GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Advanced Object Oriented Programming
(Course Code: 4340701)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	4th Semester

1.   **RATIONALE**

This course is designed to teach object-oriented programming concepts, techniques, and applications using the Java programming language. Object-oriented programming emphasis on the fundamentals of the structured design with classes, including development, testing, implementation and documentation also includes object-oriented programming techniques, classes and objects. Java is a simple, portable, distributive, robust, secure, dynamic, architecture neutral, object oriented programming language. Java programming language is designed to enable the development of a small, reliable, portable, distributed, real-time operating platform, high-performance applications for the widest range of computing platforms possible as well as cross-platform interaction. By making applications available across heterogeneous environments, businesses can provide more services, boost end-user productivity, communication and collaboration to enterprise and consumer applications. The Java programming language originated as part of a research project to develop advanced software for a wide variety of network devices and embedded systems. The Java programming language is used as the teaching vehicle for this course.

The aim of this course is that student should learn platform independent object oriented programming and java as base language for advanced technology like three tier architecture applications, cloud computing and web development.

2.   **COMPETENCY**

The aim of this course is to help the students to attain the following industry identified competency through various teaching-learning experiences:
- Develop java application using object-oriented approach.

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

Course Outcomes:

a)   Write simple java programs for a given problem statement.

b)   Use object oriented programming concepts to solve real world problems.

c)   Develop an object-oriented program using inheritance and package concepts for a given problem statement.

d)   Develop an object oriented program using multithreading and exception handling for a given problem statement.

e)   Develop an object-oriented program by using the files and collection framework.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
CI	T	P	C	CA	ESE	CA	ESE	
3	0	4	5	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: CI-Class Room Instructions; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, CA - Continuous Assessment; ESE - End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Req
1.	* Install JDK, write a simple "Hello World" or similar java program, compilation, debugging, executing using java compiler and interpreter.	I	2
2.	Write a program in Java to find maximum of three numbers using conditional operator.	I	1
3.	Write a program in Java to reverse the digits of a number using while loop	I	1
4.	Write a program in Java to add two 3*3 matrices.	I	2

5.	Write a program in Java to generate first n prime numbers.	I	2
6.	Write a program in Java which has a class Student having two instance variables enrollmentNo and name. Create 3 objects of Student class in main method and display student's name.	II	1
7.	*Write a program in Java which has a class Rectangle having two instance variables height and weight. Initialize the class using constructor.	II	1
8.	Write a program in Java demonstrate the use of "this" keyword.	II	2
9.	Write a program in Java to demonstrate the use of "static" keyword.	II	2
10.	Write a program in Java to demonstrate the use of "final" keyword.	II	2
11.	*Write a program in Java which has a class Shape having 2 overloaded methods area(float radius) and area(float length, float width). Display the area of circle and rectangle using overloaded methods.	II	2
12.	Write a program in Java to demonstrate the constructor overloading.	II	2
13.	Write a java program to demonstrate use of "String" class methods : chatAt(), contains(), format(), length(), split()	II	1
14.	Write a program in Java to demonstrate single inheritance	III	1
15.	Write a program in Java to demonstrate multilevel inheritance	III	2
16.	Write a program in Java to demonstrate hierarchical inheritance.	III	2
17.	Write a program in Java to demonstrate method overriding.	III	2
18.	*Write a program in Java which has a class Car having two instance variables topSpeed and name. Override toString() method in Car class. Create 5 instances of Car class and print the instances.	III	2
19.	Write a program in Java to implement multiple inheritance using interfaces.	III	2
20.	*Write a program in Java which has an **abstract** class **Shape** having three subclasses: **Triangle**, **Rectangle**, **and Circle**. Define method	III	4

	area() in the abstract class Shape and override **area()** method to calculate the area.		
21.	Write a program in Java to demonstrate use of final class.	III	2
22.	Write a program in Java to demonstrate use of package.	III	2
23.	Write a program in Java to develop user defined exception for 'Divide by Zero' error.	IV	2
24.	*Write a program in Java to develop Banking Application in which user deposits the amount Rs 25000 and then start withdrawing of Rs 20000, Rs 4000 and it throws exception "Not Sufficient Fund" when user withdraws Rs. 2000 thereafter.	IV	2
25.	*Write a program that executes two threads. One thread displays "Thread1" every 1000 milliseconds, and the other displays "Thread2" every 2000 milliseconds. Create the threads by extending the **Thread** class	IV	2
26.	Write a program that executes two threads. One thread will print the even numbers and another thread will print odd numbers from 1 to 200.	IV	2
27.	*Write a program in Java to perform read and write operations on a Text file.	V	2
28.	Write a program in Java to demonstrate use of List. 1) Create ArrayList and add weekdays (in string form) 2) Create LinkedList and add months (in string form) Display both List.	V	2
29.	Write a program in Java to create a new HashSet, add colors(in string form) and iterate through all elements using for-each loop to display the collection.	V	2
30.	*Write a Java program to create a new HashMap, add 5 students' data (enrolment no and name). retrieve and display the student's name from HashMap using enrolment no.	V	2

Note

i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.**

ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..

To learn Object-Oriented programming concepts and techniques using the Java programming language. To learn to write, test, and debug introductory level Object-Oriented programs using Java. In addition, the student will be introduced to the following concepts, which are important workforce activities:

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Correctness of the program/application	30
2	Readability and documentation of the program/application	10
3	Design/Develop/Implement Program/application – Write code, integrate subsystems	20
4	Debugging ability – Perform unit testing, Test and validate program/application	20
5	Execution of the program/application and answer to the sample questions.	20
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with Windows/Linux/Unix Operating System.	All
2	JDK (Java Development Kit) Version 8 or above	All
3	Any editor - Notepad++, Visual Studio Code, Eclipse IDE, NetBeans IDE	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.
a)   Motivation and Attitude towards learning
b)   Learning Methodology and Communication styles
c)   Use of technology
d)   Work as a leader/a team member.
e)   Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.   'Valuing Level' in 1st year
ii.   'Organization Level' in 2nd year.
iii.   'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –1: **Introduction to Java Programming Language**	1a. Describe java features and applications and environment setup of Java programming language. 1b. Install Java Components 1c. Write simple program using java programming language 1d. Describe data types, identifiers, constants and variables 1e. Write programs using arrays 1f. List types of operators 1g. Write simple java programs using decision and control structures.	1. Introduction to Java and Brief history, java features, java Applications 2. Java components: Java Virtual Machine (JVM), Java Runtime Environment (JRE), JDK (Java Development Kit). Importance of byte code and Garbage Collection 3. Java environment setup; Structure of java program; Compilation and execution of java program, , Comment Syntax 4. Primitive Data Types : byte, short, int, long, float, double, char, Boolean 5. Identifiers, Declarations of constants & variables, Type Conversion and Type Casting, Scope of variables 6. Arrays of Primitive Data Types, Types of Arrays : one-dimensional and two-dimensional array 7. Different Operators: Arithmetic, Bitwise, Rational, Logical, Assignment, Conditional, Ternary, Increment and Decrement 8. Decision & Control Statements: Selection Statement (if, if...else, switch), Loops (while, do-while, for), Jump

		Statements : break, continue, return
Unit– 2: **Object Oriented Programming Concepts**	2a.Differentiate between POP and OOP 2b. List object oriented programming concepts 2c. Develop simple java program using class. 2d. Use this and final keyword 2e. Write object oriented program using constructor 2f. Write java program using String class	1. Procedure-Oriented vs. Object-Oriented Programming concept 2. Basics of OOP: Class, Object, Encapsulation, Polymorphism Abstraction, Inheritance 3. Defining classes, fields and methods, creating objects 4. Accessing rules : public, private, protected, default 5. this keyword, static keyword, final keyword 6. Constructors: Default constructors, Parameterized constructors, Copy constructors, Passing object as a parameter 7. method overloading, constructor overloading 8. Wrapper Classes, String Class and its methods: chatAt(), contains(), format(), length(), split() 9. User Input: Scanner class and Command Line Arguments
Unit– 3: **Inheritance, Packages & Interfaces**	3a. List types of inheritance 3b. Write program to implement single, multilevel, hierarchical inheritance 3c. Write programs to implement method overriding 3d. Write programs to implement overriding using Object class 3e. Write programs to implement multiple inheritance	1. Basics of Inheritance, Types of inheritance: single, multiple, multilevel, hierarchical and hybrid inheritance, 2. method overriding, Object class and overriding its methods : equals(), toString(), finalize(), hashCode() 3. Defining interface, implementing interface, multiple inheritance using interface 4. Abstract class and final class 5. Creating package, importing package, access rules for packages

	3f. Create a user-defined package and use that package	
Unit–4: **Exception Handling & Multithreading**	4a. Describe errors and types of exceptions 4b. List types of errors 4c. Write user-defined exceptions 4d. Define thread, creating threads, multithreading, thread priority & synchronization	1. Types of errors, exceptions, try...catch statement, multiple catch blocks, throw and throws keywords, finally clause, uses of exceptions, user defined exceptions 2. Concept of Multithreading, Creating thread, extending Thread class, implementing Runnable interface, life cycle of a thread, Thread priority, Thread exception handing in threads
Unit–5: **File Handling and Collections Framework**	5a. Describe basics of streams, stream classes, creation, reading and writing files in context to file handling 5b. Describe Collections framework 5c. Write programs using ArrayList and LinkedList 5d. Write programs to Map classes	1. Stream classes, class hierarchy, useful I/O classes : FileInputStream, FileOutputStream 2. Creation of text file, reading and writing text files 3. Collections Framework overview, Collection classes- ArrayList, LinkedList, HashSet. The For-Each loop 4. Map class : HashMap

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Java Programming Language	08	4	4	6	14
II	Object Oriented Programming	11	3	6	9	18

	Concepts					
III	Inheritance, Packages and Interfaces	11	3	6	9	18
IV	Exception Handling and Multithreading	06	2	3	5	10
V	File Handling and Collections Framework	06	2	3	5	10
	Total	42	14	22	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a)   Undertake micro-projects in teams.
b)   List different versions of java and their new features
c)   Prepare charts to explain use/process of the identified topic.
d)   https://java-iitd.vlabs.ac.in/   this website provides virtual lab and gives simulation of java programs.
e)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edX, Coursera, Udemy etc. to further enhance their learning.
f)   https://www.codechef.com this website gives competitive programming problems, students are expected to solve examples and crosscheck with output.
g)   Encourage students to form a coding club at institute level and can help the slow learners

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a)   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b)   Guide student(s) in undertaking micro-projects.
c)   Managing Learning Environment
d)   Diagnosing Essential Missed Learning concepts that will help for students.
e)   Guide Students to do Personalized learning so that students can understand the course material at his or her pace.
f)   Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

g)   *'CI" in section No. 4* means different types of teaching methods that are to be employed by teachers to develop the outcomes.

h)   About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.

i)   With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

j)   Guide students on how to address issues on environment and sustainability using the knowledge of this course

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed *three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about **16 (sixteen) student engagement hours** (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:
1.   Student Record Keeping System
2.   Inventory Management System
3.   Airline reservation system
4.   Electricity billing system
5.   Healthcare management system
6.   Library management system
7.   Bank management system
8.   Medical management system
9.   Quiz management system
10.   Survey System
11.   Stock management system
12.   Tic Tac Toe Game
13.   Chess Game
14.   Battleship Console Game

13.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN

1	Java: The Complete Reference, Twelfth Edition	Herbert Schildt	Tata McGraw Hill
2	Programming with Java | 6th Edition	E Balagurusamy	Tata McGraw Hill
3	Sachin Malhotra & Saurabh Choudhary	Programming in JAVA, Second Edition	Oxford
4	Head First Java: A Brain-Friendly Guide, Third Edition	Kathy Sierra, Bert Bates, Trisha Gee	Shroff/O'Reilly

14.   SUGGESTED LEARNING WEBSITES

a)   https://docs.oracle.com/javase/tutorial/ (Documentation)

b)   https://www.w3schools.com/java/default.asp (Blog)

c)   https://www.javatpoint.com/java-tutorial (Blog)

d)   https://www.geeksforgeeks.org/java/ (Blog)

e)   https://cse.iitkgp.ac.in/~dsamanta/java/ch3.htm#Introduction (Blog)

f)   https://www.youtube.com/playlist?list=PLbRMhDVUMngcx5xHChJ-f7ofxZI4JzuQR (Video Series)

g)   https://onlinecourses.nptel.ac.in/noc23_cs46/preview (Certification)

h)   https://in.coursera.org/specializations/java-programming (Certification)

i)   https://www.edx.org/course/software-development-fundamentals (Certification)

j)   https://www.w3schools.com/java/tryjava.asp?filename=demo_compiler (Online Editor)

15.   PO-COMPETENCY-CO MAPPING

Semester II	Basics of Operating System (Course Code:)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency Develop java application using object-oriented approach.									
Course Outcomes CO a) Write simple java programs for a given problem statement.	2	-	-	-	-	-	2		

CO b) Use object oriented programming concepts to solve real world problems.	2	3	3	2	-	2	2			
CO c) Develop an object-oriented program using inheritance and package concepts for a given problem statement.	2	3	3	2	-	2	2			
CO d) Develop an object oriented program using multithreading and exception handling for a given problem statement.	2	3	3	2	-	2	2			
CO e) Develop an object-oriented program by using the files and collection framework.	3	3	3	2	-	2	2			

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	Shri P. P. Kotak Principal	S&S Gandhi , Surat	9825469617	kotakp2003@yahoo.com
2	Smt. M. P. Mehta HOD	Government Polytechnic, Himmatnagar	9879578273	manishamehtain@gmail.com
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GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Introduction to Software Engineering
(Course Code: 4340702)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	4th Semester

1.   **RATIONALE**

The Software engineering provides platform to develop Application or software in a systematic way. After studying the subject the students will be able to develop and design the software according to given requirements. It involves various steps in analysis and design of the system. It includes the knowledge of preparing project systematically. This course helps to know about various aspects of the software engineering so that the students will be able to understand the responsibilities while designing and implementing the project.

2.   **COMPETENCY**

The course content should be taught and implemented with the aim to develop various types of related skills leading to the achievement of the following competency

•   Identify and analyze problems in the field of Software development.

3.   **COURSE OUTCOMES (COs)**

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

a)   Compare various software development process models.
b)   Prepare software analysis and design using SRS, DFD and object oriented UML diagrams.
c)   Prepare software development plan using project scheduling.
d)   Prepare test-cases to test software functionalities.

4. **TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total
CI	T	P	C	CA	ESE	CA	ESE	Marks
3	0	2	4	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs

required for the attainment of the COs.
Legends: CI-ClassRoom Instructions; T – Tutorial/Teacher Guided Theory Practice; P -
Practical; C – Credit, CA - Continuous Assessment; ESE - End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. *Some of the*
PrOs *marked* ***'*'*** *are compulsory, as they are crucial for that particular CO. These PrOs need to*
be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor
Domain'.

Sr.No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Req
1	Describe various software development models with appropriate diagram	I	02
2	Write problem statement to define the project title with bounded scope of the project.	I	01
3	Select relevant process model to define activities and related tasks set for assigned project	I	01
4	Gather application specific requirements- Requirement gathering	II	02
5	Prepare broad SRS (software requirement software) for the above selected project	II	02
6	Develop data designs using DFDs (data flow diagram) and E-R (entity-relationship) diagram.	II	04
7	Prepare use-cases and draw use case diagram	II	02
8	Develop a class diagram for selected project	II	02
9	Develop Sequence diagram for selected project	II	02
10	Develop the activity diagram to represent flow from one activity to another for software development.	II	02
11	Evaluate size of the project using Function point metric for the assigned project.	III	02
12	Estimate cost of the project using COCOMO (Constructive Cost Model) / COCOMO II approach for the assigned project.	III	02
13	Use flow chart and Gantt charts to track progress of the assigned project. (Use Sprint burn down chart if agile model is selected).	III	02
14	Prepare various test case for selected project.	IV	02
	Total		28

Note

i. *Faculty should ensure that students select different problem statement in a group for practical 2 to 14. Size of group should not be more than 3 students.*
ii. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.***

iii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Problem selection and its feasibility study	30
2	Decompose problem into modules	20
3	Ability to estimate size and cost of the software	30
4	Presentation and Documentation Skills	10
5	Submission of reports within time	10
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration of windows or UNIX OS	All
2	Software tool : Any UML tool	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.
a)   Work as a leader/a team member.
b)   Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
i.   'Valuing Level' in 1st year
ii.   'Organization Level' in 2nd year.
iii.   'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them).

If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –1: Software Process Models	1a. Define Software Engineering. 1b. Recommend the relevant software solution for the given problem. 1c. Describe Generic Framework Activity 1d. Select the relevant software process model for the given problem statement with justification. 1e.. Suggest the relevant activities in Agile Development Process in the given situation with justification	1.1 Defining software 1.2 Software Application Domain i. System Software ii. Application Software iii. Embedded Software iv. Web Application v. Artificial Intelligence Software 1.3 Software Engineering – A layered Approach 1.4 Generic Process Model 1.5 Generic Framework Activity, Umbrella activity 1.6 Software Development Models i. Waterfall Model ii. Incremental Process Model iii. Prototype Model iv. Spiral Model 1.7 Agile Development Model i. Agility Principles ii. Agile Model vs Iterative Waterfall Model 1.8 Types of widely used Agile Models i. Extreme Programming(XP) ii. Scrum
Unit– 2: Software Requirement Analysis and Design	2a. Identify Software requirements for the given problem 2b. Prepare SRS from the requirement analysis 2c. Represent the specified problem in the given design notation – DFD 2d. Draw the relevant UML diagrams for the given problem	2.1 Requirement Gathering and Analysis 2.2 Software Requirement Specification (SRS) i. Characteristic ii. Customer requirement iii. Functional Requirement 2.3 Software Requirement Specification(SRS) 2.4 Software Design i. Characteristics of good software design ii. Analysis v/s design 2.5 Cohesion & Coupling i. Classification of cohesion ii. Classification of coupling **Function Oriented Software Design** 2.6 Data Flow Diagram(DFD) i. Context Diagram ii. Level 1 DFD

Unit–3: Software Project Estimation & Scheduling	3a. Estimate the size of the software product using the given method 3b. Evaluate the size of the given software using COCOMO model 3c.Prepare the Flow chart/ Gantt chart/ Sprint burn down chart to track progress of the given project.	3.1 Responsibility of software project Manager 3.2 Metrics for Size Estimation i. Line of Code ii. Function Points 3.2 Project Estimation Techniques using COCOMO model 3.3 Project Scheduling i. Gantt Chart ii. Flow Chart iii. Sprint burn down chart for agile model 3.3 Risk Management i. Risk Identification ii. Risk Assessment iii. Risk Control
Unit–4: Software Coding and Testing	4c. Describe different code review techniques 4d. Prepare test cases for the given module.	**Coding** 4.1 Coding standards and guidelines 4.2 Code review i. Code Work through ii. Code Inspection 4.2 Software Documentation i. Internal Documentation ii. External Documentation **Testing** 4.3 Testing Fundamentals 4.4 Functional Testing – Black box testing 4.5 Structural Testing – White box testing 4.6 Overview of Alpha & Beta Testing 4.7 Overview of Unit testing & Integration testing 4.8 Test Documentation – test case templates

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks

I	Software Process Models	10	06	08	04	18
II	Software Requirement Analysis and Design	14	04	08	08	20
III	Software Project Estimation & Scheduling	10	06	08	04	18
IV	Software Coding and testing	08	04	06	04	14
Total		**42**	**22**	**32**	**16**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

<u>**Note**</u>*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a)   Undertake micro-projects in teams.
b)   Prepare charts for various models, SDLC life cycles, UML notations etc.
c)   Prepare SRS documents based on case study.
d)   Discuss various case studies available on internet.
e)   An hour of problem solving for various case study topics may be organized and students are encouraged to participate
f)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.
g)   Encourage students to interact with the industry person to discuss and gather information of current trends, models, documentation, testing methods and different tools used in industry.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a)   Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b)   Guide student(s) in undertaking micro-projects.
c)   Managing Learning Environment
d)   Diagnosing Essential Missed Learning concepts that will help for students.
e)   Guide Students to do Personalized learning so that students can understand the course material at his or her pace.
f)   Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

g)   **'CI" in section No. 4**means different types of teaching methods that are to be employed by teachers to develop the outcomes.

h)   About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.

i)   With respect to **section No.10**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.

j)   Guide students on how to address issues on environment and sustainability using the knowledge of this course

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three.**

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about **16 (sixteen) student engagement hours** (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

a)   Case study on student management system

b)   Case study on library management system

c)   Case study on hospital management system

d)   Case study on banking system

e)   Case study on collage management system

f)   Case study on movie ticket booking system

g)   Case study on online food ordering application

h)   Case study on online shopping

i)   Case study on hotel management system

j)   Case study on bus ticket reservation system

k)   Case study on railway ticket reservation system

l)   Case study on flight ticket reservation system

m)   Case study on leave management system in large organization

n)   Case study on stock management system in mall

o)   Case study on attendance management system

p)   Case study on vehicle rental system

q)   Case study on hospital appointment booking

r)   Case study on gym management system

s)   Case study on Tours and Travel Management

t)   Case study on hostel management system

u)   Case study on employee management system

13.   **SUGGESTED LEARNING RESOURCES**

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Software Engineering: A Practitioner's Approach	Roger S. Pressman	Tata McGraw Hill, 2010, ISBN :978-007-126782-3
2	Fundamentals of Software Engineering	Rajib Mall	PHI,2018, ISBN:978-93-88028-02-8
3	Object Oriented Modeling and design with UML	Michael R Blaha and James R Rambaugh	Pearson Prentice Hall, 2009 ISBN:978-81-317-1106-4

14.   **SUGGESTED LEARNING WEBSITES**
a)   https://www.javatpoint.com/
b)   https://www.geeksforgeeks.org/
c)   https://www.tutorialspoint.com/
d)   www.w3schools.com
e)   https://www.techtarget.com/searchsoftwarequality/definition/agile-software-development

15.   PO-COMPETENCY-CO MAPPING

Semester IV	Introduction to Software Engineering (Course Code: 4340702)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency Identify and analyze problems in the field of Software development										
Course Outcomes CO a) Compare various software development process models.	2	-	-	-	-	-	-			
CO b) Prepare software analysis and design using SRS, DFD and object oriented UML diagrams.	2	3	2	2	-	2	2			
CO c) Prepare software development plan using project scheduling.	2	1	2	2	-	3	2			
CO d) Prepare test-cases to test software functionalities	2	-	-	-	-	-	-			

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
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GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Computer Networking
(Course Code: 4340703)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	4th Semester

1.   RATIONALE

Computers and computer networks are the sole of the computer-based information systems. In present times, whether it is small or big organization they own their private computer networks to handle computer-based information systems. Therefore in every organisation, establishing, commissioning (making operational) and maintaining secure computer networks has becomes one of the essential jobs of a diploma computer engineer too. This course is therefore designed to help the computer engineering diploma holders to develop this competency

2.   COMPETENCY

The course content should be taught and implemented with the aim to develop various types of related skills leading to the achievement of the following competency

●   **Use Software and hardware technology to establish, commission (make operational) and maintain secure computer networks**.

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

a)   Classify various types of networks base on their construction, usage and scope
b)   Differentiate OSI and TCP/IP models
c)   Select proper transmission media and devices based on network requirements.
d)   CompareIPv4 and IPv6 addressing scheme
e)   Identify various types of network security threats

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
CI	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: CI-ClassRoom Instructions; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, CA - Continuous Assessment; ESE - End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs.*Some of the **PrOs** marked '*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

Sr.No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Req
1	Connect computer using given topology with wired media. Assume six devices are arranged, if in: a) bus topology b) ring topology c) star topology d) mesh topology Find out number of cables(links), ports needed in each device and total number of ports needed in entire network for each of above stated topology.	I	02
2	Study about OSI model network Layers.	II	02
3	Prepare and Test Straight UTP Cable and Cross UTP Cable.	III	02
4	Study and Test various Network devices available at Department/Institute. (Repeater, Hub, Switch, Bridge, Router and Gateway).	III	04
5	Determine whether following IPv4 address are valid or invalid. If valid IPv4 address then find class, Network and Host ID of an IPv4 address. If invalid IPv4 address then write reason for the same. a) 1.4.5.5 b) 75.45.301.14 c) 111.56.045.78 d) 192.226.12.11 e) 130.45.151.154 f) 11100010.23.14.67 g) 221.34.7.8.20 h) 240.230.220.89	IV	02

6	Determine Class and Network Address for given IPv4 address and subnet mask.	IV	02

IPv4 address	Subnet Mask	Class	Subnet
172.16.2.10	255.255.255.0		
10.6.24.20	255.255.240.0		
10.30.36.12	255.255.255.0		

7	Subnet the IP address 216.21.5.0 into 30 hosts in each subnet.	IV	02
8	Identify valid IPv6 addresses and if invalid IPv6 address then write reason for the same: a) 2001 : db8: 3333 : 4444 : 5555 : 6666 : 7777 : 8888 b) : : c) 225.1.4.2 d) 2001: db8: : e) : : 1234 : 5678 f) 2001 : db8: : 1234 : 5678 g) 2001:0db8:0001:0000:0000:0ab9:C0A8:0102 h) fe80:2030:31:24	IV	02
9	Study of firewall in providing network security.	V	02
10	Run basic utilities and network commands: ipconfig, ping, tracert, netstat, pathping , route		04
11	Micro Project		14
	Total		38

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Regularity	20
2	Problem Analysis	20
3	Development of the Solution	20
4	Testing of the Solution	20
5	Mock viva test	20
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with variousNetwork management software.	3,4,5
2	Various Network devices, different types of network cables, Network Interface Card, CrimpingTool, UTPCableTester, Layer 2Switch., WirelessAccess pointandWirelessrouter, ImpactingTool, Networkcableconnectors. NetworkTrainerKit	3,4,5

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.

a)   Work as a leader/a team member.

b)   Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.   'Valuing Level' in 1st year

ii.   'Organization Level' in 2nd year.

iii.   'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –1: Basics of Computer Network	1 a. List the applications of Computer Networks. 1 b. Differentiate various line configurations.	1.1 Definition & need of networks 1.2 Categories of Computer Networks base on scope and connection 1.3 Line Configuration 1.4 Network Topology

	1 c. Design a computer network considering particular topology. 1 d. Categories computer network based on scope and connection 1 e. Explain use of various types of servers.	1.5 Standard Organizations and Protocols 1.6 Applications and features of different types of servers: File server, Pint Server, Mail Server, Web Server, Proxy Server
Unit– 2: **The Reference Model for network communication**	2 a. List all layers of OSI and TCP/IP. 2 b. Describe functions of each layer. 2 c. Compare OSI and TCP/IP Model.	2.1 OSI model & function of each Layer 2.2 TCP/ IP model& function of each Layer 2.3 Comparison of OSI & TCP/IP Models
Unit– 3: **Transmission Media & Network devices**	3 a. List guided and unguided transmission media. 3 b. Select appropriate transmission media for a given network. 3 c. Explain use of various Network devices. 3 d. Differentiate Layer 2 and Layer 3 Switches.	3.1 Types of TransmissionMedia 3.2 Guided Media: Twisted Pair, CoaxialCable, Fiber 3.3 Un Guided Media: Electromagnetic spectrum, Radio Transmission,MicrowaveTransmission,In fraredTransmission,SatelliteCommunicat ion 3.4 Network Devices: Repeaters, Hubs, Switches, Routers, Access Points, Gateways. Bridges 3.5 Difference between Layer 2 and Layer 3 Switches.
Unit–4: **IP Protocol**	4 a. Describe IP v4 and IP v6 protocol. 4b. Illustrate subnet and usage of subnet masking. 4 c. Differentiate IPv4 and IPv6.	4.1 IPProtocol–IPv4: Characteristics, Advantages and Disadvantages, Packet structure, Address classes, Subnet & masking, Reserved Address. 4.2 IP Protocol – IP v6: Characteristics, Addressing modes, Address types, Special Address 4.3 Difference between IPv4 and IPv6
Unit–5: **Network Security Aspects**	5a. Define Security Basics. List and discuss various security terms, recent trends in computer security. 5 b. Describe various types of threats that exist for computers and networks 5 c. Describe working principle of FIREWALLs.	5.1 Security Basics – Confidentiality, Integrity, Availability 5.2 Threats to security: Viruses and Worms, Intruders, Insiders, Criminal organizations, Terrorists, Information warfare 5.3 Firewalls: working, design principles

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Computer Network	07	3	6	6	15
II	The Reference Model for networkcommunication	07	3	6	0	9
III	Transmission Media & Network devices	10	6	10	0	16
IV	IP Protocol	09	4	6	10	20
V	Network Security Aspects	09	4	6	0	10
	Total	**42**	**22**	**34**	**16**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a)   Undertake micro-projects in teams.
b)   http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php,thiswebsite gives output for various computer network practicals, students are expected to solve examples and crosscheck with output.
c)   An hour of problem solving for various networktopology and IPv4 addresses-subnetting problems may be organized and students are encouraged to participate
d)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.
e)   List different types of Network operating system
f)   Identify type of Network in your Institute.

g)   Prepare a design of Network in your Institute

h)   Visit your Institute server room and various places where Racks and servers installed, identify various Network components, collect information about installation of necessary hardware and software.

i)   Visit any ISP in your area.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a)   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.

b)   Guide student(s) in undertaking micro-projects.

c)   Managing Learning Environment

d)   Diagnosing Essential Missed Learning concepts that will help for students.

e)   Guide Students to do Personalized learning so that students can understand the course material at his or her pace.

f)   Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

g)   *'CI" in section No. 4*means different types of teaching methods that are to be employed by teachers to develop the outcomes.

h)   About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.

i)   With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

j)   Guide students on how to address issues on environment and sustainability using the knowledge of this course

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should *not exceed three.*

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each student due to   the micro-project should be about *14 (fourteen) student engagement hours* (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

a)   Develop a small Network. (Hands on Training.)
b)   Install Windows 2003/Windows 2008 Network operating System
c)   Install & Configure File Server.
d)   Install & Configure Print Server.
e)   Install & Configure Mail Server.
f)   Install & Configure Proxy Server.
g)   Install & Configure Web Server
h)   Install a small wireless network using access points.
i)   Set, Configure& Test secured network.
j)   Case study on any one layer of OSI model.
k)   Case study on various Line Configuration in Computer Networks
l)   Case study on guided and unguided transmission media.
m)   Case study on different types of Network devices.
n)   Case study onDifference between Layer 2 and Layer 3 Switches.
o)   Case study on various Network Services.
p)   Case study on various Network Applications
q)   Case study on IPv4 Address scheme
r)   Case study on IPv4 Address – subnetting
s)   Case study on various types of threats that exist for computers and networks
t)   Case study on different methods of dealing with threats that exist for computers and networks
u)   Case study on various physical security components that can protect any computer and network.
v)   Case study on various types of malicious software that exists.
w)   Case study on FIREWALLs.
x)   Configure Web browser security settings.
y)   Configure a system for various security experiments.
z)   Case study on Demonstration of wireless network between mobile device and PC for file transfer.
aa)   Animate any one Network topology.

13.   SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	ComputerNetworks	AndrewSTannebaum&DavidJWetherall	Pearson, 2012
2.	InformationTechnologyToday	S.Jaiswal	GalgotiaPublications
3.	Computer Networks	Bhushan Trivedi	OxfordUniversityPress,2013
4.	DataCommunication& Networking,	Forouzen	TataMcGrawHill

5.	Data&Computer Communication,	WilliamsStallings	PrenticeHallofIndia
6.	NetworksforComputer ScientistsandEngineers	YouluZheng&Shakil Akhtar	OxfordUniversityPress,2012
7.	PrinciplesOfComputerSecurityCompTIASecurity+AndBeyond(ExamSY0-301),3rd EditionBooks	Conklin, Wm. ArthurGregoryWhite,DwayneWilliams,Roger Davis,ChuckCothren ,CoreySchou	Mc Graw HillISBN:97812590 61196,2012

14.   SUGGESTED LEARNING WEBSITES

a)   http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php
b)   https://www.javatpoint.com/computer-network-tutorial
c)   https://www.geeksforgeeks.org/basics-computer-networking
d)   https://nptel.ac.in/courses/106106091
e)   https://www.cisco.com/c/en_in/products/security/what-is-network-security.html
f)   NetworkSimulatorTool: GNS3v0.8.5,NetSimK

15.   PO-COMPETENCY-CO MAPPING

Semester IV	Computer Networking(Course Code:)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency **Use Software and hardware technology to establish, commission (make operational) and maintain secure computer networks**										
Course Outcomes CO a) Classify various types of networks base on their construction, usage and scope	2	2	-	-	-	-	1			
CO b) Differentiate OSI and TCP/IP models	2	-	-	-	-	-	1			
CO c) Select proper transmission media and devices based on network requirements.	2	2	1	1	-	-	1			
CO d) Compare IPv4 and IPv6 addressing schemes.	2	1	1	1	-	-	-			
CO e) Identify various types of network security threats	2	1	1	1	1	-	1			

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation ofeach competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Introduction to Web Development
(Course Code: 4340704)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	4th Semester

1. RATIONALE

In our day-to-day lives, we use a number of web applications, such as online ticket or hotel booking, e-commerce, social networks, email, etc. All of these web applications are stored on a remote server, delivered over the Internet and accessed through a browser interface.
PHP is an open-source, server-side scripting language designed specifically for web applications. PHP is one of the most popular choices among developers to develop dynamic, interactive, secure and database-driven web applications.
In the growing field of web technologies, it is essential for diploma-passing students to learn the PHP language to help them build web applications. The goal of this course is to develop web development skills in students using the server-side scripting language-PHP. Students will learn the integration of HTML, CSS, PHP and MySQL database to develop web applications. This course will help students who want to develop web-based applications for their final year project.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop various types of related skills leading to the achievement of the following competency

- **Develop Interactive Web applications using PHP and MySQL.**

3. COURSE OUTCOMES (COs)

The practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

a) Develop PHP scripts using variables, operators and control structures.
b) Develop PHP scripts using arrays and functions.
c) Develop PHP scripts by applying object oriented concepts.
d) Develop web pages using form controls with validation to collect user inputs in PHP.
e) Develop and host interactive websites using PHP and MySQL database.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
CI	T	P	C	CA	ESE	CA	ESE	
3	0	4	5	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: CI *– Classroom Instructions;* **T** *– Tutorial/Teacher Guided Theory Practice;* **P** *– Practical;* **C** *– Credit,* **CA** *– Continuous Assessment;* **ESE** *– End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the subcomponents of the COs. *Some of the* **PrOs** *marked* **'*'** *are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	**Environment Setup** i. Install and configure PHP, Web Server and MySQL database using XAMPP/WAMP/LAMP/MAMP. ii. Create a web page that displays "Hello World."	1	2
2.	**Form Introduction** i. Create a web page that collects user information using a form and displays it when the user clicks the submit button.	4	2

3.	**Variables, Operators and Expressions**
	i. Write a script to implement a simple calculator for mathematical operations.
	ii. A company has following payment scheme for their staff:
	    a. Net Salary = Gross Salary – Deduction
	    b. Gross Salary = Basic pay + DA + HRA + Medical
	    c. Deduction = Insurance + PF
	Where, DA (Dearness Allowance) = 50% of Basic pay
	        HRA (House Rent Allowance) = 10% of Basic pay
	        Medical = 4% of Basic pay
	        Insurance = 7% of Gross salary
	        PF (Provident Fund) = 5% of Gross salary
		1	2

	Write a script to take the basic salary of an employee as input and calculate the net payment to any employee.		
4.	**Decision making statements**	1	4

Decision making statements

i. Write a script that reads the name of the car and displays the name of the company the car belongs to as per the below table:

Car	Company
Safari, Nexon, Tigor, Tiago	Tata
XUV700, XUV300, Bolero	Mahindra
i20, Verna, Venue, Creta	Hyundai
Swift, Alto, Baleno, Brezza	Suzuki

ii. Write a script to read the marks of 4 subjects and display the result as per the below instructions:

GTU GRADE	Mark-Range
AA	85 - 100
AB	75 - 84
BB	65 - 74
BC	55 - 64
CC	45 - 54
CD	40 - 44
DD	35 - 39
FF	< 35 (FAIL)

a. Each of the four subjects is worth 100 marks.
b. If a student gets less than 35 marks in any subject, then he/she will be marked as FAIL, otherwise he/she will be marked as PASS.

The result contains the grade of each individual subject in tabular format as per the above table.

Loops
iii. Write a script to display Fibonacci numbers up to a given term.
iv. Write a script to display a multiplication table for the given number.

| 5. | **Arrays**
i.   Write a script to calculate the length of a string and count the number of words in the given string without using string functions.
ii. Write a script to sort a given indexed array.
iii. Write a script to perform 3 x 3 matrix Multiplication.
iv. Write a script to encode a given message into equivalent Morse code. | 2 | 4 |
| 6. | **Functions**
i.   Consider a currency system in which there are notes of 7 denominations, namely Rs. 1, Rs. 2, Rs. 5, Rs. 10, Rs. 20, Rs. 50 | 2 | 4 |

	and Rs. 100. Write a function that computes the smallest number of notes that will combine for a given amount of money.
	ii. Write scripts using string functions:
	    a. to check if the given string is lowercase or not.
	    b. to reverse the given string.
	    c. to remove white spaces from the given string.
	    d. to replace the given word from the given string.
	iii. Write scripts using math functions:
	    a. to generate a random number between the given range.
	    b. to display the binary, octal and hexadecimal of a given decimal number.
	    c. to display the sin, cos and tan of the given angle.
	iv. Write a script to display the current date and time in different formats.		

7.	**OOP Concepts**
	  i. Write a script to:
	    a. Define a class with constructor and destructor.
	    b. Create an object of a class and access its public properties and methods.
	 ii. Write a script that uses the set attribute and get attribute methods to access a class's private attributes of a class.
	iii. Write a script to demonstrate single inheritance.
	iv. Write a script to demonstrate multiple inheritance.
	 v. Write a script to demonstrate multilevel inheritance.
	vi. Write a script to demonstrate method overriding.
	vii. Write a script to demonstrate method overloading based on the number of arguments.
	viii. Write a script to demonstrate a simple interface.
	ix. Write a script to demonstrate a simple abstract class.
	 x. Write a script to demonstrate cloning of objects.
		3	8

8.	**Forms** i. Create a web page using a form to collect employee information. ii. Extend practical - 8(i) to validate user information using regular expressions. iii. Create two distinct web pages to demonstrate information passing between them using URL - Get method. iv. Create two different web pages to demonstrate information passing between web pages using Hidden variables – Post method.	4	6
9.	**Session, Cookies** i. Create web pages to demonstrate passing information using Session. ii. Write a script to demonstrate storing and retrieving information from cookies.	4	4

10.	**Database**
	  i. Create a web page that reads employee information using a form and stores it in the database.
	  ii. Create a web page for employee log-in.
	  iii. Write a script to upload an image to the server.
	  iv. After an employee logs in, create a Home web page that displays basic employee information.
	  v. Create a web page to delete employee profiles from the database.
	  vi. Create a web page that allows employees to change their password.
		5	8

11.	**Email, PDF, JSON**
	  i. Write a script to generate a salary slip for an employee in PDF format.
	  ii. Write a script to send an email.
	  iii. Write a script to convert an associative array into JSON string format and vice versa.
		5	6

12.	**Simple Web Application** Create a simple web application for Employee Management with 3-4 web pages and host it using cPanel and Filezilla.	5	6
	Total Hours		**56**

Remark: In the above practical list, practical-2 will help students practice using forms for user input. In practicals 3 to 12, students should take user input via forms.

Note

  i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.***

  ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Correctness of solution/answer	30
2	Interpret and Solve various algorithms	30
3	Debugging ability	20
4	Program execution/answer to sample questions	20
	Total	**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with   broad   specifications   to   facilitate   procurement   of   them   by   the

administrators/management of the institutes. This will ensure conduction of practicals in all institutions across the state in a proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with Windows/Linux/Mac Operating System.	All
2	XAMPP/WAMP/LAMP/MAMP servers.	All
3	Text Editor such as VS Code, Sublime, Atom etc.	All
4	Web Browser such as Chrome, Firefox, Edge, Safari etc.	All
5	Internet Connection.	All
6	Database tool such as MySQL, Maria DB or equivalent.	11, 13
7	Web Domain, Web space and cPanel.	13

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.

a)   Follow Coding standards and practices.
b)   Maintain tools and equipment.
c)   Search for project ideas.
d)   Organize project files and resources.
e)   Work as a leader or team member.
f)   Present project work.
g)   Adhere to ethical practices.
h)   Follow safety practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.   'Valuing Level' in 1st year
ii.   'Organization Level' in 2nd year.
iii.   'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically include lower level UOs in them).

If required, more such high level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –1: Introduction to PHP	1a. Write simple scripts using variables, constants, and operators. 1b. Write simple scripts using decision making statements to solve the given problem. 1c. Write simple scripts using loop controls to solve the given problem.	1.1 Introduction to Static and Dynamic Websites 1.2 Introduction to PHP and it's History 1.3 Basic PHP syntax and file structure 1.4 Output statements: echo and print 1.5 PHP variables and value types 1.6 PHP Constants and magic constants 1.7 PHP Operators and their precedence: i. Arithmetic operators ii. Increment-decrement operators iii. Assignment operators iv. Logical operators v. Bitwise operators vi. Comparison operators 1.8 Decision-making statements: if statement, if-else statement, else-if clause, switch-case statement, the *?* operator 1.9 Loops: while loop, for loop, foreach loop, nesting loops 1.10 Break and continue statements
Unit– 2: Arrays and Functions in PHP	2a. Use different types of arrays for a given application. 2b. Create a custom user defined function for a given requirement. 2c. Use PHP in-built functions to perform string operations, simple mathematical operations and to process date and time.	2.1. Introduction to PHP Arrays and types of arrays: Indexed, Associative and Multidimensional arrays 2.2. PHP Strings: single quoted, double quoted, heredoc syntax, nowdoc syntax 2.3. Creating, Manipulating and traversing different types of arrays 2.4. User defined function: creating a function, calling a function and

		returning a value from function
		2.5. Function with default arguments, passing arguments by value and reference
		2.6. Variable scope, accessing global variables inside a function
		2.7. Variable function
		2.8. Using PHP built-in functions
		i. String processing functions: chr(), ord(), strlen(), trim(), ltrim(), rtrim(), join(), substr(), str_replace(), str_split(), str_word_count(), strcmp(), strcasecmp(), strops(), stripos(), strrev(), strtolower(), strtoupper(),str_shuffle()
		ii. Mathematical functions: abs(), ceil(), floor(), round(), rand(), min(), max(), pi(), pow(), sqrt(), exp(), log(), decbin(), decoct(), dechex(), sin(), cos(), tan(), deg2rad(), rad2deg()
		iii. Date/time function: getdate(), gettimeofday(), time(), date_create(), mktime(), date_format(), date_diff(), checkdate()
Unit– 3: Object Oriented Concepts in PHP	3a. Define class, object, constructor and destructor for a given problem. 3b. Implement Inheritance to extend the base class. 3c. Use polymorphism to solve the given problem. 3d. Clone the given object.	3.1. OOP concepts: Class, Object, Properties, Methods, Encapsulation, Access modifiers 3.2. Creating Classes, Objects 3.3. Constructors and Destructors 3.4. Inheritance 3.5. Polymorphism: Overloading, Overriding 3.6. Interface 3.7. Abstract Class 3.8. Final keyword 3.9. Cloning Objects

Unit–4: Forms Handling, Session, Cookies	4a. Design a webpage using form controls to collect user input.
	4b. Access form data using PHP.
	4c. Validate a form using PHP
	4d. Implement a simple session using session variables.
	4e. Use cookies to store data.
		4.1. Form controls: Text Box, Textarea, List Box, Dropdown, Check Box, Radio Box, Buttons, Upload, color, date etc.
		4.2. Retrieving form data using GET and POST methods
		4.3. Form Validation using PHP
		4.4. Working with multiple forms
		   i. A web page having multiple forms
		   ii. A form having multiple submit buttons
		4.5. Session: creating a session, storing and accessing session data and destroying session
		4.6. Cookies: setting a cookies, accessing cookies data and destroying cookies

Unit–5: Working with Database in PHP	5a. Use the MySQL database to store data in PHP.
	5b. Insert, update and delete data from the MySQL database using PHP.
	5c. Use the data from the form to insert/update the MySQL database.
	5d. Retrieve data from the MySQL database and display it in various formats.
	5e. Host a website using cPanel and Filezilla software.
		5.1. Introduction to MySQL Database with PHP
		5.2. Creating a database using phpMyAdmin & console
		5.3. Connecting with MySQL database
		5.4. Executing MySQL queries
		5.5. Performing database operations
		   i. Create/delete a table
		   ii. Insert data into the table
		   iii. Update data into the table
		   iv. Retrieve data from the table
		   v. Delete data from the table
		5.6. Displaying data from the database in different formats, including tables
		5.7. Working on mini-project: Developing simple web application and hosting it on web server

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to PHP	7	2	4	6	12
II	Arrays and Functions in PHP	8	2	4	8	14
III	Object Oriented Concepts in PHP	8	2	4	8	14
IV	Forms, Session, Cookies	8	2	4	8	14
V	Database Operations	11	2	6	8	16
Total		**42**	10	22	38	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro-project, the report should be as per the suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:
  a)   Prepare a journal of practicals.
  b)   Undertake micro/mini-projects in teams.
  c)   Develop a simple website using HTML, CSS, PHP and MySQL.
  d)   Perform a survey on different web technologies and websites using those technologies.
  e)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edX, Coursera, Udemy etc. to further enhance their learning.
  f)   Encourage students to participate in different coding competitions like hackathons, online competitions on Codechef etc.
  g)   Encourage students to form a coding club at the institute level and can help the slow learners.
  h)   Contribute to Open Source Software project.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a)   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.

b)   Guide student(s) in undertaking micro-projects.

c)   Managing Learning Environment

d)   Diagnosing Essential Missed Learning concepts that will help students.

e)   Guide Students to do Personalized learning so that students can understand the course material at his or her pace.

f)   Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

g)   *"CI" in section No. 4* means different types of teaching methods that are to be employed by teachers to develop the outcomes.

h)   About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.

i)   With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

j)   Guide students on how to address issues on environment and sustainability using the knowledge of this course

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should *not exceed three.*

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about *16 (sixteen) student engagement hours* (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

a)   Develop a web application to send plain text emails, send HTML messages and send mails with attachments.

b)   Develop a web application to generate Word documents or PDFs automatically from an excel file or a database.

c)   Develop a web based Library Management Application with add books, search books, issue books and return books functionalities.

d)   Develop a Two-Factor Authentication (2FA) system.

e)   Develop a web application for e-commerce.

f) Develop a web application for Restaurant Management System.
g) Develop a web application for Hotel Management System
h) Develop a web application for Movie Review and Suggestions.
i) Develop a web application for Online Quiz System.
j) Develop a web application for Student Feedback Management System.
k) Develop a web application for Employee Pay Management System.
l) Develop a web based Chatbot system.
m) Develop a Fitness Club Management System.
n) Develop a web application for Hospital Management System.
o) Develop a web application for Online Blood Bank.
p) Develop an application to scrap website information.

13.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	PHP: The Complete Reference	Steven Holzner	McGraw Hill Education ISBN-13: 978-0070223622
2	Head First PHP & MySQL: A Brain-Friendly Guide	Lynn Beighley, Michael Morrison	O'Reilly ISBN-13: 978-0596006303
3	Learning PHP, MySQL & JavaScript with j Query, CSS & HTML5	Robin Nixon	Shroff Publishers & Distributers Private Limited – Mumbai ISBN-13: 978-9352130153
4	PHP and MySQL Web Development	Laura Thomson, Luke Welling	Pearson Education ISBN-13: 978-9332582736
5	PHP Cookbook	David Sklar, Adam Trachtenberg	O'Reilly ISBN-13: 978-1449363758
6	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications With PHP and mySQL	Alan Forbes	Createspace Independent Pub ISBN-13 : 978-1522792147

14.   SUGGESTED LEARNING WEBSITES

a) https://www.php.net/manual/en/langref.php
b) https://www.tutorialspoint.com/php/index.htm
c) https://www.w3schools.com/php/default.asp
d) https://www.codecademy.com/learn/learn-php
e) https://www.geeksforgeeks.org/php-tutorials
f) https://www.youtube.com/watch?v=OK_JCtrrv-c
g) https://phpapprentice.com

15.   PO-COMPETENCY-CO MAPPING

Semester III	Scripting Language - Introduction to Web Development (Course Code: 4340704)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ develop ment of solutions	PO 4 Enginee ring Tools, Experim entatio n and Testing	PO 5 Engineering practices for society, sustainabilit y and environmen t	PO 6 Project Manage ment	PO 7 Life-long learnin g	PSO 1	PSO 2	PSO 3 (If neede d)
Competency	**Develop simple applications using Python to solve the given problem.**									
CO a) Develop PHP scripts using variables, operators and control structures.	3	2	1	2	-	-	1			
CO b) Develop PHP scripts using arrays and functions.	3	3	1	2	-	-	1			
CO c) Develop PHP scripts by applying object oriented concepts.	2	2	2	2	-	1	1			
CO d) Develop web pages using form controls with validation to collect user inputs in PHP.	2	2	2	2	-	2	2			
CO e) Develop and host interactive websites using PHP and MySQL database.	2	2	2	3	-	3	3			

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	**Smt. Manisha Mehta** Head of Computer Department	Government Polytechnic - Himatnagar	9879578273	manishamehtain@gmail. com
2	**Smt. Jasmine Kargathala** Lecturer in Computer Engineering	Government Girls Polytechnic - Ahmedabad	9824799620	jdaftary@gmail.com
3	**Shri Kartik Detroja** Lecturer in Computer Engineering	Government Polytechnic - Porbandar	9972419091	detroja.kartik@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Modern Practical Tools
(Course Code: 4340705)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	Forth

1.   RATIONALE

Today's modern industry uses many frameworks for a front-end web design and Angular is one of them for developing dynamic web applications. It covers all the basics of frontend web application development using the Angular framework in order to provide developers insights into real-world challenges and scenarios they face throughout their day-to-day development process, as well as provides tips and best practices for becoming a web application developer.

Self-learning tips on exploring Angular topics are provided to equip the student better to continuously keep upgrading their knowledge and skills even after landing a career in Angular. All the key theories and concepts related to the Angular framework and front-end web development are explained with the help of real-world day-to-day problems. The learners will be asked to complete projects and challenges based on the concepts which they learned in lab sessions to help them to get a real-world glimpse into practical Angular front-end programming. Below are major reasons for considering learning Angular over other platforms.
.

- Optimal code

- Easy to Integrate

- Support for Single Page Applications

- Declarative User Interface

- Modularity

- Cross-platform compatibility

This course will give basic knowledge and skills for front-end design for web application development using Angular framework.

2.   COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through Angular Framework experiences:

- **Use Angular Framework to build appealing dynamic web application for all platforms.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Prepare environment for angular project using Node.js, npm and visual code editor.
b) Apply angular directives, components and pipes in different web page development.
c) Utilize angular template driven and reactive forms in different problem solutions.
d) Design pages to make HTTP GET/POST calls to perform CRUD operations using different server-side APIs.
e) Develop single page dynamic applications using Angular framework and APIs.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	2	1	0	0	25	25	50

(*): For this practical only course, 25 marks under the practical CA has two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

***Legends: L**-Lecture; T– Tutorial/Teacher Guided Theory Practice; P-Practical; C– Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *Some of the **PrOs** marked '*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Setup environment for Angular framework by Installing Node.js, npm package manager using editor like Visual Code.	I	01*
2	Create first application to print Hello World mesage using angular framework.	I	01*
3	Design a web page to utilize property binding and event binding concepts using button and textbox controls.	I	01*
4	Create various components of web page using Attribute Directives.	II	01*
5	Design a web page to display student grading system in tabular format with alternate color style using ngSwitch, ngStyle Directives.	II	01*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
6	Design component to perform following tasks A) To Add or Remove number of students using textbox and button controls and display it in tabular structure format. B) Give row level remove button option to student table and record should be deleted when click on it..	II	02*
7	Create a component to display a products list from array. the product component should display a product Id, name, purchase date, price, and image for the product and search using various pipes.	II	02*
8	Design a student registration page using template driven form approach and utilize different form and controls level ng validation classes.	III	01*
9	Design component to enter faculty details like Code, Name, Email, Type, Faculty Status (Active, Inactive), Subjects Teaching (with option to add multiple subjects dynamically) using reactive form with various types of validation of form and controls.	III	02*
10	Design a page to implement Add to Cart functionality using decorators, custom properties, custom events of component communication.	III	01*
11	Develop page to demonstrate different methods of angular component lifecycle.	III	01*
12	Design an e-commerce product page and product details page that displays product details when clicking on any particular product.	III	02*
13	Design a page to display student information using dependency Injection.	IV	02*
14	Develop a page for product listing and search-as-you-type using observables and web APIs from database.	IV	02*
15	Design web page to display student data in table using HTTP GET/POST Calls from web APIs.	IV	02*
16	Design web page to insert product data in table using web APIs.	IV	01*
17	Design a page to implement Multiview component with login, logout functionalities using different routing options.	V	02*
18	Develop a page to demonstrate page navigation of product list using routing concepts.	V	01*
19	Design a page to load customer and Sales order data using lazy loading technique in angular.	V	01*
20	Design a page to implement CORS concept.	V	01*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Total 20 Practical Exercises		**28 Hrs.**

Note

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

*ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

S.No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Use of creative and innovative approach.	20
2	Readability	15
3	Code Efficiency	30
4	Verify practical implementation for desired output.	25
5	Readability and documentation of the program/Quality of input and output displayed (messaging and formatting).	10
	Total	**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system with operating system and browser that supports JavaScript.	All
2	HTML IDEs and Code Editors Open-source tools like Visual Studio Code, Notepad++	All
3	Open-source jQuery, Node.js, Node Package Manager (npm)	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this course competency.

   a)   Work as a leader/a team member.
   b)   Follow ethical programming practices.
   c)   Practice environmentally friendly methods and processes.
   d)   Follow safety precautions.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

    i.   'Valuing Level' in 1st year
   ii.   'Organization Level' in 2nd year.
  iii.   'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of Revised Bloom's taxonomy that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics

Unit – I: Introduction to Angular Framework	1a Setup Angular Development Environment
	1b Getting Started first Angular Project
	1c Identify the various pieces that the Angular skeleton application generates and their needs and uses.
	1d Relate basic Angular data binding mechanism.
		1.1 Why Angular
		1.2 Development Environment: Node JS, Type script, Angular CLI
		1.3 Starting Your First Angular Project
		1.4 Understanding the Angular CLI
		1.5 Running first Application for Hello World
		1.6 Basics of an Angular Application
		    Root HTML--index.html
		    The Entry Point--main.ts
		    Main Module--app.module.ts
		    Root Component-AppComponent
		1.7 Creating a Component
		1.8 Understanding Data Binding
		1.9 Understanding Property Binding
		1.10 Understanding Event Binding
		1.11 Using Models for Cleaner Code

Unit– II: Angular Directives, Components and Pipes	2a. Classify various type of Directives used in angular 2b. Apply various attributes, decorator, and styles to components. 2c. Use various states of component life cycle. 2d. Utilize various types of pipes in template expression for display data in Angular.	2.1 Introduction Directives 2.2 Built-In Attribute Directives: NgClass, NgStyle 2.3 Alternative Class and Style Binding Syntax 2.4 Built-In Structural Directives Ngif , NgFor, NgSwitch, Multiple Sibling Structural Directives 2.5 Defining a Component 2.6 Selector, Template, Styles, Style Encapsulation, Others Components and Modules 2.7 Input, Output and Change Detection 2.8 Component Lifecycle, Interfaces and Functions, View Projection 2.9 Introduction to Pipes 2.10 Built-In Pipes, Angular Custom Pipes, Pure and Impure Pipes 2.11 Pipe Transform Interface &

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
		Transform Function
Unit– III: Angular Template Driven Forms and Reactive Forms	3a. Show usage of template driven Forms. 3b. Perform page design with Reactive Forms. 3c. Apply Form Array in various components. 3d. Differentiate Template driven and reactive Forms.	3.1 Introduction to Template-Driven Forms 3.2 Setting Up Forms 3.3 Alternative to NgModel-Event and Property Binding 3.4 NgModel 3.5 A Complete Form, Control State and Validity 3.6 Working with Form Groups 3.7 Introduction to Reactive Forms 3.8 Using Reactive Forms: Form Controls, Form Groups, Form Builders 3.9 Form Data, Control State, Validity, and Error Messages 3.10 Form Arrays
Unit–IV: Angular Services and HTTP calls	4a. Correlate the concepts of Angular services and Dependency Injection 4b. Develop customize APIs for different CRUD operations. 4c. Apply Various HTTP calls in application development. 4d. Utilize Observables feature in customized application.	4.1 Introduction to Angular Services. 4.2 Creating Our Own Angular Service and Dependency Injection 4.3 Introducing HttpClient, Server Setup, Using HitpClientModule,HTTP GET/POST Calls 4.4 Design Server-side APIs using PHP and MYSQL 4.5 Advanced HTTP: Options-Headers/Params, Observe/Response Type, Interceptors 4.6 RxJS, Observables and Advanced Observables
Unit–V: Angular Routing and Application Development	5a. setup the Angular router for any Angular application. 5b. Apply different routing concept for navigation. 5c. Use Route Guard for authenticated page navigation. 5d. Utilize concepts of CORS and Lazy loading to design web pages.	5.1 Server Setup, Importing the Router Module, Displaying the Route Contents, Navigating Within the Application, Wildcards and Defaults 5.2 Common Routing Requirements, Required Route Params, Optional Route Params 5.3 Route Guards: Authenticated-Only Routes, Preventing Unload, Preloading Data Using Resolve 5.4 API/Server Calls and CORS 5.5 Lazy Loading

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Angular Framework	3				
II	Angular Directives, Components and Pipes	6				
III	Angular Template Driven Forms and Reactive Forms	7				
IV	Angular Services and HTTP calls	7				
V	Angular Routing and Application Development	5				
	Total	**28**				

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Identify tools used for web page development and present its features.
b) Undertake course "Angular - The Complete Guide (2023 Edition)" available on Udemy online platform. (https://www.udemy.com/course/the-complete-guide-to-angular-2/).
c) Undertake course "Angular Course" available on internsala online platform. (Angular Course - Learn Angular JS Online with Certificate (internshala.com)) or any other such site.
d) Undertake course "Routing and Navigation Concepts in Angular" available on coursera online platform. Routing and Navigation Concepts in Angular (coursera.org)) or any other such site.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) *'P' in section No. 4*means different types of instructions that are to be employed by teachers to develop the outcomes.
d) About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.
e) With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
f) Guide students for open-source Angular framework and other resources.

g) Motivate students to visit as many websites as they can to increase the design knowledge and creativity.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the microproject should be about **12-14 (twelve to fourteen) student engagement hours** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Develop a Notepad application with functionality of digital Notebook.
b) Develop currency converter application using angular framework.
c) Develop Angular Bare Bones project showcases Angular routing
d) Develop a dynamic single page application for awareness towards blood donation, organ donation, follow healthy life style and quit smoking in society.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Angular in Action	Jeremy Wilken	Manning Publications. ISBN-10: 1617293318 ISBN-13: 978-1617293313
2	Angular: Up and Running: Learning Angular, Step by Step	Shyam Seshadri	O'Reilly Media, Inc. ISBN-10: 9352137426 ISBN-13: 978-9352137428
3	ng-book: The Complete Guide to Angular	Felipe Coury, Ari Lerner, Carlos Taborda	Createspace Independent Publishing Platform. ISBN-10: 1985170280 ISBN-13: 978-1985170285
4	Angular Projects	Aristeidis Bampakos, Mark Thompson	Packt Publishing Ltd. ISBN-10: 1800205260 ISBN-13: 978-1800205260
5	Angular Development with TypeScript	Yakov Fain, Anton Moiseev	Manning; 2nd edition ISBN-10: 1617295345 ISBN-13: 978-1617295348
6	Angular Cookbook	Muhammad Ahsan Ayaz, Najla Obaid	Packt Publishing Limited, ISBN-10: 1838989439 ISBN-13: 978-1838989439

14.   SOFTWARE/LEARNING WEBSITES

- https://www.geeksforgeeks.org/angular-8-introduction/

- Angular7 Tutorial (tutorialspoint.com)

- https://docs.angularjs.org/guide/concepts

- https://www.w3schools.blog/angular-8-tutorial

- https://www.simplilearn.com/tutorials/angular-tutorial

- https://www.javatpoint.com/angular-7-tutorial

15.   PO-COMPETENCY-CO MAPPING

Semester IV	Modern Practical Tools (Course Code: 4340705)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimen- tation&Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life- long learning
Competency	Use Angular Framework to build appealing dynamic web application for all platforms.						
Course Outcomes CO a) Prepare environment for angular project using Node.js, npm and visual code editor.	2	-	1	1	-	-	-
CO b) Apply angular directives, components and pipes in different web page development.	2	1	1	1	-	-	1
CO c) Utilize angular template driven and reactive forms in different problem solutions.	2	2	2	2	-	-	-
CO d) Design pages to make HTTP GET/POST calls to perform CRUD operations using different server-side APIs.	2	2	2	2	-	-	1
CO e) Develop single page dynamic applications using Angular framework and APIs.	2	2	2	2	1	1	1

Legend: '3' for high, '2' for medium, '1' for low and '-' for no correlation of each CO with PO.

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	Jiger P. Acharya	GP Ahmedabad	9429462026	jigeracharya@gmail.com
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GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)
Semester – IV

Course Title: Contributor Personality Development
(Course Code: 4340002)

Diploma programme in which this course is offered	Semester in which offered
All branches of Diploma Engineering	4ᵗʰ Semester

Type of course: Work-Personality Development

For Year: Pre-final year for all Diploma programs

Rationale: The Contributor Program aims to accomplish the following outcomes in the lives of students–
• Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
• Build their I-Can attitude and self-confidence for their career.
• Improve their ability to engage positively to handle the challenges in career and workplaces.
• Build long-term and sustainable view of success and career that will help them make sustainable choices in a volatile and changing world of work.
• Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
• Awaken their aspiration to develop as Contributors in their organizations and society.

The program is focused on building foundational career values and the self-esteem of students to contribute in today's world of work.

The Contributor Program syllabus has been evolved and fine-tuned over several years, to –
a) address the changing needs and contemporary challenges being faced by industry and what employers today are looking for in the people they hire.
b) working extensively with universities and students and an appreciation of their challenges and concerns.
c) guided by the higher ideas and principles of Practical Vedanta in work.

OVERALL TEACHING AND EXAMINATION SCHEME
FOR ALL DIPLOMA COURSES

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
2	0	0	2	30	70	25	25	150

L- Lecture; T- Tutorial/ Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	**30**	**30**	**10**	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note:

It is the responsibility of the institute heads that marks for PA of theory & ESE and PA of practical for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

Note:
1. This subject is compulsory.
2. It will carry 2 credits.

COURSE FORMAT

Class Sessions:

- Students will have to attend 3 hours of discovery-based sessions, to build new models of thinking & capacities for every module. [i.e., total 18 hours of classroom sessions in the semester]
- They will work closely with their peers to discuss and understand these new models of thinking.
- Their learning will be facilitated by trained college faculty.
- They also go through standard end-of-module, live assessments in class via a Student App, for continuous assessment of learning, which will be used for the progressive assessment component.

Project work:
- Students will have to complete projects as part of Practical work. They have one project corresponding to each module. These projects help them apply contributor thinking into their careers and life. These also help them build their confidence to communicate, ability to do systematic research and present their thinking effectively.
- For the successful completion of projects:
  - Students will be given orientation to the project and systematic guidelines on how to conduct the project by their trained college faculty in a project orientation session.
  - The projects will be done in teams and will require research. It may also need field work.
  - Student teams present their projects in the classroom in project presentation sessions.

COURSE CONTENT:

MODULE		WHAT IS COVERED	Total Hrs.
1	Part 1: Developing self-efficacy and basic inner strength	**Who is a Contributor?** Students build a vision of who they can become as a 'Contributor' in their career. They gain clarity on expectations from the future workforce, and importance of being a contributor. This enables students to transform their expectation of themselves in their career and future work.	3 hrs Lab Sessions (discovery-based facilitator led)

2		**The 'creator approach' to life & challenges** In a "caged approach", we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the "creator approach" to challenges and situations. This helps them take ownership & responsibility to shape destiny, build a new future, find answers to challenges; and stop being complainers.	Same as above
3		**Develop yourself to succeed: The I CAN Approach** Students learn to develop an "I CAN" attitude to everything. This is the base that helps them develop a Growth Identity & builds their self-esteem step by step; making them ready to deal with the dynamic demands of the future workplace.	Same as above
4	Part 2: Building ability to make more effective career choices	**Achieving Sustainable Success in their career** Students discover how to achieve sustainable or lasting success, by making themselves success worthy. Where their focus shifts to building one's "engine of success" rather than being focused on chasing the "fruits of success". This is important, because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruits of success fall prey to disappointment, loss in motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not. This helps them make better choices in life, that leads to steady success & long-term career fulfillment in an uncertain world.	Same as above
5		**Career Development Pathways open to us** In this topic, students explore a range of diverse "career development models" and the possibilities for contribution that each opens up for them. This helps them open up hidden opportunities that such an environment offers. And free themselves from a herd mentality when making career	Same as above

		choices.	
6		**Unleashing our Power to Contribute** In this topic, students learn how to expand the contribution possible in any role they play. This helps them take charge of their own career growth & discover their power to contribute in any role or job.	Same as above
Project work		Project Assignments are given corresponding to each of the six topics. These projects require research and field work beyond the classroom that students are expected to do.	Beyond classroom, with student presentations in the class

Reference resources:

A. Basic reference for both students and teachers –

1. Student Resources for study comprising of key ideas learnt in the classroom in each topic and additional references to videos, articles etc. from the internet for continued exploration. These resources are made available via the Student App.

2. In-class Assessment Quizzes for each of the 6 modules that students do via the Student App.

3. Structured classroom presentations that teachers use to conduct classes systematically. This is provided via a digital delivery platform (only for teachers).

4. Guides and preparation material to help teachers prepare for the classroom sessions. This is also provided via the digital delivery platform.

5. Project Guides and support materials provided via the digital delivery platform and the Student App.

These will be made available by Illumine (www.illumine.in), Knowledge Partner for the Contributor Program.

B. Advanced reference for teachers –

1. On Contributors, Srinivas V.; Illumine Ideas, 2011
2. Awaken the Contributor Within (Contributor Ethic), Srinivas V.; Illumine Ideas, 2019
3. Becoming a Contributor Teacher (Contributor Ethic), Srinivas V.; Illumine Ideas, 2018
4. Reclaiming our intentionality: from "victims" to "creators of our destiny" (Design of Life), Srinivas V.; Illumine Ideas, 2016.
5. Examining our motives of work: can we ask more out of ourselves? (Design of Life), Srinivas V.; Illumine Ideas, 2016.
6. Building a Contributor Ethic in Organizations, Srinivas V.; Illumine Ideas, 2019.

7. Enlightened Citizenship and Democracy; Swami Ranganathananda, Bharatiya Vidya Bhavan, 1989
8. Eternal Values for a Changing Society – Vol I-IV, Swami Ranganathananda; Bharatiya Vidya Bhavan

9.   Karma Yoga, Swami Vivekananda; Advaita Ashrama
10. Six Pillars of Self Esteem, Nathaniel Branden; Bantam, 1995
11. Mindset: The New Psychology of Success, Carol S. Dweck; Random House Publishing Group, 2007
12. Lasting Contribution: How to Think, Plan, and Act to Accomplish Meaningful Work, Tad Waddington; Agate Publishing, 2007
13. Why not? how to use everyday ingenuity to solve problems big and small, Barry Nalebuff, Ian Ayres; Harvard Business School Press, 2003
14. The value mindset: returning to the first principles of capitalist enterprise (Ch 8 & 9); Erik Stern, Mike Hutchinson; John Wiley and Sons, 2004
15. The Power of Full Engagement: Managing Energy, Not Time, is the Key to High Performance and Personal Renewal, Jim Loehr, Tony Schwartz; Simon and Schuster, 2003
16. Responsibility at work: how leading professionals act (or don't act) responsibly, Howard Gardner; John Wiley & Sons, 2007

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
Outcome of class sessions		
CO-1	Students are able to recognize the work ideal of a Contributor in terms of their motives for working and approach to work. They appreciate the value and importance of becoming Contributors in today's context.	10-12%
CO-2	Students are able to recognize & appreciate a "caged" approach as distinct from a "creator" approach in the way people deal with challenges and situations; and learn ways to develop a creator approach.	10-12%
CO-3	Students are able to recognize an "I Can" approach or way of thinking in situations. They learn how to apply this thinking to systematically develop themselves and their self-confidence in any area they choose.	10-12%
CO-4	Students are able to widen their understanding of success, that will help them make more sustainable career choices.	10-12%
CO-5	Students are able to recognize & appreciate different career development pathways and their value; to open up different career possibilities for themselves.	10-12%
CO-6	Students are able to recognize that any role has the potential for contribution. And they learn how to systematically expand the contributions and impact they can make in any role.	10-12%
Outcome of practical /project sessions		
	Students learn to apply the new thinking in the real world context	30%

EXAMINATION PATTERN:

End Semester Examination Pattern:

1.0   The final examination will cover all six modules included in the course content.

2.0   The examination is largely understanding and application oriented. Thus, a thorough appreciation of the key concepts of the course to recognize contributor thinking and application of the concepts in everyday life & work context, will help students to do well in the examination.

3.0   The examination paper will have ~30 questions and is to be completed in 1 ½ hours.

4.0   All questions are compulsory.

5.0   Pattern of questions –
  o There are four sections in the question paper.
  o All questions are in multiple-choice format (MCQ).
  o The questions are in the form of scenarios / situations giving options. The student is expected to choose one option out of the given options.

6.0   The total number of marks is **70 marks**. The No. of questions and maximum marks per section is given below:

Section	Type of questions & No. of questions	Marking scheme
Section A	Case with 4 MCQs (with 2 or 3 options each). Student has to choose only one option.	2 questions x 3 marks each 2 questions x 2 marks each Max. marks = 10 marks Min. marks = zero
Section B	10 MCQs (with two valid options each). Student has to choose only one option.	10 questions x 2 marks each Max. marks = 20 marks Min. marks = zero
Section C	5 MCQs (with 3 or 4 options each). Student has to prioritize/ rank the statements & choose only one option that is closest to their ranking or priority-combination.	5 questions x 2 marks each Max. marks = 10 marks Min. marks = zero
Section D	10 MCQs (with 3 options each). Student has to choose only one option.	10 questions x 3 marks each Max. marks = 30 marks Min. marks = 10 marks

Sample Question Paper Pattern:

Section A

Instructions: This section has a scenario. Read carefully before answering the subsequent questions. There are 4 questions in this section. All questions are compulsory. Each question has 3 or 2 options. Choose ONLY ONE option which you consider the most appropriate option. Read carefully before answering.

Maximum Marks: 10

> E-retailer Flipkart has announced that it will use the services of Dabbawalas of Mumbai for delivering goods to customers.
>
> The Dabbawalas have been in the profession of transporting lunch boxes with absolute accuracy for more than 120 years. Their unique delivery system has been smooth, and reliable under all conditions. Their business involves no paper or administrative team. This helps in keeping the costs down.
>
> However the Dabbawalas are not technology savvy which can be a problem for Flipkart.

1. The biggest advantage of this partnership is that…   *[3 marks]*

a] …it will reduce Flipkart's cost of delivery significantly.

b] …it is an unusual and beneficial partnership for all concerned.

c] …it will give Dabbawalas additional income.

2. Suppose a partnership fails, your learning from it would be…   *[2 marks]*

    a] These things happen, don't think about it but go forward.

    b] I need to think through more carefully whom to partner with and how we work together.

Section B

Instructions: There are 10 questions in this section. All questions are compulsory. Each question has 2 statements. Select ONLY ONE statement you feel is closest to your thinking and mark it on the answer sheet given to you.

[10 Qs x 2 marks = max. marks 20]

3. An astronomer made a discovery of a new planet at a unique location in the galaxy after several years of work. This helped prove and support an already well-established theory in Physics. Will the astronomer be called a Contributor?

    a] No, not a contributor, as finally his work led to nothing substantial (the theory was already well established).

    b] Yes, he is a Contributor because he continued for long and didn't give up so that he could make a discovery.

4. a] "I won the 'Best Athlete Award' last year. I should practice well enough to win it again this year."

    b] "I won the 'Best Athlete Award' last year. For this year's sports day, I should practice to improve my stamina and speed."

Section C

Instructions: This section will have 5 questions. All questions are compulsory. Each question has some statements with a unique number (e.g. 1, 2, 3, 4) and 3 or 4 options (e.g. a, b, c, d). Each option is either a combination of statements or a specific order of the statements. Choose ONLY ONE option closest to your thinking and mark it on the answer sheet given to you.

[5 Qs x 2 marks = max. marks 10]

5. What makes a project successful? *(Rank in the order of most likely to least likely option)*

    1. An inspiring team leader who can delegate jobs to his team.

    2. Hardworking team members who complete the tasks which are assigned to them.

    3. A team who believes the project should be successful.

    4. People who think like a 'team'.

        a] 4-3-2-1   b] 2-1-4-3   c] 2-1-3-4   d] 4-3-1-2

6. What are the different I CANs required to crack a job interview?
    1. I CAN learn to articulate my thoughts in a better manner
    2. I CAN overcome the fear of others judging me
    3. I CAN train myself to build my stamina
    4. I CAN think calmly to answer difficult questions
    a] 1, 2, 3   b] 1, 2, 4   c] 1, 3, 4   d] 2, 3, 4

Section D

Instructions: There are 10 questions in this section. All questions are compulsory. Each question has 3 options. Select ONLY ONE option you feel is the most appropriate and mark it on the answer sheet given to you.

[10 Qs x 3 marks = max. marks 30]

7. Which is a Contribution to Self, that a football player can make in his role?
    a] Asking for personalized attention from the coach and better opportunities to prove himself in the team.
    b] Improving his dribbling and passing techniques and his ability to work in smooth co-ordination with other players
    c] Winning more matches and increasing the number of goals scored by him in different matches.

8. Vaibhav, a mechanical engineering student, guides his classmates in completing their lab and group project work, gives regular updates on the progress to the teacher and works with everyone so that the journals of the entire class are submitted in time for external evaluation. What roles is Vaibhav playing in his college/class?
    a] Student leader, friend, role model
    b] Student, classmate, class representative
    c] Student, mentor, coordinator, representative of the class, assisting the teacher