

Government Polytechnic, Pune

'180OB' – Scheme

Programme Name	:	Diploma Programme in CO/IT
Programme Code	:	06/26/07
Course Title	:	Programming with PYTHON
Course Code	:	CM5101
Prerequisite course code and name	:	-
Class Declaration	:	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme					
L	T	P		Theory Marks		Practical Marks		Total Marks	
L	T	P	C	ESE	PA	*ESE	PA	150	
2	-	4	6	Marks	40	10	50		50
				Exam Duration	2 Hrs	1 Hr	2 Hrs		

(*): PE (Practical Examination)

Legends: L- lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

Python is powerful programming language. It has efficient high level data structures and a simple but effective approach to object oriented programming. Python code is simple, short, readable, intuitive and powerful and thus it is effective for introducing computing and problem solving for beginners. Its elegant syntax and dynamic typing together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Develop applications using Python programming to solve given problems.**

4. COURSE OUTCOMES (COs)

The theory, 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:

1. Develop simple Python programs using Python IDE.
2. Execute programs using operators and control flow statements.
3. Perform Operations on Python Data structures.
4. Develop applications using Functions, Modules and Packages.
5. Develop applications using object oriented concepts in python.
6. Write Python code for File and Exception Handling.

5. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Install and configure python IDE.	CO1	02
2.	1	Write simple Python Program to display message on screen.	CO1	02
3.	2	Write simple Python Program using operators: <ul style="list-style-type: none"> • Arithmetic Operators • Logical Operators • Bitwise Operators 	CO2	02
4.	2	Write simple Python Program to demonstrate use of conditional statements: <ul style="list-style-type: none"> • 'if' Statement • 'if...else' Statement • 'if' Statement • Nested 'if' Statement 	CO2	04
5.	2	Write Python Program to demonstrate use of looping statements: <ul style="list-style-type: none"> • 'while' loop • 'for' loop • Nested loops 	CO2	04
6.	2	Write Python Program to demonstrate use of looping statements: <ul style="list-style-type: none"> • continue • pass • break 	CO2	04
7.	3	Write Python Program to perform following operations on Lists: <ul style="list-style-type: none"> • Create List • Access List • Update List (Add Item, Remove Item) • Delete List 	CO3	04
8.	3	Write Python Program to perform following operations on Tuples: <ul style="list-style-type: none"> • Create Tuple • Access Tuple • Update Tuple • Delete Tuple 	CO3	04
9.	3	Write Python Program to perform following operations	CO3	04

		on Set: <ul style="list-style-type: none"> • Create Set • Access Set elements • Update Set • Delete Set 		
10.	3	Write Python Program to perform following operations on Dictionaries: <ul style="list-style-type: none"> • Create Dictionary • Access Dictionary elements • Update Dictionary • Delete Dictionary • Looping through Dictionary 	CO3	04
11.	4	i. Write Python Program to demonstrate math built-in functions (Any 2 Programs) ii. Write Python Program to demonstrate string built-in functions (Any 2 Programs)	CO4	04
12.	4	Develop user defined python function for given problem: <ul style="list-style-type: none"> • Function with minimum 2 arguments • Function returning values 	CO4	04
13.	4	Write Python Program to demonstrate use of: <ul style="list-style-type: none"> • Built-in module (eg. Keyword, math, number, operator) • User defined module 	CO4	04
14.	4	Write Python Program to demonstrate use of: <ul style="list-style-type: none"> • Built-in packages (eg. NumPy, Pandas) • User defined packages 	CO4	04
15.	5	Write Python Program to demonstrate following operations: <ul style="list-style-type: none"> • Method overloading • Method overriding 	CO5	02
16.	5	Write Python Program to demonstrate following operations: <ul style="list-style-type: none"> • Simple Inheritance • Multiple Inheritance 	CO5	04
17.		Write Python Program to demonstrate File Handling through: <ul style="list-style-type: none"> • Opening file in different modes • Accessing file • Reading and Writing file • Closing file • Renaming and Deleting file 	CO6	04
18.	6	Write Python Program to handle user defined exception for given problem.	CO6	04
		Total Hours		64

Sr. No.	Performance Indicators	Weightage in %
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Sr. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem (Process)	40
b.	Quality of output achieved (Product)	30
c.	Complete the practical in stipulated time	10
d.	Observations and Recording	10
e.	Answer to sample questions	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	Hardware: Personal computer Pentium IV, 2 GHz minimum (i3-i5 preferable), RAM minimum 2 GB.	For all experiments
2	Python Interpreter/IDE	

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I	
UNIT 1 . Introduction to Python Programming (Weightage-04 , Hrs- 04)	
1a. Explain features of Python. 1b. Identify the given variables, keywords and constants in python. 1c. Use Indention, Comments in the given program. 1d. Install the Python IDE and editor. 1e. Write the python program to display the given text.	1.1 Features of Python-Interactive, Object Oriented, Interpreted, Platform independent. 1.2 Python Building blocks- Identifiers, Keywords, Indention, variables, comments. 1.3 Python Environment Setup- Installation and working of IDE. 1.4 Running Simple Python scripts to display message. 1.5 Python Data Types: Numbers, Strings, Tuples, Lists, Dictionary, Declaration and use of data types.
UNIT 2 . Python Operators and Control Flow (Weightage-06 , Hrs- 04)	
2a. Write simple Python program for the given arithmetic expressions. 2b. Write a Python program using	2.1 Basic Operators: Arithmetic, Comparison/Relational, Assignment, Logical, Bitwise, Membership, Identity Operators. Python Operator precedence. 2.2 Control Flow. 2.3 Conditional Statements (if, if...else, nested if). 2.4 Looping in Python (While loop, for loop, nested loops).

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
decision making structure for two-way/multi-way branching to solve the given problem.	2.5 Loop manipulation using continue, pass, break, else.
UNIT 3 . Data Structures in Python (Weightage-10 , Hrs- 08)	
3a. Write python program to use and manipulate lists for the given problem. 3b. Write python program to use and manipulate Tuples for the given problem. 3c. Write python program to use and manipulate Sets for the given problem. 3d. Write python program to use and manipulate Dictionaries for the given problem	3.1 Lists: Defining Lists, Accessing values in list, deleting values from list, updating lists. Basic List Operations, Built-in List Functions. 3.2 Tuples: Accessing values in Tuples, deleting values from Tuples and updating Tuples. Basic Tuple operations, Built-in Tuple Functions. 3.3 Sets: Accessing values in Set, deleting values from Set and updating Sets. Basic Set operations, Built-in Set Functions. 3.4 Dictionaries: Accessing values in Dictionary, deleting values from Dictionary and updating Dictionary. Basic Dictionary operations, Built-in Dictionary Functions.
SECTION II	
UNIT 4 . Python Functions, Modules and Packages (Weightage-08 , Hrs- 06)	
4a. Use the Python standard functions for the given problem. 4b. Develop relevant user defined functions for the given problem. 4c. Write Python module for the given problem. 4d. Write Python Package for the given problem.	4.1 Use of Python built-in functions (Eg. type/data conversion functions, math functions etc.). 4.2 User defined functions: Function definition, Function calling, function arguments and parameter passing, return statement, scope of variable: Global variable and Local variable. 4.3 Modules: Writing modules, importing modules, importing objects from modules, python built-in modules, (Eg. Numeric and mathematical module, Functional programming module), Namespace and Scoping. 4.4 Python Packages: Introduction, Writing Python Packages, using standard (Eg.math, scipy, Numpy, matplotlib, pandas etc.) and user defined Packages.
UNIT 5 . Object Oriented Programming in Python (Weightage-06 , Hrs- 04)	
5a. Create Classes and Objects to solve the given problem. 5b. Write Python code for data hiding for the given problem.	5.1 Creating Classes and Objects. 5.2 Method Overloading and Overriding. 5.3 Data Hiding. 5.4 Data Abstraction. 5.5 Inheritance and Composition Classes. 5.6 Customization vi inheritance specializing inherited

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
5c. Write Python code using data abstraction for the given problem. 5d. Write Python program using inheritance for the given problem.	methods.
UNIT 6 . File and Exception Handling (Weightage-06 , Hrs- 06)	
6a. Write Python code for the given reading values from keyboard. 6b. Read data from the given file. 6c. Write the given data to a file. 6d. Handle the given exceptions through python program.	6.1 I/O operations: Reading keyboard input, printing to screen. 6.2 File Handling: Opening file in different modes, accessing file contents using standard library functions, reading and writing files, closing files renaming and deleting files. 6.3 Exception Handling: Introduction, 'try: except:' statement, 'raise' statement, user defined exceptions.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No	Unit Title	Teaching Hrs	Distribution of Theory Marks			
			R Level	U Level	A and above Levels	Total Marks
1	Introduction to Python Programming	04	2	2	-	04
2	Python Operators and Control Flow	04	-	2	4	06
3	Data Structures in Python	08	2	4	4	10
4	Python Functions, Modules and Packages	06	2	2	4	08
5	Object Oriented Programming in Python	04	-	2	4	06
6	File and Exception Handling	06	-	2	4	06
	Total	32	06	14	20	40

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Prepare journal of practicals.

10. 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:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.8, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various components, operation and
- Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

(Only for Class Declaration Courses)

*Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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. Similar micro-projects could be added by the concerned faculty:

- Create an English Dictionary which is able to perform following function
 - Add a word and its meaning.
 - Delete a word and its meaning.
 - Update a word and its meaning.
 - Print list of word and its meaning.
- Create Finance Currency calculator using classes and objects.
- Develop a game (Hangman, Tick Toe, Snake etc.) using Python data structure, functions and packages.

Many more.....

12. SUGGESTED LEARNING RESOURCES

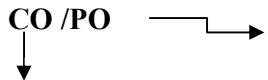
Sr. No.	Title of Book	Author	Publication
1	Python Programing	K. Nageswara Rao, Shaikh Akbar	Scitech Publications (India) Pvt. Ltd. ISBN:9789385983450

Sr. No.	Title of Book	Author	Publication
2	Learning Python	Mark Lutz	5 th Edition, O'Reilly Publication ISBN-13:978-1449355739
3	Python Essential Reference	David Beazley	4 th Edition, Addison-Wesley Professional ISBN: 9780672329784
4	Head First Python, 2nd Edition	Paul, Barry	O'Reilly Publication, 2nd Edition ISBN: 1491919531


13. SOFTWARE/LEARNING WEBSITES

- <https://www.tutorialspoint.com/python/index.htm>
- nptel.ac.in/courses/117106113/34
- <https://www.w3schools.com/python/default.asp>
- <https://www.programiz.com/python-programming>
- <http://spoken-tutorial.org/>
- <https://docs.python.org/3/tutorial/>
- <https://www.w3resource.com/python-exercises/>
- <https://anandology.com/python-practice-book/>

14. PO - COMPETENCY- CO MAPPING

CO / PO 	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Develop simple Python programs using Python IDE	2	1	2	1	1	-	2
Execute programs using operators and control flow statements	2	2	2	3	1	1	3
Perform Operations on Python Data structures	2	2	3	3	1	2	3
Write Python code for Functions, Modules and Packages	2	2	3	3	1	2	3
Develop applications using object oriented concepts in python	2	2	3	3	1	2	3
Write Python code for File and Exception Handling	2	2	3	3	1	2	3
Summary	2	2	2	3	1	2	3

PSO - COMPETENCY- CO MAPPING

CO /PSO 	PSO1	PSO2
Develop simple Python programs using Python IDE	-	3
Execute programs using operators and control flow statements	-	3
Perform Operations on Python Data structures	-	3
Write Python code for Functions, Modules and Packages	-	3
Develop applications using object oriented concepts in python	-	3
Write Python code for File and Exception Handling	-	3

<p>Sign:</p> <p>Name: Smt S.P.Panchakshari Smt A M Galshetwar Smt H F Khan Smt A B Bhusagare</p> <p>(Course Expert /s)</p>	<p>Sign:</p> <p>Name: Mr.U.V.Kokate (Head of Department) (Computer Dept.)</p>
<p>Sign:</p> <p>Name: Mr.U.V.Kokate (Program Head) (Computer Dept.)</p>	<p>Sign:</p> <p>Name: Mr. A.S.Zanpure (CDC)</p>

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma Programme in Computer Engineering / Information Technology
Programme code	06/26/07
Name of Course	Server Side Scripting Using JSP
Course Code	CM5102
Prerequisite course code and name	-
Class Declaration	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)				Total Credits (L+T+P)	Examination Scheme				Total Marks
					Theory		Practical		
L	T	P	C		ESE	PA	*ESE	PA	
				Marks	40	10	50	50	150
02	00	04	06	Exam Duration	2 Hrs	1 Hr	2 Hr		

(*):PE (Practical Examination)

Legends: L- lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

3. In current trends of web world, dynamic and platform independent web applications are required. Java Server Page is an important scripting technology for computer engineering and Information Technology diploma graduates to develop dynamic and platform independent web-based applications. JSP is widely used server side scripting technology as it allows designing web – based applications using java APIs, JDBC APIs.

4. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

Build Webpages using Java Server Page.

5. COURSE OUTCOMES (COs)

The theory, 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:

1. Handle HTTP request- response using Servlet.
2. Design simple JSP page using JSP elements.
3. Managing threads, sessions, events, and filters.
4. Perform database operations using JDBC.

5. Deploy web applications.

6. SUGGESTED PRACTICALS/ EXERCISES

The practical's in this section are Pros (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Install Web Server and database tool	CO1	02
2.		Write a program for demonstration of HTTP request and response using Servlet	CO1	02
3.		Develop a program to demonstrate use of all basic elements of JSP (Any 4 programs)	CO2	04
4.	2	Write a simple JSP program for Demonstrating use of expressions, declarations (Any 2 programs)	CO2	04
5.	3	Write a JSP program for Demonstrating use of request dispatching	CO1	04
6.		Write programs to demonstrate attributes of Page Directives	CO1	04
7.		Write a JSP programs for session management using Session tracking	CO3	04
8.		Write a JSP programs for session management using: URL re-writing Hidden Form Field	CO3	04
9.		Write program to insert records using JDBC	CO4	04
10.		Write program to display specific records using JDBC	CO4	04
11.		Write program to search and update records using JDBC	CO4	04
12.		Write program to remove specific records using JDBC	CO4	02
13.	4	Write a program to demonstrate use of JSP Filters	CO3	04
14.		Write a JSP program for Demonstration of Event Listeners	CO3	04
15.	5	Write program to demonstrate use of JSP Standard Tag Library (JSTL)	CO5	10
16.	6	Deploy a mini project in web server.	CO5	04
TOTAL				64

S.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr.No.
1	Computer system	ALL
2	Any compatible open source tools (e.g. NetBean IDE/ Eclipse IDE/ Any equivalent IDE, Any compatible web server, Any compatible database tool e.g. MySQL or any equivalent tool)	ALL

8. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Web programming Environment – Introduction (Weightage-06 , Hrs- 04)	
1a. Select use of Servlet or JSP for the given problem 1b. Maintain HTTP sessions 1c. Use Servlet for request and response	1.1 Servlet and JSP overview: Servlet Life cycle, Servlet Classes, Threading Models, JSP life-cycle 1.2 Overview of the Hypertext Transfer Protocol(HTTP): The HTTP Specification, HTTP Request-Response Model, HTTP sessions 1.3 The Servlet API, The Javax.Servlet Package, Reading Servlet Parameters, Reading Initialization Parameter
UNIT 2 Introduction to JSP (Weightage- 06 , Hrs- 06)	
2a Design page using JSP elements and declarations for the given problem 2b Develop web logic using JSP expressions and Scriptlets and declarations for the given problem	2.1 Overview of JSP 2.2 JSP Syntax and semantics: Components of JSP page, JSP Development Model, and complete example. 2.3 Expressions 2.4 Scriptlets 2.5 Declarations
UNIT 3 Request Dispatching and Session and JDBC (Weightage-08 , Hrs- 06)	
3a. Apply the given validation rule. 3b. Use relevant page directive(s) to create page instructions for the given problem 3c. Use relevant session API to manage the session 3d. Use relevant JDBC driver for connecting the given database 3e. Write statements to perform	3.1 Request dispatching and Form validation 3.2 Page directives 3.3 Session Management : Session tracking, Session API 3.4 JDBC: Overview of JDBC, JDBC Drivers, ResultSet, Statement, Prepared Statement, Connecting to a Database with DriverManager

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
primitive database operations using JDBC	
UNIT 4 Application Event Listeners and Filters (Weightage- 06 , Hrs- 04)	
4a. Write function to handle given event using event listener 4b. Use the relevant JSP Filter to solve the given problem	4.1 Application Event Listeners 4.2 Filters: Filter overview, Developing and deploying a Filter
UNIT 5 JSP Tag Extensions (Weightage- 08 , Hrs- 08)	
5a Select relevant custom tags to design web page for the given problem. 5b. Develop business logic using expression language for the given situation	5.1 Custom Tags: Introduction and how it works 5.2 Tag Handlers and Tag Libraries 5.3 Expression Language 5.4 The JSP Standard Tag Library(JSTL) 5.5 Tag Extensions, Tag Files, and JSP Fragments
UNIT 6 Testing and Deploying web application (Weightage- 06 , Hrs- 04)	
6a. Test and Debug the Web application model. 6b. Deploying Web application.	6.1 JSP Testing and Debugging: Building a Mental Model. 6.2 Testing in Isolation. 6.3 Debugging Tools. 6.4 The web application environment. 6.5 The web archive (war) file. 6.6 The deployment Descriptor.

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	Web programming Environment – Introduction	04	02	01	03	06
II	Introduction to JSP	06	01	02	03	06
III	Request Dispatching and Session and JDBC	06	04	01	03	08
IV	Application Event Listeners and Filters	04	01	02	03	06
V	JSP Tag Extensions	08	02	02	04	08
VI	Testing and Deploying web application	04	01	02	03	06
Total		32	11	10	19	40

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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Drawing flowchart and writing algorithms for the given problem statements.
- b. Prepare practical files with write-ups, programs and its outputs.

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. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- d. Guide student(s) in undertaking micro-projects.
- e. Use Flash/Animations to explain various components, operation and
- f. Teacher should ask the students to go through instruction and Technical manuals

12. SUGGESTED MICRO-PROJECTS

(Only for Class Declaration Courses)

*Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.*

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	The Complete Reference JSP	Phil Hanna	McGraw-Hill
2	Head First Servlets and JSP	Bert Bates, Kathy Sierra, Bryan Basham	O'Reilly Media, June 2009
3	Java Server Programming	Dreamtech Software Team	Dreamtech Press

14. SOFTWARE/LEARNING WEBSITES

1. <https://www.javatpoint.com/jsp-tutorial>
2. <https://www.tutorialspoint.com/jsp/index.htm>
3. <http://www.jsptut.com/>
4. <https://beginnersbook.com/jsp-tutorial-for-beginners/>
5. <https://www.studytonight.com/jsp/>
6. <https://onlinecourses.nptel.ac.in>

15. PO - COMPETENCY- CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	3	2	-	2
CO2	3	2	3	2	2	1	2
CO3	3	2	3	2	1	2	2
CO4	3	2	3	3	0	2	2
CO5	3	2	3	3	2	-	3
Summary	3	2	3	1	1	1	1

13. PSO - COMPETENCY- CO MAPPING

	PSO1	PSO2
CO1	1	-
CO2	-	1
CO3	-	1
CO4	-	1
CO5	1	-
CO5	-	1

Sign: Name: (Smt.A.S.Paike) (Smt.M.G.Yawalkar) (Smt.K.S.Gaikwad) (Course Expert /s)	Sign: Name: (Mr. U. V. Kokate) (Head of Computer Engineering)
Sign:- Name: (Mr. U .V. Kokate) (Program Head) (Computer Engineering Department)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in ET/CE/EE//ME/MT/CM/IT/DDGM
Programme code	06/26
Name of Course	Programming using PHP
Course Code	CM5103
Prerequisite course code and name	-
Whether Class Declaration course ?	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C	ESE	PA	*ESE	PA		
				Marks	40	10	50	50	150
02	-	04	06	Exam Duration	2 Hrs	1 Hr			

(*):PE (Practical Examination)

Legends: L- lecture-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

In the growing field of Web technology it is essential for every Diploma Engineers to learn PHP Language to help them build large and complex web applications.PHP can be used in three Primary ways: for server side scripting, for command line scripting and to develop client side GUI applications.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Develop simple web-based application using PHP language.**

4. COURSE OUTCOMES (COs)

The theory, 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:

- 1 Write program in PHP for interactive web development.
- 2 Implement different functions and use type conversion methods.
- 3 Write programs using arrays and graphics concepts.
- 4 Apply object-oriented concepts in programming.
- 5 Develop web pages with validations.
- 6 Create and manipulate database in PHP programming

5. SUGGESTED PRACTICALS/ EXERCISES

The practical's in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Installation & Sample PHP program.	CO1	1
2.	1	WAP for using expressions and operators.	CO1	2
3.	1	WAP for using Flow Control -if else, while loop and switch case, etc.	CO1	2
4.	2	WAP for on anonymous and variable functions.	CO2	2
5.	2	WAP on string functions.	CO2	1
6.	3	WAP for Creating & manipulating Indexed array, Associative and Multidimensional array.	CO3	2
7.	3	WAP different function with array.	CO3	1
8.	3	Program using basic drawing functions	CO3	1
9.	3	Program on scaling images.	CO3	2
10.	3	Program on converting an image to text	CO3	1
11.	3	Program to create sample PDF document	CO3	1
12.	4	Creating an Object, Accessing Properties and Methods, Declaring a class in PHP program.	CO4	1
13.	4	Create an Overloading and Overriding class using Inheritance.	CO4	2
14.	4	Program on introspection	CO4	3
15.	4	Program on serialization	CO4	1
16.	5	Design a simple web page using following form controls a. Text box b. Radio button c. Check box d. Buttons	CO5	1
17.	5	Design a simple web page using following form controls a. List box b. Combo box c. Hidden field box	CO5	1
18.	6	Develop web page with data validation.	CO5	
19.	6	To build a sample PHP-database application using database connectivity and displaying database	CO6	3
20.	ALL UNITS	Create a Mini Project by Concluding all above subtopics.	ALL	4

	Total Hrs		32
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Sr.No.	Performance Indicators	Weightage in %
a.	Problem Selection and its feasibility study	20
b.	Logical thinking to decompose problem into modules	30
c.	Ability to estimates size and cost of software	30
d.	Presentation and Technical documentation skills	10
e.	Submission of reports within time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr. No.	Major Equipment/ Instruments Required	PrO. No.
1	Hardware: Computer system (i3 - i5 preferable) (Any computer system with basic configuration)	For All Experiments
2	Operating system: Windows / Linux	
3	Any compatible open source tools (Any compatible web server, Any compatible database tool e.g. MySQL or any equivalent tool)	

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 1: Introduction to PHP& Basics (Weightage-04, Hrs.- 04)	
1a. Write programs in PHP using basic syntactical constructs. 1b. Write PHP program using flow control statements.	1. 1 History of PHP, Advantages of PHP, Syntax of PHP 1.2 Variables, Data types, Expressions and operators. 1.3Flow control statements
UNIT 2. Functions and Strings (Weightage-08, Hrs.- 04)	
2a. Write program using parameter passing to call a function. 2b. Use type conversion methods in programs.	2.1 Calling a function, Defining a function, function parameters, Return values and errors from function, Including code. 2.2 Variable Functions, Anonymous Functions 2.3 String functions, Type Conversion
UNIT 3. Arrays and Graphics (Weightage-08, Hrs-08)	

3a. Write programs using arrays. 3b. Create and scale images using graphics concepts. 3c. Write program to create PDF document.	3.1 Creating & Manipulating Array, and Types of Arrays. 3.2 Extracting data from arrays, implode, explode, array flip 3.3 Storing data & comparing arrays 3.4 Extracting Multiple Values, arithmetic array function 3.5 Basics Graphics Concepts, Creating Images, Images with text, Scaling Images, Using PDF extensions.
UNIT 4. Object Oriented Concepts (Weightage-8, Hrs-6)	
4a. Apply object-oriented concepts in programming: Inheritance, Cloning 4b. Write programs using Introspection, Serialization.	4.1 Declaring a class & object, Accessing Properties and Methods, Static Class, Abstract Class, Interfaces 4.2 Inheritance, Overloading and Overriding, Cloning Object. 4.3 Introspection, Serialization
UNIT 5. Browser Handling (Weightage-06, Hrs.- 04)	
5a. Develop web pages using GUI components 5b. Implement validation of web page on client and server side 5c. Describe use and storage of cookies.	5.1 Creating a webpage using GUI Components, Reading data from web page 5.2 Web page validation (Client-Server side) 5.3 Session, Cookies & Sending Email
UNIT 6. Databases (Weightage-06, Hrs.- 06)	
6a. Use database techniques for creating and manipulating databases through PHP. 6b. Write programs for MySQL connectivity.	6.1 Relational Database and SQL using MySQL 6.2 PEAR DB basics, Advanced Database Techniques 6.3 Sample Application for PHP-MySQL Connectivity

8. 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
1	Introduction to PHP & Basics	04	02	01	01	04
2	Functions and Strings	04	02	02	04	08
3	Arrays and Graphics	08	02	02	04	08
4	Oops Concepts	06	02	02	04	08
5	Browser: Handling	04	01	02	03	06
6	Databases	06	01	02	03	06
Total		32	10	11	19	40

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Prepare journals based on practical's performed in laboratory.

-
- b. Undertake micro-projects.

10. 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. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- d. Guide student(s) in undertaking micro-projects.
- e. Correlate subtopics with power plant system and equipments.
- f. Use proper equivalent analogy to explain different concepts.
- g. Use Flash/Animations to explain various components, operation and
- h. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

(Only for Class Declaration Courses)

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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. Similar micro-projects could be added by the concerned faculty:

- a. Develop web application for student attendance management system.
- b. Develop web application for-
 - i. sending plain text email.
 - ii. sending HTML message.
 - iii. sending emails with attachment
- c. Develop web application for Library Management system.
- d. Develop web application for Student feedback system.

(Any other micro-projects suggested by subject faculty on similar line.

(Use structure and other features of 'C' to develop above listed applications)

12. SUGGESTED LEARNING RESOURCES

S.N .	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Rasmus Lerdorf, Kevin.T & Peter M.	Programing PHP, O'Reilly	
2	Steven Holzner	The Complete Reference PHP (Third Edition covers PHP), Tata - McGraw hill	

13. SOFTWARE/LEARNING WEBSITES

1. <https://www.w3schools.com/php/default.asp>
2. <http://www.tizag.com/phpT/>
3. <https://www.tutorialspoint.com/php/index.htm>
4. <https://www.geeksforgeeks.org/php/>

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	3	2	2	2
CO2	2	2	3	3	2	2	2
CO3	2	2	3	3	2	2	2
CO4	2	2	3	3	2	2	3
CO5	2	2	3	2	2	2	3
CO6	2	2	3	2	1	2	-

	PSO1	PSO2
CO1	-	3
CO2	-	3
CO3	-	3
CO4	-	3
CO5	-	3

Sign: Name: Mrs. R.J Chavan Mrs. S.B Gosavi (Course Expert /s)	Sign: Name Mr. U.V. Kokate (Head of Department)
Sign: Name: Mr. U.V. Kokate (Program Head) (Computer Dept.)	Sign: Name: Shri A.S. Zanzure (CDC)

Government Polytechnic, Pune

'1800B' – Scheme

Programme	Diploma in Computer Engineering
Programme code	06/26
Name of Course	Android Application Programming
Course Code	CM5104
Prerequisite course code and name	NIL
Class Declaration	Yes

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PA	*ESE	PA	150
02	00	04	06	Marks	40	10	50	
				Exam Duration	2 Hrs	1 Hr	2 Hr	

(*PE): Practical Examination

Legends: L- lecture-Tutorial/teacher guided theory practice-practical, ESE-End semester examination, A- Progressive Assessment.

2. RATIONALE

The use of mobile communication and android based applications are increasing day by day. It is therefore necessary for students to know how to build mobile applications for android operating system. This course covers the necessary concepts which are required to develop Android applications. After completing this course students will be able to design and built various applications using android framework.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Develop android applications.**

4. COURSE OUTCOMES (COs)

The theory, 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:

1. Identify need of android operating system with its features.
2. Configure android environment and development tools.
3. Design graphical user interface layouts.
4. Develop android application using user interface components.
5. Create android application to perform database operations.
6. Deploy android application including security parameters.

5. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	2	Install and configure java development kit (JDK), android studio and android SDK with android virtual device	2	2
2.	2	Develop a program to display Hello World on screen	2	2
3.	3	Develop a program to implement Linear Layout, Frame Layout, Relative Layout, Table Layout	3	4
4.	4	Develop a program to implement Text View and Auto Complete Text view and Edit Text.	4	4
5.	4	Develop a program to implement Button, Image Button and Toggle Button.	4	2
6.	4	Develop a program to implement Checkbox.	4	2
7.	4	Develop a program to implement Radio Button and Radio Group.	4	2
8.	4	Develop a program to implement Progress Bar.	4	2
9.	4	Develop a program to implement List View, Grid View, Image View and Scroll View.	4	4
10.	4	Develop a program to implement Custom Toast Alert.	4	2
11.	4	Develop a program to implement Date and Time Picker.	4	4
12.	5	Develop a program to implement new activity using explicit intent and implicit intent.	4	4
13.	5	Develop a program to implement horizontal and vertical fragments.	4	2
14.	5	Develop a program to implement service.	4	2
15.	5	Develop a program to implement Broadcast receiver.	4	2
16.	3,4,5	Create a login form with all necessary validations (On success or unsuccessful login, display appropriate toast Message)	3,4	4
17.	5	Develop a program to perform (Insert and delete) database operations using SQLite Database.	5	4
18.	5	Develop a program to perform (Search and Update) database operations using SQLite Database.	5	4
19.	6	Develop a program to send SMS.	6	2
20.	All	Develop a Mini Project using all android components.	2-6	10
		Total Hrs		64

S.No.	Performance Indicators	Weightage in %
a.	Correctness of user interface design	30
b.	Correctness of programming logic applied	30
c.	Debugging ability	20
d.	Answer to questions	10
e.	Submission of assignment with in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr.No.	Major Equipment/ Instruments Required	PrO. No.
1	Computer System with minimum 4 GB RAM	All
2	Any open source tool (Android Studio / Eclipse IDE), JDK, SQLite or any other equivalent database	All

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Introduction to Android Operating System (Weightage-6, Hrs-4)	
1a. Compare various android versions. 1b. List needs of android Operating system. 1c. Explain android architecture with its features.	1.1 Introduction to Android Operating System, Android Ecosystem, Android versions. 1.2 Need of Android, Android Activity, 1.3 Features Of Android, Android Architecture
UNIT 2. Installation and configuration of Android Environment (Weightage-6,Hrs-6)	
2a. Installation of application development environment and its configuration. 2b. Explain android lifecycle. 2c. Develop a simple android application.	2.1 Java JDK, Android SDK 2.2 Android Development Tools (ADT), Android Virtual Devices (AVDs), Emulators. 2.3 Dalvik Virtual Machine, Difference between JVM and DVM 2.4 Steps to install and configure Android Studio and SDK 2.5 Android lifecycle: Introduction, Lifecycle phases.
UNIT 3. Fundamental of UI Components and Layouts (Weightage-8, Hrs-6)	
3a. Describe android directory structure. 3b. Identify various screen	3.1 Directory Structure ,Understanding components of a screen, 3.2 Fundamental UI Design 3.3 Linear Layout 3.4 Absolute Layout

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
components. 3c. Design GUI using layouts.	3.5 Frame Layout 3.6 Relative Layout 3.7 Table Layout
UNIT 4. Designing User Interface (Weightage-6, Hrs-6)	
4a. Describe various user interface components 4b. Develop android application using various user interface components.	4.1 Text View, Edit Text, Auto complete Text View 4.2 Button, Image Button Toggle Button 4.4 Radio Button And Radio Group 4.5 Checkbox 4.6 Progress Bar 4.7 List View 4.8 Grid View 4.9 Image View 4.10 Scroll View 4.11 Custom Toast Alert 4.12 Time And Date Picker
UNIT 5. Activity, Multimedia and Databases (Weightage-8, Hrs-6)	
5a. Explain Intents and its use while developing android application. 5b. Develop application using activities, fragments, intents and services. 5c. Perform database transactions.	5.1 Intent and its types, Intent_Filter 5.2 Activity Lifecycle 5.3 Broadcast Lifecycle 5.4 Content Provider 5.5 Fragments, Service 5.6 Play Audio and Video, Text to speech, speech to Text 5.7 SQLite Database, necessity of SQLite, Creation and connection of the database, extracting value from cursors, Transactions.
UNIT 6. Security and Application Deployment (Weightage-6, Hrs-4)	
6a. Develop application to send SMS. 6b. Explain android permissions and security model. 6c. Deploy android application.	6.1 SMS Telephony 6.2 Understanding the Android Security Model, Declaring and Using Permissions, Understanding and Using Custom Permission. 6.3 Application Deployment: Creating Small Application, Signing of application and steps of Deploying app on Google Play Store.

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Android Operating System	4	4	2	0	6
II	Installation and configuration of Android Environment	6	2	4	0	6
III	Fundamental of UI Components and Layouts	6	2	2	4	8

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Designing User Interface	6	2	2	2	6
V	Activity, Multimedia and Databases	6	2	2	4	8
VI	Security and Application Deployment	4	2	2	2	6
Total		32	14	14	12	40

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journal of practical.
- Undertake micro-projects.
- Develop applications based on real world scenario.

10. 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:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.09, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Use different Audio/Video media for understanding of concepts.
- Guide students in undertaking micro-projects.
- Ensure tools used are of latest version.
- Encourage students to refer various web sites / Mobile applications to have detail understanding of advanced concepts.
- Observe continuously the performance of students in laboratory.

11. 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. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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. Similar micro-projects could be added by the concerned faculty:

1. Develop an android application on Housing Societies Management System.
2. Develop an android application on file converters.
3. Develop an android application for scientific calculator.
4. Develop an android application for simple game.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	ANDROID	Prasanna Kumar Dixit , Vikas Publications, First Edition 2014	9789325977884
2	Android Programming for Beginners	John Hortan , Packet Publication, First Edition 2015	978-1-78588-326-2

13. SOFTWARE/LEARNING WEBSITES

1. <https://www.tutorialspoint.com/android>
2. https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf
3. <http://developer.android.com>

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	1	3	1	1	2
CO2	2	2	1	3	1	1	2
CO3	2	3	3	3	1	1	2
CO4	2	3	3	3	1	1	2
CO5	2	3	3	3	3	3	2
CO6	2	3	3	3	3	3	2

	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	3
CO6	-	3

Sign: Name: Shri T.P. Sharma Smt S.P. Panchakshari (Course Expert /s)	Sign: Name: Shri.U.V. Kokate (Head of Department)
Sign: Name: Shri A.S.Zanpure (CDC)	

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in Computer Engineering
Programme code	06/26
Name of Course	Network Management and Administration
Course Code	CM5105
Prerequisite course code and name	NA
Class Declaration	YES

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PA	*ESE	PA	
				Marks	40	10	50	50
02	00	04	06	Exam Duration	2 Hrs.	1 Hrs.	2 Hrs	

(*): Oral Examination

Legends: L- lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

This course is aimed at providing the students with conceptual understanding of network management and apply the principles of design, configuration and operation of network and service management systems, Architecture and standards for network management will be presented.

3. COMPETENCY

The aim of this course is to attend following industry identified competency through various teaching learning experiences:

- **Operation, administration, maintenance, and provisioning of networked systems.**
- **Maintain the networking environment.**

4. COURSE OUTCOMES (COs)

The theory, 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:

1. Deploy the network management center.
2. Classify different network management functional areas, and related tasks.
3. Categorize existing network management models.
4. Apply the integrated network management concepts.
5. Analyze Internet network management framework.
6. Apply existing technologies and trends in the network management arena.

5. SUGGESTED PRACTICALS/ EXERCISES

The practical's in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1.	1	Study of NOC(Network Operation center), GNOC(Global NOC), SOC(security Operation center)	1	04
2.	2	Study of network management of software(network performance monitor, PRTG Network Monitor)	1,2	04
3.	3	Implementation of SNMP protocol	3	08
4.		Managing Operations and monitoring using SNMP	3	08
5.	4	Study of IN-BAND and OUT OF BAND network Management.	5	08
6.		Detail study of FCAPS for PRTG network monitor(fault management, Configuration, Accounting, Performance, Security) framework	5,6	08
7.	5	Study of ticketing system and incident management in SolarWinds.	4	08
8.	6	Study of automation of Network monitoring	5,6	08
9.	6	Implementation of MPLS using Cisco Network tool.	5,6	08
Total Hrs.				64

Sr. No.	Performance Indicators	weightage in %
a.	Learn network management and organization aspects.	20
b.	Learn the policy control and different protocol architecture	10
c.	Learn operational support system	10
d.	Understand different management issue	10
e.	Understand network management architecture	20
f.	Understand different network monitoring tools	10
g.	Understand key aspects of MPLS	10
h.	Submission of report in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr. No.	Major Equipment/ Instruments Required	PrO. No.
1	Computers	ALL
2	Networking (Internet)	ALL

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Requirements for the Management of Network (Weightage-06 , Hrs.- 06)	
1.a Define network management 1.b Explain Organizational Aspects of Management 1.c Explain Time Aspects of Management	1.1 Management Scenarios 1.2 Management Functions 1.3 Organizational Aspects of Management 1.4 Time Aspects of Management
UNIT 2. IP Network Management (Weightage-08, Hrs.- 08)	
2.a Choose Configuration Method, 2.b Discover architecture for SNMP 2.c Choose configuration protocol 2.d Explain policy control	2.1 Choosing to Manage Your Network 2.2 Choosing a Configuration Method 2.3 Management Information Base 2.4 Simple Network Management Protocol 2.5 Extensible Markup Language 2.6 Common Object Request Broker Architecture 2.7 Choosing a Configuration Protocol 2.8 Choosing to Collect Statistics Policy Control
UNIT 3 IP-Based Service Implementation and Network (Weightage-08 , Hrs.- 06)	
3.a Define OSS (Operation Support System) 3.b Explain OSS architecture 3.c Discover Network Management Issues.	3.1 IP-Based Service Implementation—OSS (Operation Support System) 3.2 Provisioning Issues 3.3 Network Management Issues 3.4 OSS Architecture
UNIT 4 Network Management Architecture (Weightage-06, Hrs.- 04)	
4.a Define Network Management 4b. Demonstrate Network Management Architecture	4.1 Background 4.2 Defining Network Management 4.3 Network Management Mechanisms 4.4 Architectural Considerations
UNIT 5 SLA Network Monitoring (Weightage- 06 , Hrs.- 04)	
5a Demonstrate Passive Network Monitoring 5b Demonstrate Active Network Monitoring	5.1 Passive and Active Network Monitoring: Passive Network Monitoring, Active Network Monitoring
UNIT 6 MPLS Network Monitoring (Weightage- 06 , Hrs.- 04)	
6a Describe MPLS 6b Demonstrate Management Information Base Modules for MPLS	6.1A Brief Introduction to MPLS: MPLS Applications, Key Aspects of MPLS Network Management Management Information Base Modules for MPLS

8. 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	Requirements for the Management of Network	06	04	01	01	06
II	IP Network Management	08	06	01	01	08
III	IP-Based Service Implementation and Network	06	02	04	02	08

IV	Network Management Architecture	04	02	03	01	06
V	SLA Network Monitoring	04	04	01	01	06
VI	MPLS Network Monitoring	04	04	01	01	06
Total		32	22	11	07	40

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Prepare journals based on practical performed in laboratory.
- b. Analysis of real time networking laboratories and organizations (cyber café)

10. 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. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- c. With respect to item No.8, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- d. Use proper equivalent analogy to explain different concepts.
Use Flash/**Animations** to explain various components, operation and
- e. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

- a. Web Server monitoring techniques (example TCP, HTTP)any one.
- b. Network design with Single DHCP Server for any organization.
- c. Case study for OSS Architecture.

12. SUGGESTED LEARNING RESOURCES

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
01	Network management: know it all	Network management: know it all Adrian Farrel. . [et al.] (Morgan Kaufmann know it all series) Morgan Kaufmann Publishers is an imprint of Elsevier.30 Corporate Drive, Suite 400, Burlington, MA 01803	978-0-12-374598-9

13. SOFTWARE/LEARNING WEBSITES

- 1 www.nptel.com
- 2 https://www.tutorialspoint.com/data_communication_computer_network/
- 3 <http://en.citizendium.org/wiki/Cryptography>
- 4 <http://www.tutorialspoint.com/cryptography/>

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	2	2	-	2	2
CO2	1	2	3	2	-	2	3
CO3	1	3	2	3	-	-	2
CO4	1	-	3	2	-	2	2
CO5	1	2	3	2	1	2	2
CO6	-	-	3	2	3	2	3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	2	3
CO5	2	3
CO6	2	3

Sign: Name: Smt. Bharati K.Vyas Smt.Aafiya.A.Shaikh (Course Expert /s)	Sign: Name: Mr.Umesh.V.Kokate (Head) (Computer Dept.)
Sign: Name: Mr.Umesh.V.Kokate (Program Head) (Computer Dept.)	Sign: Name: Mr. A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in ET/CE/EE/ME/MT/CM/IT/DDGM
Programme code	01/02/03/04/05/06/07/08/16/17/21/22/23/24/26
Name of Course	Digital Forensics and Ethical Hacking
Course Code	CM5106
Prerequisite course code and name	--
Class Declaration	Yes

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	PA	*ESE	PA	150
				Marks	80	20	25	
03	00	02	05	Exam Duration	3 Hrs.	1 Hr.		

(*): OE (Oral Examination)

Legends: L- lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment

2. RATIONALE

Digital forensic investigation plays a vital role in predicting and analyzing the digital crime. It is procedure of preservation, identification, analysis and report making of digital evidence stored as data on magnetically encoded information. The data resides in the computer in a hidden way such that only special forensic software tools and standard procedures can fetch/retrieve it. Hacking outlines computer hacker tricks and techniques that one can use to access the security of information system, find vulnerabilities that matter and fix the weaknesses before the criminal hackers and malicious insiders take advantage of them. Ethical hacking is the professional and legal types of security system. So, this course will enable the students to employ security measures and keep an external hackers and malicious users in check.

3. COMPETENCY

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

- **Locate digital evidences in cyber breaches and use ethical hacking techniques as preventive measures.**

4. COURSE OUTCOMES (COs)

The theory, 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:

- 1 Describe Models of Digital Forensic Investigation.
- 2 Locate the digital evidences in file system.
- 3 Follow Evidence handling procedures.
- 4 Select relevant tools for hacking.
- 5 Detect system and network vulnerabilities.
- 6 Apply Hacking Methodologies to get into the system.

5. SUGGESTED PRACTICALS/ EXERCISES

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. Required
1.	I	a. Monitor CPU Utilization* and Memory Utilization for detecting unauthorized process activations. *Hint: More CPU utilization as compared to Memory is an indicator of anomaly	CO1, CO2	2
	I	b. Create complete memory dump using windows.		2
	II	c. Read Memory Dump Using Windows Driver toolkit.		
2.	I	Crack passwords using password cracking tools like <i>LC4/John the Ripper/pwdump</i> or any equivalent.	CO1	2
3.	II	Read and Interpret* Operating Systems logs on Windows/Linux file system. *Hint: Check whether the log gives information about file systems. Any such entry indicates some malicious activity.	CO2	2
4.	II	Install Kali Linux.	CO2	2
5.	III	Collect live data on Windows:	CO3	
		a) Create a response toolkit on windows having utility <i>cmd.exe, PsLoggedOn, netstat</i>		2
		b) Establish TCP connection between forensic workstation and the target system using <i>netcat</i>		2
		c) Run trusted <i>cmd.exe</i> , identify logged users and remote access users, Record creation, access times and all the modifications made to the files		2
6.	V	a) Check whether Email is a spam by analyzing the Email Header b) Install software like SpamAssasin (an antispam platform) c) Read and analyze Email Header using software like SpamAssasin	CO5	2
7.	IV, VI	a) Install Wireshark tool on Windows/Kali Linux	CO4, CO6	2
		b) Use Wireshark tool to capture network traffic and to understand three-way handshaking concept/Analyze the packet.		2
8.	V,VI	Perform port scanning using <i>nmap</i> utility to test whether ports	CO5,	2

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. Required
		are listening and vulnerable .	CO6	
9.	V	Perform Arp poisoning on Kali Linux using <i>Etercap</i> or equivalent tool.	CO5	2
10.	V	Establish DoS attack using TCP/ICMP flooding: a) Ping continuously a particular machine at a time from different machines and observe the machine behavior on Network. b) Write shell script for continuously flooding a Machine with ping and observe the machine behavior on Network.	CO5	2 2
Total				32

S. No.	Performance Indicators	Weightage in %
1	Configuration of Windows/Kali Linux operating system	40
2	Use of different digital forensic and ethical hacking tools	40
3	Submit journal report in time	20
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Windows/Linux operating system.	
3	Digital Forensic and Hacking Tools preferably Open source as mentioned in practicals	

7. UNDERPINNING THEORY COMPONENTS

The following topics/sub topics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I: Basics of Digital Forensics (Weightage-12 , Hrs-06)	
1a. Explain the given rule of digital forensic. 1b. Describe the given model of digital forensic investigation. 1c. Identify whether the given issue in digital forensics is ethical or unethical 1d. Explain characteristics of the given Model of Digital Forensic	1.1 Digital forensics: Digital forensic History of forensic, Rules of digital forensic, Digital forensics investigation and its goal 1.2 Models of Digital Forensic Investigation: DFRWS Investigative Model, Abstract Digital Forensics Model (ADFM), Integrated Digital Investigation Process (IDIP), End-to-End digital investigation process (EEDIP), An extended model for cybercrime investigation, UML

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Investigation.	modeling of digital forensic process model (UMDFPM) 1.3 Ethical issues in digital forensic: General ethical norms for investigators, Unethical norms for investigation
Unit II: Hardware and Software Environments (Weightage-12 , Hrs- 08)	
2a. Describe the given nature of digital information. 2b. Show relationship between different categories in the given file system. 2c. Write steps to locate the given evidence in file system. 2d. Describe the indicators of integrity for the given information.	2.1 Computers and the nature of digital information: Magnetic hard drives and tapes, Optical media storage devices, Random-access memory (RAM), Solid-state drive (SSD) storage devices, Network-stored data, The cloud 2.2 File systems that contain evidence: file system category, filename category, metadata category, content category 2.3 Locating evidence in file systems: Determining the means of transgression, opportunity to transgress, and the motive to transgress, Deciding where to look for possible evidence, Indexing and searching for files, Unallocated data analysis 2.4 Password security, encryption, and hidden files: User access to computer devices importance of information confidentiality, information integrity, and information availability, User access security controls, Encrypted devices and files
Unit III: Digital Evidence (Weightage-16 , Hrs- 10)	
3a. Describe the given rule of digital evidence. 3b. Explain characteristics of the given type of digital evidence. 3c. Explain features of the given Challenge in evidence handling. 3d. Describe the given evidence handling procedure.	3.1 Digital Evidences: Definition, Best Evidence Rule, Original Evidence 3.2 Rules of Digital Evidence 3.3 Characteristics of Digital Evidence: Locard's Exchange Principle, Digital Stream of bits 3.4 Types of evidence: Illustrative, Electronics, Documented, Explainable, Substantial, Testimonial 3.5 Challenges in evidence handling: Authentication of evidence, Chain of custody, Evidence validation 3.6 Volatile evidence 3.7 Evidence handling procedure: Evidence system description, digital photos, evidence tag, evidence label, evidence storage, evidence log, working copies, evidence backup, evidence disposition, evidence custodial audit, evidence safe, shipping evidence media

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>3.8 Ethical issues/legal principle of digital evidence: Circumstantial and hearsay nature of Digital Evidence, Authorization to conduct Digital Forensics investigation, authenticity of digital evidence, scientific method</p> <p>3.9 Digital Evidence and metadata</p>
Unit IV: Basics of Hacking (Weightage-14 , Hrs-08)	
<p>4a. Explain the features of the given type of attack on computer system.</p> <p>4b. Describe the features of the given ethical hacking principle to be obeyed.</p> <p>4c. Explain the process of ethical hacking for the given problem.</p> <p>4d. Classify the given component of cracking the Hacker Mindset.</p>	<p>4.1 Ethical Hacking: How Hackers Beget Ethical Hackers, Defining hacker, Malicious users</p> <p>4.2 Understanding the need to hack your own systems</p> <p>4.3 Understanding the dangers your systems face: Nontechnical attacks, Network-infrastructure attacks, Operating-system attacks, Application and other specialized attacks</p> <p>4.4 Obeying the Ethical hacking Principles: Working ethically, Respecting privacy Not crashing your systems</p> <p>4.5 Ethical hacking Process: Formulating plan, Selecting tools, Executing the plan, Evaluating results</p> <p>4.6 Cracking the Hacker Mindset: What You're Up Against? Who breaks in to computer systems, Identifying the purpose of hacking, Planning and Performing Attacks, Maintaining Anonymity</p>
Unit V: Types of Hacking (Weightage-14 , Hrs-08)	
<p>5a. Describe the characteristics of the given type of Network Infrastructure Vulnerability.</p> <p>5b. Explain features of the given type of operating system Vulnerability.</p> <p>5c. Describe the given type of best practice followed to minimize e-mail security risk.</p> <p>5d. Describe the given type of best practice followed to minimize Database Vulnerability.</p>	<p>5.1 Network Hacking Network Infrastructure:</p> <ul style="list-style-type: none"> • Network Infrastructure Vulnerabilities, • Scanning-Ports, Ping swiping • Scanning SNMP, Grabbing Banners • Analysing Network Data and Network Analyzer, MAC-daddy attack <p>Wireless LANs:</p> <ul style="list-style-type: none"> • Implications of Wireless Network Vulnerabilities, • Wireless Network Attacks <p>5.2 Operating System Hacking</p> <ul style="list-style-type: none"> • Introduction of Windows and Linux Vulnerabilities <p>5.3 Applications Hacking Messaging Systems</p> <ul style="list-style-type: none"> • Vulnerabilities, E-Mail Attacks- E-Mail Bombs, Banners, • Best practices for minimizing e-mail security risks

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Web Applications: <ul style="list-style-type: none"> • Web Vulnerabilities, Directories Traversal and Countermeasures, Database system <ul style="list-style-type: none"> • Database Vulnerabilities • Best practices for minimizing database security risks
Unit VI: Ethical Hacking Plan and Hacking Methodologies (Weightage-12 , Hrs-08)	
6a. Write steps to develop ethical hacking plan 6b. Select appropriate security assessment tool. 6c. Describe hacking methodologies 6d. Describe vulnerabilities in the system.	6.1 Developing Ethical Hacking Plan <ul style="list-style-type: none"> • Establishing your Goal • Determining which system to hack • Creating testing standards • Selecting security assessment tools 6.2 Hacking Methodologies <ul style="list-style-type: none"> • Setting the stage for testing • Seeing what others see • Scanning systems • Determining what's running on open ports • Assessing vulnerabilities • Penetrating the system

8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Digital Forensics	06	04	06	02	12
II	Hardware and Software Environments	08	02	04	06	12
III	Digital Evidence	10	02	08	06	16
IV	Basics of Hacking	08	02	08	04	14
V	Types of Hacking	08	02	08	04	14
VI	Ethical Hacking Plan and Hacking Methodologies	08	02	06	04	12
Total		48	14	40	26	80

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare journals based on practical performed in laboratory.
- b) Prepare report on suggestive case study of digital forensic as give below:
 - i. The Aaron Caffrey case – United Kingdom, 2003
<http://digitalcommons.law.scu.edu/cgi/viewcontent.gi?article=1370&context=chtlj>

- ii. The Julie Amero case – Connecticut, 2007
<http://dfir.com.br/wp-content/uploads/2014/02/julieamerosummary.pdf>
- iii. The Michael Fiola case – Massachusetts, 2008
<http://truthinjustice.org/fiola.htm>.

10. 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) '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e) Use different Audio Visual media for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Demonstrate students thoroughly before they start doing the practice.
- h) Observe continuously and monitor the performance of students in Lab.

11. 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 is group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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. Similar micro-projects could be added by the concerned faculty:

- a) Study any Trojan attack. Identify the Trojan attack:
 - i. State the way trojan got installed on particular Machine.
 - ii. State the effects of the Trojan.
 - iii. Elaborate/Mention/State protection/Blocking mechanism for this specific Trojan, example specification of any anti-threats platform which filters the Trojan.
- b) Study Credit card fraud as an identity threat. Identify:
 - i. Use of digital media in carrying out fraud.
 - ii. Vulnerability Exploited.
 - iii. Effect of fraud.
 - iv. Protection/Precaution to be taken against such frauds.
- c) Study any case of forgery /falsification crime case solved using digital forensics:

- i. Identify the model used for Digital Investigation.
 - ii. Was investigation done ethically or unethically.
 - iii. Where does digital evidence found for crime establishment?
 - iv. State the punishment meted.
- d) Study any case of fake profiling. Identify
- i. The way digital forensics was used in detecting the fraud.
 - ii. Where was digital evidence located?
 - iii. Effects.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Digital Forensic	Jain,Nilakashi Kalbande, Dhananjat R.	Wiley Publishing, New Delhi, 2017, ISBN: 978-81-265-6574-0
2	The Basics of Digital Forensic	Sammons,John	Elsevier, Netherlands ISBN 978-1-59749-661-2
3	Hacking for Dummies	Kevin Beaver CISSP	Wiley Publishing, New Delhi ISBN: 978-81-265-6554-2

13. SOFTWARE/LEARNING WEBSITES

- a) <https://resources.infosecinstitute.com/digital-forensics-models/#gref>.
- b) <https://docs.microsoft.com/en-us/sysinternals/downloads/psloggedon>
- c) <https://docs.kali.org/introduction/download-official-kali-linux-images>
- d) www.openwall.com/passwords/windows-pwdump

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	1	2	1	2
CO2	2	2	-	-	1	1	3
CO3	1	3	2	1	2	2	2
CO4	2	1	2	3	2	2	3
CO5	3	2	1	3	3	1	3
CO6	3	2	2	3	3	3	3

	PSO1	PSO2
CO1	-	1
CO2	1	2
CO3	2	1
CO4	-	2
CO5	2	2
CO6	1	3

Sign: Name: Smt. H.F.Khan Smt. S.P.Ambavane Smt. K.S.Sathavane (Course Expert /s)	Sign: Name: Shri.U.V.Kokate (Head of Department) Computer Engineering
Sign: Name: Shri. U. V. Kokate (Program Head) (Computer Engineering)	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in ET/CE/EE//ME/MT/CM/IT/DDGM
Programme code	01/02/03/04/05/ 06/07 /08/16/17/21/22/23/24/26
Name of Course	Data Mining
Course Code	CM5107
Prerequisite course code and name	-
Class Declaration	Yes

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory		Practical		
L	T	P	C	ESE	PA	*ESE	PA	150
03	00	02	05	Marks	80	20	25	
				Exam Duration	3 Hrs	1 Hr	2 Hr	

(*): OE (Oral Examination)

Legends: L- lecture-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

Data mining is a process used by companies to turn raw data into useful information. By using software to look for patterns in large batches of data, businesses can learn more about their customers to develop more effective marketing strategies, increase sales and decrease costs. The objective of this course is to train students Data Mining and Data Warehousing concepts using open source tools and datasets.

3. COMPETENCY

The aim of this course is to help the students to attain the following competency through various teaching learning experiences.

- **Apply data pre-processing, data mining concepts using open source tools.**

4. COURSE OUTCOMES:

1. Learn the concept of Data Mining & its attributes
2. Solve statistical data problems
3. Describe data pre-processing.
4. Apply various classification and clustering techniques.
5. Describe datawarehouse concepts.
6. Apply WEKA for data mining.

5. SUGGESTED PRACTICALS/ EXERCISES

The practical's in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approximate Hours Required.
1	2	Make use of ARFF files taking input and display the output of the files.	2	2
2	2	Convert any excel file to .csv format and prepare it as ARFF files.	2	2
3	3	Preprocess and classify any one dataset. (http://archive.ics.uci.edu/ml/)	3	2
4	3	Apply data cleansing on any TWO datasets. 1: http://archive.ics.uci.edu/ml/ 2: www.kdnuggets.com/datasets/)	3	4
5	4	Apply clustering techniques on any TWO datasets.(http://archive.ics.uci.edu/ml/)	4	4
6.	4	Classify any TWO datasets using decision tree. www.kdnuggets.com/datasets/	4	4
7.	5	Apply association technique on any TWO datasets. 1: http://archive.ics.uci.edu/ml/ , 2: www.kdnuggets.com/datasets/)	5	04
8	6	Install and use WEKA Tool	6	02
9		Use of Weka Explorer, Mining techniques and Attribute Relation File Format (ARFF) (http://archive.ics.uci.edu/ml/)		04
10		Practice various Data Mining techniques available in WEKA		04
Total Hrs				32

All above practicals are to be done on WEKA tool.

S.No.	Performance Indicators	Weightage in %
a.	Installation/configuration of WEKA TOOL	30
b.	Data Processing, Classification, Clustering, Association	40
c.	Class to get desired output	10
d.	Observations, Data Set Exploration and Recording	10
e.	Answer to sample questions	10
Total		100

6. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr. No.	Major Equipment/ Instruments Required	PrO. No.
1	WEKA TOOL	ALL
2	DATA SETS	ALL

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. BASICS OF DATA MINING (Weightage-10, Hrs- 06)	
1a. Data Mining 1b. Kinds of data 1c. Kinds of patterns 1d. Cluster analysis 1.e Outlier analysis	1.1. What is data mining? 1.2 Kinds of Data 1.2.1 Database Data 1.2.2 Data Warehouses 1.2.3 Transactional Data 1.2.4 Other Kinds of Data 1.3 Kinds of patterns 1.3.1 Characterization and Discrimination 1.3.2. Mining frequent patterns, associations and correlations 1.3.3 Classification and regression analysis for predictive analysis 1.3.4 Cluster analysis 1.3.5 Outlier analysis

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 2. KNOW DATA CONCEPTS (Weightage-10, Hrs- 06)	
2a. Mining techniques and Attribute Relation File Format (ARFF). 2b. Practice basic Statistical calculations on Data using WEKA.	2.1 Data Attributes 2.1.1 Nominal Attributes 2.1.2 Binary Attributes 2.1.3 Ordinal Attributes 2.1.4 Numeric Attributes 2.1.5 Discrete versus Continuous Attributes 2.2 Central Tendency- Mean, Median, and Mode 2.3 Dispersion: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range.
UNIT 3. DATA PREPROCESSING (Weightage- 20, Hrs- 12)	
3a. Data preprocessing 3b. Data cleaning 3c. Data integration 3d. Data reduction	3.1 Need of preprocessing 3.2 Tasks in Data Preprocessing 3.3 Data Cleaning 3.3.1 Missing Values 3.3.2 Noisy Data 3.3.3 Data Cleaning as a Process 3.4 Data Integration 3.4.1 Entity Identification Problem 3.4.2 Redundancy and Correlation Analysis 3.4.3 Tuple Duplication 3.4.4 Data Value Conflict Detection and Resolution 3.5 Data Reduction 3.5.1 Wavelet Transforms 3.5.2 Principal Component Analysis 3.5.3 Attribute Subset Selection 3.5.4 Parametric data reduction 3.5.4 Histograms 3.5.5 Clustering
UNIT 4. CLASSIFICATION (Weightage-20, Hrs- 12)	
4a. Describe various classification methods 4b. Describe clustering.	4.1 Basic Concepts 4.2 Decision tree induction 4.3 Bayes classification methods 4.4 Rule based classification 4.5 Classification by back propagation 4.6 Support vector machines 4.7 K- Nearest neighbor classifier 4.8 Genetic algorithms 4.9 Rough set approach 4.10 Fuzzy sets 4.11 Clustering: K means

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 5. DATAWAREHOUSING (Weightage-15, Hrs- 9)	
5a. Data Warehousing.	5.1 Basic concepts 5.2 Differences between Operational Database Systems and Data Warehouses 5.3 Datawarehouse: A Multitire architecture 5.4 Data warehouse models: Enterprise Warehouse, Data Mart, Virtual Warehouse
UNIT 6. DATA MINING TOOL: WEKA (Weightage-05, Hrs- 3)	
6. WEKA Tool	a. WEKA tool b. Installation c. Load data d. File formats e. Preprocessing data f. Classifiers g. Clustering h. Association i. Feature Selection

8. 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 data mining	06	05	05	00	10
II	Know data concepts	06	02	02	06	10
III	Data Preprocessing	12	08	07	05	20
IV	Classification	12	05	05	10	20
V	Datawarehousing	09	08	06	01	15
VI	Data Mining Tool:WEKA	03	00	01	04	05
Total		48	28	26	26	80

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Search various datasets from Internet.
- b. Search various free software tools used for data mining and make practice of using them.

10. 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:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.8, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Use Flash/Animations to explain various components, operation and
- Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

- Create your own small dataset.
- Apply WEKA tool on your dataset.
- Apply WEKA tool on publicly available datasets.

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Books	Author	Publications
1	Data Mining Concepts and Techniques	Jiawei Han and Micheline Kamber	Kaufmann Publishers, 2011
2	Data Mining Techniques	Arun K Pujari	Orient Longman Publishers
3	Fundamentals of Data Warehouses	M.Jarke, M Lenzerni	
4	Principles of Data Mining	David Hand, Heikki Mannila, Padhraic Smyth,	PHI

13. SOFTWARE/LEARNING WEBSITES

- <https://www.solver.com/xlminer-data-mining>
- <https://www.xlminer.com/>
- https://www.tutorialspoint.com/weka/what_is_weka.htm
- <https://www.cs.waikato.ac.nz/ml/weka/>

14 . PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	-	-	2
CO2	3	-	2	2	-	-	2
CO3	3	3	2	2	-	-	2
CO4	1	-	-	3	-	-	2
CO5	3	2	2	2	1	-	3
CO6	1	2	2	2	1	-	3

	PSO1	PSO2
CO1	3	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-
CO6	3	-

Sign: Name: 1. Shri. Dr. S. B. Nikam 2. Smt. N. R. Wagh (Course Expert /s)	Sign: Name: Shri. U. V .Kokate (Head of Department) Computer Engineering
Sign: Name: Shri. U. V. Kokate (Programme Head) Computer Engineering	Sign: Name: Shri A.S.Zanpure (CDC)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in Computer Engineering
Programme code	06/26
Name of Course	CLOUD COMPUTING
Course Code	CM5108
Prerequisite course code and name	--
Class Declaration	Yes

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C	ESE	PA	*ESE	PA		
03	00	02	05	Marks	80	20	25	25	150
				Exam Duration	3 Hrs.	1 Hr.			

(*): *OE (Oral Examination)*

Legends: *L- lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment*

2. RATIONALE

Cloud computing has evolved as a very important computing model, which enables information, software, and many other important resources to be provisioned over the network as services in an on-demand manner. This course covers various basic aspects of cloud computing such as cloud types, security in cloud, storage in cloud, cloud monitoring and management etc. This enables students to create and maintain cloud-based services which will also enable them to implement virtualization, and implement security in cloud services.

3. COMPETENCY

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

- **Use Cloud computing to provide various services.**

4. COURSE OUTCOMES (COs)

The theory, 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:

1. Describe the basic concepts of cloud computing
2. Classify various Cloud Service Models
3. Explain Cloud Service and resource management mechanisms

4. Illustrate Data Management in cloud
5. Demonstrate Cloud Security Measures
6. Compare and utilize various Open Source and Commercial Cloud.

5. SUGGESTED PRACTICALS/ EXERCISES

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Relevant CO	Approx. Hrs. Required
1.	1	Study of any cloud architecture and it's service provider	CO1	2
2.	1	Use Google Docs to make spreadsheets and notes	CO1	2
3.	2	Study of Networking in Cloud: Virtual Private Cloud.	CO2	2
4.	2	Case Study: PAAS(Facebook, Google App Engine)	CO2	4
5.	3,4	Case Study: Cloud Monitoring and Management	CO3, CO4	4
6.	5	Study of Cloud Security such as Data Loss Prevention, Threat Detection etc.	CO5	4
7.	6	Study of GCP Console: - Understanding Projects - Billing in GCP. - Install and configure Cloud SDK.	CO6	4
8.	6	Study of GCP Console: Understanding Projects - Use Cloud Shell. - GCP APIs. - Cloud Console Mobile App	CO6	4
9.	6	Study of GCP Console: Compute Engine -Running a basic Apache web server under -Deploy basic App over the web server.	CO6	4
10.	6	Study of GCP Console: Cloud storage -Hosting a static website	CO6	2
Total				32

S. No.	Performance Indicators	Weightage in %
1	Configuration of cloud SDK	30
2	Use of different cloud services to solve given problem	40
3	Use security measure to secure the provided cloud service	10
4	Submit journal report in time	20
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with advanced configuration)	All
2	Internet connectivity (24 * 7)	

7. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I: Cloud Computing Fundamentals (Weightage-12, Hrs-06)	
1a. Explain the properties and characteristics of Cloud Computing 1b. Explain various layers and types of Cloud 1c. Identify the challenges and risks related to various aspects such as Security and Privacy 1d. Explain the evolution of cloud computing and virtualization	1.1 Cloud Computing in a Nutshell 1.2 Roots of Cloud Computing: From Mainframes to Clouds, SOA, Web Services, Web 2.0, and Mashups, Grid Computing, Utility Computing, Hardware Virtualization, Virtual Appliances and the Open Virtualization Format, Autonomic Computing 1.3 Layers and Types of Clouds: Infrastructure as a Service, Platform as a Service, Software as a Service, Deployment Models 1.4 Properties and Characteristics of a Cloud computing 1.5 Challenges and Risks: Security, Privacy, and Trust, Data Lock-In and Standardization, Availability, Fault-Tolerance, and Disaster Recovery, Resource Management and Energy-Efficiency
Unit II: Cloud Architecture (Weightage-12 , Hrs- 08)	
2a. Explain the given component of cloud computing Architecture 2b. Compare various cloud computing model 2c. Illustrate the services offered by various cloud computing models 2d. Compare various Cloud deployment models	2.1 Cloud computing architecture: basic components – front-end platform, back-end platform, networking, cloud-based delivery 2.2 Cloud Infrastructure Management: Features, Cloud computing stack 2.3 Cloud Service Models: 2.3.1 Infrastructure as a Service (IaaS) 2.3.2 Platform as a Service (PaaS) 2.3.3 Software as a Service (SaaS) 2.4 Cloud Deployment Models: Public, Private, Community, Hybrid
Unit III: Service Management and Resource Management in Cloud computing (Weightage-16, Hrs- 10)	
3a. Outline Cloud Service Management procedure 3b. Explain Economics for Cloud Service Management 3c. Explain Policies and mechanisms for cloud resource management	3.1 Cloud Service Management 3.1.1 Service Level Objectives (SLO): Load balancing, Admission control 3.1.2 Service Level Agreement (SLA): Life-cycle of SLA, Types of SLA, SLA management in Cloud 3.1.3 Cloud economics 3.2 Cloud Resource management 3.2.1 Policies and mechanism for resource management: Admission control, capacity

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	allocation, Load balancing, energy optimization, QoS (Quality of Service) guarantees
Unit IV: Cloud Data Management (Weightage-14, Hrs-08)	
4a. Outline Data Management in Cloud Computing 4b. Relate Database and Data Stores in Cloud 4c. Explain Large Scale Data Processing	4.1 Data Management in Cloud Computing: Introduction, Need of Data Management 4.2 Looking at Data, Scalability & Cloud Services 4.3 Database & Data Stores in Cloud 4.4 Large Scale Data Processing
Unit V: Cloud Security (Weightage-10, Hrs-06)	
5a. Explain need of Cloud Security 5b. Compare various Cloud security Methods 5c. Interpret Access Management.	5.1 Need and importance of Cloud Security 5.2 Methods of Providing Cloud Security 5.3 Infrastructure Security: Methods, Case study 5.4 Data security and Storage: Methods, Case study 5.5 Identity and Access Management: Access Control, Trust, Reputation, Risk
Unit VI: Open Source and Commercial Clouds (Weightage-16, Hrs-10)	
6a. Compare Open source and Commercial Cloud platforms 6b. Demonstrate various Open Source Cloud Platforms 6c. Outline existing commercial cloud platforms. 6d. Illustrate Cloud Service Providers in Market	6.1 Open source Vs Paid/ Commercial Cloud platforms 6.2 Introduction to Open Source Clouds Platform: Characteristics, Existing Open source cloud platforms 6.3 Introduction to Commercial Clouds Platforms: 6.3.1 Characteristics 6.3.2 Existing commercial cloud platforms: 6.4 Major Cloud Service Providers in Market: Google Cloud Platform (GCP), Amazon AWS, Microsoft Azure

8. 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	Cloud Computing Fundamentals	06	6	6	-	12
II	Cloud Architecture	08	4	4	4	12
III	Service Management and Resource Management in Cloud computing	10	4	6	6	16
IV	Cloud Data Management	08	4	6	4	14
V	Cloud Security	06	2	4	4	10
VI	Open Source and Commercial Clouds	10	4	6	6	16
Total		48	24	32	24	80

9. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare journals based on practical performed in laboratory.
- b) Prepare report on suggestive case study of any cloud service for given Cloud Service Provider.

10. 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) '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e) Use different Audio Visual media for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Demonstrate students thoroughly before they start doing the practice.
- h) Observe continuously and monitor the performance of students in Lab.

11. 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 is group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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. Similar micro-projects could be added by the concerned faculty:

- i. Discover Various Open Source and Commercial Cloud Platforms
- ii. Distinguish and Determine Cloud Platform for given problem statement
- iii. Create and Maintain Virtual Machines over Open Source Cloud
- iv. Choose cloud security measures to prevent data leak through SQL injection
- v. Make use of Cloud – Platform as Service to build a simple web application
- vi. Deploy a simple web application over open source cloud

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Cloud Computing	Dr. Kumar Saurabh	Wiley Publication
2	Cloud computing principles and paradigms	Rajkumar Buyya	Wiley Publication
3	Enterprise Cloud Computing	Gautam Shroff	Cambridge

13. SOFTWARE/LEARNING WEBSITES

- a) <https://www.nptel.ac.in>
- b) <https://cloud.google.com/>

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	-	-	-	-
CO2	2	2	1	1	-	1	-
CO3	2	3	2	2	1	1	-
CO4	2	2	2	2	1	2	-
CO5	2	3	2	3	1	2	1
CO6	2	3	3	3	-	3	1

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	-	2
CO4	-	2
CO5	-	2
CO6	-	3

Sign: Name: 1. Mrs. K.S. Sathawane 2. Mrs. M.G. Yawalkar (Course Experts)	Sign: Name: Mr. U.V. Kokate (Head of Department) Computer Engineering
Sign: Name: Mr. U.V. Kokate (Program Head) Computer Engineering	Sign: Name: Mr. A.S.Zanpure (CDC In-charge)

Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in Computer Engineering
Programme code	06/26
Name of Course	WIRELESS SENSOR NETWORK
Course Code	CM5109
Prerequisite course code and name	Nil
Class Declaration	Yes

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		ESE	PA	*ESE	PA	
				Marks	80	20	25	25	150
03	00	02	05	Exam Duration	3 Hrs	1 Hr	2 Hr		

(*OE: Oral Examination)

Legends: L- lecture, guided theory practice, ESE-End semester examination, PA- Progressive Assessment.

2. RATIONALE

Nowadays, Wireless Sensor Networks (WSNs) emerge as an active research area in which challenging topics involve energy consumption, routing algorithms, selection of sensors location according to a given premise, robustness, efficiency, and so forth. Despite the open problems in WSNs, there are already a high number of applications available. In all cases for the design of any application, one of the main objectives is to keep the WSN alive and functional as long as possible. A key factor in this is the way the network is formed. The presents most recent formation techniques and mechanisms for the WSNs. The goal of this course is to give an overview of fundamental problems in the area of WSNs. We will discuss existing solutions for some of these problems. Data aggregation, information dissemination, security issues, power management, localization, topology control, routing, naming, collaborative signal and information processing for target tracking, security, are some of the topics that will be covered in this course.

3. COMPETENCY

The aim of this course is to help the students to attain the following competency through various teaching learning experiences.

To learn the basic principles behind a Wireless Sensor Network and able to specify the requirements for the hardware and software solutions for energy-efficient sensor network for new applications

4. COURSE OUTCOMES (COs)

1. Describe various concepts and terminologies used in WSN.
2. Identify importance and use of radio communication and link management in WSN
3. Demonstrate various wireless standards and protocols associated with WSN.
4. Recognize importance of localization and routing techniques used in WSN.
5. Understand techniques of data aggregation and importance of security in WSN.
6. Analyze the issues involved in design and deployment of WSN.

5. SUGGESTED PRACTICALS/ EXERCISES

The practical's in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Unit No.	Practical Exercises	Relevant CO	Approximate Hours Required.
1	1	Study of various components of Sensor Node.	1	2
2	1	Study various Parameters of sensor node.	1	2
3	3	Design a network using source and sink node	2	2
4	4	Routing Messages using sensors.	3	4
5	1	Application of WSN in Hospital, Railway, Agriculture, Factory, City, plane	4	4
6	3	Basics of IOT Programming using the Arduino Platform	5	4
7	6	Sensing data using the MKR1000 board.	5	4
8	6	Programming a MKR1000 board over the air in a standalone	5	2
9	4	Collecting and exchanging data on WSN	5	4
10	5	Sensing audio data and interpreting results.	6	4
			Total	32

Sr.No.	Performance Indicators	Weightage in %
a.	Effective practical implementation within specific time	60
b.	Handling of WSN networking components	10
c.	Answer to questions	20
d.	Submission of assignment with in time	10
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

Sr.No.	Major Equipment/ Instruments Required	PrO. No.
1	Sensor Nodes	All
2	Network Simulator	All
3	Arduino UNO Controller and Arduino Platform	6
4	MKR1000 board	7,8

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
UNIT 1. Fundamentals of WIRELESS SENSOR NETWORK (Weightage-14, Hrs-10)	
1. List the benefits and applications of WSN. 2. Understand Challenges of WSN. 3. Select appropriate WSN architecture according to the requirements.	1.1 Fundamentals of WSN- What are Wireless Sensor Networks, Challenges for Wireless Sensor Networks, Sensor Node, Anatomy of a Sensor Node, 1.2 Architecture of WSN: Single-Node Architecture - Hardware Components, 1.3 Performance metrics in WSN, types of WSN.
UNIT 2. Radio Communication & Link Management (Weightage- 14 , Hrs-12)	
1. Describe need of Radio Communication. 2. Study properties of Wireless Communication. 3. Differentiate between circuit switched and datagram network	2.1 Radio Waves and Modulation/ Demodulation 2.2 Properties of Wireless Communications, Medium Access Protocols, Wireless Links Introduction 2.3 Properties of Wireless Links, Error Control, Naming and Addressing, Topology Control
UNIT 3. Wireless Standards & Protocol Stack (Weightage-16, Hrs-12)	
1. Describe WSN IEEE Standards. 2. Establish wireless LAN 3. Create a Bluetooth enabled network.	3.1 WSN Standards- IEEE802.15.4 ISA 100.11a, 6LoWPAN, IEEE802.15.3, 3.2 Low rate WPAN, Zigbee, Wireless HART, 3.3 Wibree, BLE, Zwave, ANT, Insteon, 3.4 Wavenis, Protocol stack of WSNs, Cross Layer Protocol Stack.

UNIT 4. Localization & Routing (Weightage-16, Hrs-14)	
1. Analyzing issues of Localization.	4.1 Localization: Localization Challenges and Properties, Deployment Schemes, Proximity Schemes, Ranging Schemes,
2. Describe Routing issues.	4.2 Range-Based Localization, Range-Free Localization 4.3 Routing Basics, Routing Metrics, Routing Protocols, 4.4 Full-Network Broadcast, Location-Based Routing, Directed Diffusion, Collection Tree Protocol, Zigbee, Multi-Hop Communications
UNIT 5 Data Aggregation & Security (Weightage-20, Hrs-16)	
1. Identify the protocols working in a layered architecture.	5.1 Clustering Techniques
2. Troubleshoot the network using standard network model.	5.2 In-Network Processing and Data Aggregation,
3. Analysis of Security issues in WSN.	5.3 Compressive Sampling, 5.4 Security Issues in Wireless Sensor Networks, 5.5 Attacks, Defensive Measures, 5.7 Security requirements and threat model. Layer.
UNIT 6. Designing & Deploying WSN Applications (Weightage-16, Hrs-14)	
1. Describe Design and Deploying issues of WSN.	6.1 Designing and Deploying WSN Applications, 6.2 Early WSN Deployments 6.3 General Problems, General Testing and Validation, Requirements Analysis
2. Demonstrate application of WSN	6.4 Top-Down Design Process, Bottom-Up Implementation Process.
3. Analyze WSN Analysis	

8. 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	Fundamentals of WIRELESS SENSOR NETWORK	10	6	4	4	14
II	Radio Communication & Link Management	12	4	6	4	14
III	Wireless Standards & Protocol Stack	12	4	6	6	16
IV	Localization & Routing	14	4	6	6	16
V	Data Aggregation & Security	16	6	6	8	20
VI	Designing & Deploying WSN Applications					
Total		64	24	28	28	80

9. 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:

1. Identify need of Wireless Sensor Network in your Department.
2. Analysis of Various Components of Wireless Sensor Network.
3. Analysis of Limitation of Wireless Sensor Network.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1. Demonstration of Wireless Sensor Network installation in the institute and its technology. Give an environment to establish, configure and troubleshoot a small network by giving hands on practice.
2. Massive open online courses (MOOCs) can be used to teach various topics.

11. SUGGESTED MICRO-PROJECTS

1. Automated Street Light System.
2. Weather Forecasting using System.
3. Automated Traffic Control System.

12. SUGGESTED LEARNING RESOURCES

S.N .	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Wireless Sensor Networks	Kazem Sohraby, Daniel Minoli, & Taieb Znati, John Wiley, 2007.	0471743003
2	Wireless Sensor Networks	Zhao Feng, Elsevier India	
3	Wireless Sensor Networks Springer India	Raghavendra Sivalingam Znati	
4	Building Wireless Sensor Networks	Robert Faludi O'reilly	

13. SOFTWARE/LEARNING WEBSITES

1. www.nptel.ac.in
2. www.tutorialspoint.com

14. PO - COMPETENCY- CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	2	1	-	-	1
CO2	1	2	2	2	-	-	1
CO3	1	2	2	2	1	1	1
CO4	1	1	3	2	1	1	1
CO5	1	1	3	2	1	1	1
CO6	1	1	2	2	1	1	1

CO2	1	1
CO3	1	2
CO4	1	2
CO5	1	1
CO6	1	1

Sign: Name: A.A. Shaikh N.R.Wagh (Course Expert /s)	Sign: Name: Shri U.V. Kokate (Head of Department)
Sign: Name: Shri U.V. Kokate (Programme Head)	Sign: Name: Shri A.S.Zanpure (CDC)