathons, online coding contests on websites like hackerrank, Codechef etc.
- At the institution level, encourage students to start a coding club.

Self Learning

- Students are encouraged to register themselves in various MOOC's such as Infosys Springboard, Swayam etc. to further enhance their learning.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

PYTHON PROGRAMMING **Course Code : 314004**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Any Database Software	29,30
2	Computer System (Any computer system with basic configuration)	All
3	Python Interpreter / IDE (Any open source python distribution such as anaconda etc) (Any open source IDE such IDLE, Jupyter Notebook, Spyder, PyCharm etc)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Python and Control flow statements	CO1	6	0	0	0	0
2	II	Data Structures in Python	CO2	8	0	0	0	0
3	III	Functions, Modules and Packages in Python	CO3	6	0	0	0	0
4	IV	Object Oriented Programming in Python	CO4	4	0	0	0	0
5	V	Introduction to Built-in Packages in Python	CO5	6	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering 1) 60% weightage is to process 2) 40% weightage to product

Summative Assessment (Assessment of Learning)

- End Semester Examination, Lab Performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	-	-	-			
CO2	2	1	1	1	-	-	-			

CO3	3	2	2	2	-	-	-			
CO4	3	3	3	2	-	-	1			
CO5	3	2	3	3	-	-	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	R. Nageswara Rao	Core Python Programming	Dreamtech Press, ISBN-13:9789390457151
2	Mark Lutz	Learning Python	O'Reilly Media, Inc, ISBN: 9781449355739
3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler	Python Basics	Real Python, ISBN-13: 9781775093329
4	Dr. Jeeva Jose	Taming Python by Programming	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN: 9789386173348
5	Rupesh Nasre	Python Programming	AICTE, ISBN 9788195986354 [Online available on AICTE e-Kumbh]

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://ekumbh.aicte-india.org/allbook.php	Python Programming
2	https://python-iitk.vlabs.ac.in/	Python Programming Lab
3	https://spoken-tutorial.org/watch/Python+3.4.3/Input-output/English/	Introduction to Python and control flow statements, Data Structures in Python, Function and module
4	https://onlinecourses.nptel.ac.in/noc19_cs41/preview	Python Programming Course
5	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094439793500160259 2_shared/overview	Python for Beginners
6	https://www.geeksforgeeks.org/python-gui-tkinter/	Python GUI Programming
7	https://www.w3schools.com/python/python_mysql_getstarted.asp	Python MySQL Database Connectivity
8	https://www.tutorialspoint.com/python_pandas/index.htm	Python pandas package
9	https://www.programiz.com/python-programming/object-oriented -programming	OOP using Python

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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UI/UX DESIGN **Course Code : 314005**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Science/**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ SE**
Semester	**: Fourth**
Course Title	**: UI/UX DESIGN**
Course Code	**: 314005**

I. RATIONALE

In digital applications, the user communicates with the product via user interface. This course is designed to elicit fundamental principles and practical skills from stakeholders which are essential to design user friendly interfaces. The course will help students to apply design thinking concepts to create or re-create the prototype.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the students to attain the following industry identified outcome through various teaching learning experiences:

Design user-centered applications, websites, interfaces.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain design thinking concept.
- CO2 - Interpret user requirements.
- CO3 - Select appropriate visual design for given problem.
- CO4 - Create interactions using design tool.
- CO5 - Create innovative design prototype for given applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314005	UI/UX DESIGN	UID	SEC	1	-	4	1	6	3	-	-	-	-	-	25	10	25@	10	25	10	75

UI/UX DESIGN **Course Code : 314005**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain design thinking concepts. TLO 1.2 Define User Interface. TLO 1.3 Describe User experience.	**Unit - I Design Thinking Fundamentals** 1.1 Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test 1.2 Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. History of UX. Need of UI and UX	Chalk-Board Demonstration Presentations Flipped Classroom
2	TLO 2.1 Explain research methods for user requirements. TLO 2.2 Describe requirement analysis techniques. TLO 2.3 Identify user persona.	**Unit - II User Requirements and its Analysis** 2.1 Introduction to research and analysis tool (freeware) such as FigJam 2.2 User requirements – Definition, Types of user research - Qualitative research, Quantitative research. Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews 2.3 User requirement analysis - Understanding target audience and client requirements, Competitive analysis, Affinity mapping, Defining User Persona	Chalk-Board Case Study Demonstration Hands-on Presentations

UI/UX DESIGN **Course Code : 314005**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Demonstrate storyboarding for given problem. TLO 3.2 Demonstrate User journey mapping for given problem. TLO 3.3 Describe graphic design principles. TLO 3.4 Explain visual communication.	**Unit - III User Interface Design** 3.1 Storyboarding, User journey mapping 3.2 Gestalt principles of design - Aesthetics in UI design - Using Light, Color and Contrast Effectively in UI Design 3.3 Introduction to any freeware design tool such as Figma 3.4 Visual Communication Design - effective visual communication for graphical user interface	Chalk-Board Demonstration Hands-on Presentations
4	TLO 4.1 Explain User Experience design. TLO 4.2 Describe steps to create gamification techniques. TLO 4.3 Describe steps to create micro-animation. TLO 4.4 Write steps to create interactions using buttons, navigations etc. in any design tool.	**Unit - IV User Experience Design Tool** 4.1 Introduction to User Experience design 4.2 UX design open source tool such as - Figma features – Navigations, interactions, Buttons Creating library 4.3 Gamification, micro-animation 4.4 Creating visual identity of the project – design system, design theme	Chalk-Board Demonstration Hands-on Presentations
5	TLO 5.1 Create low fidelity prototyping of design on paper. TLO 5.2 Create medium fidelity prototype on paper. TLO 5.3 Write steps to create high fidelity prototype using design tool. TLO 5.4 Test the design prototype.	**Unit - V Prototyping and Testing** 5.1 Introduction to Wireframing - Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity 5.2 Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in Figma 5.3 Basic considerations in wireframing – device, size, behavior, interaction 5.4 Elements used in wireframing – visual design, high fidelity elements 5.5 Prototyping and Testing	Chalk-Board Demonstration Hands-on Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify categories of website/ App such as government / e-commerce / tourism related etc. LLO 1.2 Compare different websites/ Apps under one category for design aesthetics. LLO 1.3 Use design tool to collect user requirements. LLO 1.4 Record observations using any design tool.	1	***Use Design tool for user requirement collection and analysis** • Visit minimum 5 websites/ Apps of the particular category. Identify problems in overall navigation, look and feel of websites, relevance of the information. Record all findings using Design tool	4	CO1 CO2

UI/UX DESIGN **Course Code : 314005**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Observe various interfaces used in kiosk based applications. LLO 2.2 Prepare affinity mapping of User Requirements using design tools.	2	**Use Design tool for user requirement collection and analysis of various interfaces such as kiosks** • Visit minimum 5 interfaces. Identify problems in overall navigation, look and feel of the interface, relevance of the information. Record all findings using Design tool	4	CO1 CO2
LLO 3.1 Use any Design tool to create a 'blank project'. LLO 3.2 Use frame, shape, text of design tool to create screen layout of given user interface.	3	***Recreate a given user interface using any open source design tool** (For example, to recreate the first screen of personal mobile phone etc.)	4	CO1 CO2 CO3
LLO 4.1 Use frames, images, and colors to design given screen. LLO 4.2 Explore various plug-ins/ extensions in the design tool. LLO 4.3 Use different plug-ins/extensions in design tool.	4	*** Create grid system for the given screen using any design tool** (For example dashboard of particular application/ welcome screen of any blog portal etc.)	4	CO3 CO4 CO5
LLO 5.1 Use frames, components, auto-layouts to design given screen using Design tool. LLO 5.2 Create asset using design tool. LLO 5.3 Create library/repository of created assets in the design tool.	5	***Design given user interface using various components such as auto-layouts in the design tool** (For example, design sample login page/ design registration form etc.)	4	CO2 CO3 CO4 CO5
LLO 6.1 Use horizontal scrolling component in the design tool to create given page(s).	6	***Use horizontal scrolling to create pages for given website/ App** (For example, page(s) in social media Apps/ tourism related webpage(s))	4	CO4
LLO 7.1 Use vertical scrolling component in the design tool to create given page(s).	7	***Use vertical scrolling for a given website/ App** (For example, Retail website/App or food ordering Apps etc.)	4	CO4
LLO 8.1 Use frame, shape, text tools, components of the design tool to replicate the design of given web page(s). LLO 8.2 Use interactions, menus to replicate web page design.	8	**Recreate given website for UI design, color, images, interactions, menu**	4	CO3 CO4 CO5
LLO 9.1 Use various menus - bottom menu, slide menu to demonstrate navigations in the screen.	9	***Create navigations for the given website/ App** (For example, create navigation in App using bottom menu etc.)	4	CO4
LLO 10.1 Use components and navigations to design quiz like page in design tool.	10	**Design a quiz for given user interface** (For example, quiz for LMS / government web site / retail web sites etc.)	4	CO5

UI/UX DESIGN **Course Code : 314005**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Observe gamification techniques used in existing user interfaces. LLO 11.2 Use files, templates to create gamification effect in given scenario using design tool.	11	**Create any two gamification effects for given user interface in given scenario** (For example, racing effect etc.)	4	CO3 CO4
LLO 12.1 Use files, templates to create gamification effect in given scenario using design tool.	12	**Create gamification for task completion in website such as LMS/ retail website/ banking website** (For example, popping up effect/ releasing balloons in the air etc. once a task is completed)	4	CO3 CO4 CO5
LLO 13.1 Observe micro-animations used in existing websites, Apps, interfaces. LLO 13.2 Use templates to create micro-animation for given user scenario.	13	**Create any five micro animations for the given user interface in given scenario** (For example, progress bar effect/ waitin for reply or responce effect/ status bar/ welcome page or opening page animatio etc.)	4	CO3 CO4
LLO 14.1 Use Interactions/ events to create Prototype in design tool.	14	***Create prototyping with different interactions – tab, click, hover, delay. for the given user interface**	4	CO4 CO5
LLO 15.1 Use plug-in/ extension to convert the created prototype into html page(s). LLO 15.2 Use browser to run the generated HTML page(s).	15	**Convert created prototype in HTML page(s)**	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- The micro project has to be Industry Application Based, Internet-based, Workshop-based, Laboratory-based or Field-based as suggested by Teacher:

1. Prepare a prototype for online blog:
a. Prepare a competitive analysis of similar website
b. Define user persona and prepare user journey mapping using any design tool
c. Construct prototype using - navigation, interaction, frames in design tool
d. Validate the prototype by checking navigation and conditions given
e. Convert the design prototype into HTML code

2. Reconstruct given user interface such as kiosk system:
a. Observe the given user interface
b. Identify improvement in the user interface in terms of - look and feel, navigation, interactions
c. Prepare affinity mapping using design tool

d. Reconstruct the given interface using various components in design tool

3. Prepare a prototype for food ordering App:

a. Prepare a competitive analysis of similar Apps
b. Define user persona and prepare user journey mapping using any design tool
c. Construct prototype using - navigation, interaction, frames in design tool
d. Validate the prototype by checking navigation and conditions given

4. Rebuild smart TV user interface layout

a. Visit existing interfaces of smart television
b. Record findings related to color scheme, theme, look and feel, location on display of existing interfaces
c. Record minimum 10 different user reviews regarding the smart television user interface (chose user from different backgrounds)
d. Record improvements in look, navigation, and interactions
e. Redefine user persona for existing interface
f. Rebuild the interface prototype using design tool

Assignment

-

1. Prepare a case-study report -

a. Identify any dedicated interface such as Automated deposit cum Withdrawal machine.
b. Perform a user requirement analysis through any research method (e.g. Interview/ Questionnaire etc.).
c. Define user persona for the same.
d. Prepare a low fidelity prototype for it.

2. Prepare user storyboard and user journey mapping for given user interface -

a. Identify user requirements .
b. Perform a user requirement through research methods (e.g. Interview/ Questionnaire etc.).
c. Define user persona for the same.
d. Prepare a user journey mapping for the same.
e. Prepare a storyboard for the user interface.

3. Prepare low, medium, and high fidelity prototype for given user interface -

a. Identify user interface.
b. Collect user requirements by any two methods (e.g. Personal observation/ expert review etc.)
c. Define user persona for the same.
d. Prepare a low fidelity prototype on paper for the same.

Other

- Following are some suggestive self-learning topics or any relevant topics suggested by the Teacher:

1. Prepare a feature-based detailed report of similar types of website/portal(such as Flight/ bus Reservation websites/ MIS / e-commerce web sites / educational institutions websites etc).
2. Prepare affinity mapping in any design tool (e.g. FigJam) for user requirements in given domain of the project.
3. Define user persona and perform requirements mapping using design tools in any of the following category – Ticket booking kiosk/ Online examination system / Quiz App.
4. Prepare user journey mapping for given scenario in the given project
5. Prepare low, medium, and high-fidelity prototypes for a given scenario using any design tool.
6. Prepare a library/repository of design components using any design tool like Figma.
7. Reconstruct any ticket booking website to address improvements in look and feel, ease of use within it.

UI/UX DESIGN **Course Code : 314005**

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Design tool - preferably open-source based tool such as Figma	All
2	Computer system with minimum specifications as - Processor - 2.9 GHz or equivalents or higher with 10th generation or onwards Operating System - 64 bit RAM - 8GB DDR3 or higher Internet Connectivity	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Design Thinking Fundamentals	CO1	2	0	0	0	0
2	II	User Requirements and its Analysis	CO2	3	0	0	0	0
3	III	User Interface Design	CO3	4	0	0	0	0
4	IV	User Experience Design Tool	CO4	3	0	0	0	0
5	V	Prototyping and Testing	CO5	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- 1. Continuous assessment based on process and product related performance indicators.

Each practical will be assessed considering:
60% weightage to process
40% weightage to product
2. A continuous assessment based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

UI/UX DESIGN **Course Code : 314005**

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	2	1	-	1	1			
CO2	3	2	2	2	-	-	2			
CO3	3	3	3	3	1	-	1			
CO4	2	3	3	3	2	1	1			
CO5	2	3	3	3	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Jesse James Garrett	The Elements of User Experience: User-Centered Design for the Web and Beyond	New Riders Publishing, 201 West 103 Street, Indianapolis, IN 46290 800-545-5914 ISBN:978-0-321-68368-7
2	Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef	Design Thinking: The Handbook	World Scientific Publishing Co Pte Ltd, No.16, South West Boag Road T. Nagar, Chennai 600017, INDIA ISBN-10: 9811203504 ISBN-13: 978-9811203503
3	Fabio Staiano	Designing and Prototyping Interfaces with Figma	Packt Publishing Ltd, Grosvenor House, 11 St Paul's Square, Birmingham, B3 1RB ISBN-10: 180056418X ISBN-13: 978-1800564183
4	Kilian Langenfeld	Design Thinking for Beginners	Personal Growth Hackers ISBN-10: 3967160629 ISBN-13: 978-3967160628

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://aim.gov.in/pdf/Design_Thinking.pdf	Design thinking phases and learning resources
2	https://www.ideou.com/pages/design-thinking-resources	Design thinking resources
3	https://www.figma.com/resource-library/what-is-design-thinking/	Design thinking and its stages

UI/UX DESIGN **Course Code : 314005**

Sr.No	Link / Portal	Description
4	https://www.figma.com/resource-library/what-is-ui-design/	Key elements of UI design
5	https://youtu.be/-wzNTPXVIyM?si=zET5z3GpIPl-cAry	User Experience and research methods
6	https://youtu.be/XT152i5asdQ?si=jPdLFFExnaZO8NRs	User Experience and research methods
7	https://usabilitypost.com/2008/08/14/using-light-color-and-contrast-effectively-in-ui-design/	Using Light, Color and Contrast Effectively in UI Design
8	http://web.cs.wpi.edu/~matt/courses/cs563/talks/smartin/int_design.html	Effective Visual Communication for Graphical User Interfaces
9	https://youtu.be/Y9ixRTTx5iU?si=vSCsbCr6gXD5eG-n	Visual Communication Design
10	https://youtu.be/K-DRTBMnzm8?si=DaUPM4iLW2CU3oSU	Low fidelity design
11	https://youtu.be/KCYLE78w074?si=xZsvSnO9qx7iVE2S	High fidelity design
12	www.figma.com	Figma - Design Tools - Figma and FigJam (Freeware)
13	https://www.figma.com/resource-library/design-basics/	Design basics using Figma (Freeware)
14	https://wireframe.cc/	Single-page, public wireframe without user account available in free version.
15	https://drive.google.com/file/d/1Od0G1mtlRHz5LkxgT3GPr7wDEIw7GV05/view	Design Thinking and user experience research (Notes by NPTEL)
16	https://www.mindmeister.com/	Collaborative mind mapping tool
17	https://miro.com/	UX tool
18	https://www.hotjar.com/	UIUX tool

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Computer Technology / Computer Engineering / Computer Science & Engineering / Computer Science**		
Programme Code	**: CM / CO / CW / SE**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Fourth** **NCrF Entry Level : 3.5**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																							
1	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	314301	2	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125
2	JAVA PROGRAMMING	JPR	AEC	314317	-	4	-	4	2	10	5	3	30	70	100	40	25	10	50#	20	25	10	200
3	DATA COMMUNICATION AND COMPUTER NETWORK	DCN	DSC	314318	-	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
4	MICROPROCESSOR PROGRAMMING	MIC	DSC	314321	-	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
5	PYTHON PROGRAMMING	PWP	AEC	314004	-	2	-	4	-	6	3	-	-	-	-	-	50	20	50#	20	-	-	100
6	UI/UX DESIGN	UID	SEC	314005	-	1	-	4	1	6	3	-	-	-	-	-	25	10	25@	10	25	10	75
Total					**2**	**16**	**0**	**18**	**6**		**20**		**120**	**280**	**400**		**150**		**175**		**125**		**850**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)