GOVERNMENTPOLYTECHNIC,PUNE

'120– NEP'SCHEME

PROGRAMME	DIPLOMA IN CM/IT
PROGRAMMECODE	06/07
COURSE TITLE	OPERATING SYSTEM
COURSE CODE	CM31201
PREREQUISITE COURSE CODE& TITLE	NA
CLASS DECLARATION COURSE	YES

I. LEARNING&ASSESSMENTSCHEME

CourseCode	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL&TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CM31201	OPERATING SYSTEM	DSC	4	-	2	-	6	3	3 Hrs	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Term: 0Hrs

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

Legends:@-InternalAssessment,#-ExternalAssessment,*#-OnlineExamination,@$-InternalOnlineExamination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR**(Formative Assessment -Practical)of any course; then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA(Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are**(CL+LL+TL+SL)hrs.*15Weeks**
4. **1credit** is equivalent to**30 Notional hours.**
5. *Self-learning hours shall not be reflected in the Timetable.
6. *Self-learningincludesmicro-projects/assignments/otheractivities.

II. RATIONALE:

Operating Systems are system programs, which are very essential components of Computer system. Two primary aims of operating systems are to manage resources (e.g. CPU time, memory) and to control users and software. Operating system design goals are often contradictory and vary depending on user, software, and hardware criteria. This course describes the fundamental concepts behind operating systems, and examines the ways that design goals can be achieved and practice the concept of Operating System design.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

1. Identify types of operating system
2. Describe services of operating system.
3. Execute process management commands.
4. Apply process scheduling algorithms and deadlock handling techniques.
5. Understand memory management techniques
6. Describe organization of file system.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		SECTION-I		
		UNIT-I INTRODUCTION TO OPEN SOURCE (CLHrs-08,Marks-10)		
1	**TLO1.1** Explain the functioning of given component of OS. **TLO1.2** Explain characteristics of the given type of operating system. **TLO1.3** Identify type of operating system suitable for the given type of application. **TLO1.4**Execute command on command line for the given task.	1.1Operating System: Evaluation of operating system, concept, Functions of Operating system. 1.2ViewsofOS: User View, System View 1.3Types of operating systems: Batch operating system, Multiprogramming operating system, Multitasking operating system, Real-Time Embedded Systems, Multimedia Systems, Distributed System, Mobile OS(Android, iOS) 1.4Open-Source Operating System: Linux, BSD Unix. 1.5Booting Process of operating systems	Hands-on Demonstration Presentations	CO1
		UNIT-II SERVICES AND COMPONENT (CLHrs-10,Marks-10)		
2	**TLO1.2** Start, stop and restart the given service in Linux. **TLO2.2**Explain use of given system call of specified OS. **TLO2.3**Explain process that follows in managing the given resource. **TLO2.4** Explain use of the given operating system tool..	2.1DifferentServicesofOperating System. 2.2Component of operating system: Process Management, Main memory Management, file Management, I/O system management, secondary storage management 2.3SystemCalls-Concept,typesof operating system calls 2.4Useofoperatingsystemtools,user management, security policy, device management, performance monitor, task manager.	Hands-on Demonstration Presentations	CO2
		UNIT-III PROCESS MANAGEMENT (CLHrs-10,Marks-12)		
3	**TLO3.1**Explain functions carried out in the given process state. **TLO3.2** Describe the function of the given component of process stack in PCB. **TLO3.3**Explain the characteristics of the given multithreading model. **TLO3.4**Describe method of Executing the given process command with example..	3.1Process-Processstates, Process Control Block (PCB). 3.2ProcessScheduling-Scheduling Queues Schedulers, Context switch. 3.3OperationsonProcess:Creation, Termination 3.4Inter-Process Communication (IPC): Introduction, shared memory system and message passing system. 3.5Multithreading Models 3.6Thread Libraries, Threading Issues	Hands-on Demonstration Presentations	CO3

		SECTION-II		
		UNIT-IV CPU SCHEDULING AND DEADLICK (CLHrs-12, Marks-14)		
4	**TLO4.1:**Justify the need and objective of given job scheduling criteria with relevant example. **TLO4.2**Explain with example the procedure of allocating CPU to the given process using the specified OS. **TLO4.3**Calculate turnaround time and average waiting time of the given scheduling algorithm. **TLO4.4**Explain functioning of the given necessary condition leading to deadlock.	4.1Scheduling types-Scheduling objective, CPU and I/O burst cycles, Pre- emptive, Non-Per-emptive. 4.2Scheduling criteria, Types of scheduling algorithms-First come first served (FCFS), shortest job first (SJF), Shortest Remaining Time(SRTN),Round Robin (RR) Priority scheduling, multilevel queue scheduling. 4.3Criticalsection problem. 4.4Deadlock- system, Models, Necessary condition leading to Deadlocks, Deadlock Handling- Preventions, avoidance and Recovery.	Hands-on Demonstration Presentations	**CO4**
		UNIT–V MEMORY MANAGEMENT(CLHrs-10,Marks-14)		
5	**TLO5.1**Describe the working of specified memory management function. **TLO5.2**Explain characteristic of the given memory management techniques. **TLO5.3**Write algorithm for the given page replacement technique. **TLO5.4**Calculate page fault for the given page reference string.	5.1Basic Memory Management-Partitioning, Fixed and variable, 5.2Free space management techniques-Bitmap, Linked List. 5.3Introduction to page tables. 5.4Segmentation, Fragmentation, Page Fault 5.5Virtual memory-Introduction to paging, Demand Paging 5.6Page replacement Algorithm-FIFO, LRU, Optimal.	Hands-on Demonstration Presentations	**CO5**
		UNIT–VI FILE MANAGEMENT(CLHrs-10,Marks-10)		
6	**TLO6.1**Explain the structure of the given file system with example. **TLO 6.2** Describe mechanism of the given file access method. **TLO 6.3**Explain procedure to create and access method.	6.1File-concept, Attributes, Operations, types and File System Structure. 6.2AccessMethods-Sequential, Direct, Swapping, File Allocation Methods-Contiguous, Linked, Indexed. 6.3Directory Structure-Single level, two level, tree-structured directory, Disk organization and Disk Structure-Physical structure , Logical structure, Raid structure of Disk, RAID level 0 to 6. 6.4File System Implementation: Partitions and Mounting, Virtual File Systems	Hands-on Demonstration Presentations	**CO6**

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles /Tutorial Titles	Number of hrs.	Relevant Cos
1	**LLO1.1:** Understand Operating system installation	*Advanced Linux Installation: Network and Dual Boot	02	CO1
2	**LLO2.1:** Understand the concept of disk partitioning.	*Linux Disk Management using fdisk utility to create, delete and change the partitions on the disk.	02	CO2
3	**LLO3.1**Understand to change the permissions of file and directories.	*Setting/Changing file and directory related permissions chmod and umask command.	02	CO2,CO6
4	**LLO4.1** Understand the various commands to display information about file and directories.	*Displaying File Information : inodes, inodes and directories, cp and inodes, mv and inodes, rm and inodes, ls –l	02	CO2,CO6
5	**LLO5.1** Explore the concept of Mount and unmount	*Working with Linux-supported File Systems: Mounting and Unmounting to be tested with external drives	02	CO2
6	**LLO6.1** Recognize different commands related to process Management **LLO6.2** Practice all process commands	*Linux Process Management : Jobs: Background, Kills and Interruptions and setting process priority Get Process status, Find Processes by Pattern or User, Display the Most Active Processes, wait for a process, sleep processes, Kill processes, kill all processes(Executing commands for process management–ps, fg, sleep, exit, bg, kill ,killall, nice, at, jobs)	04	CO3
7	**LLO7.1**Understand the concept of system states. **LLO7.2**Explore User management and group management. **LLO7.3**Practice group management activities.	*A. System states :init Shutting down and changing Run levels, Managing Users and Groups: Adding and Removing users with adduser, usermod and userdel commands B. Adding and Removing groups with group add, groupmod and groupdel commands, Superuser-The root UserDesktop, System Time and Date	02	CO3
8	**LLO8.1** Explore Job scheduling commands	*Scheduling jobs with crontab: cron daemon, crontab options, The format of crontab file, Environment variable settings, crontab command lines	02	CO4
9	**LLO9.1** Understand the Memory Management related commands	*Linux: Memory Management Practicing top, htop, vmstat and free command	02	CO5
10	**LLO10.1**Understand the working of scheduling algorithms **LLO10.2**Develop a program for	*Write a C program to calculate total waiting time and turnaround time of n processes with FCFC algorithm and Priority Algorithm.	04	CO4

	different scheduling algorithm			
11	**LLO11.1**Understand the concept of page replacement algorithm	*Write a c Program to implement FIFO page replacement algorithm.	02	CO5
12	**LLO 12.1** Explore all shell commands	*Executing various Shell commands Creating shell variables, writing shell scripts using decision making and various control structures., Executing various shell utilities, using file test and string test conditions in scripts, Making use of Positional Parameters. Configuring your own login shell using Functions in Shell scripts.	02	ALL
13	**Micro project**	Develop a micro project.	02	ALL

Note: Out of the above suggestive LLOs–

1. '*'Marked Practicals (LLOs) are mandatory.
2. A judicial mix of LLOs is to be performed to achieve the desired outcomes.

VI. SUGGESTEDMICROPROJECT/ASSIGNMENT/ACTIVITIESFORSPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

Self-Learning NA

Micro Project

Suggestive list of micro-project:

1. Create a report depicting features of different types of Operating system–Batch operating system, Multi-Programmed, Time shared, multiprocessor system, Real time System, Mobile Operating system etc. with example.
2. Make a comparative chart to calculate total waiting time and turn-around time of n processes with different CPU scheduling algorithm.
3. Implement a CPU scheduling algorithm for Shortest Remaining Time First and shortest Job First algorithm.
4. Compare FCFS,SJF, Priority and Round Robin with respect to turn around time and average waiting time. Give the reason of problems arises in FCFS.
5. Write a shell script that tests the connectivity of group of computers.
6. Write a shell script that counts number of files and number of directories in a directory.
7. Prepare a help guide using shell script for all the major Linux commands.
8. Write a shell script to find out-Whether given file exists.
9. Create a simple FAT file system using C programming.
10. Develop a simple memory allocation in c.
11. Implementing Demand paging in Operating system.
12. Create report on Linux Utilities in detail.
13. Prepare report on various generations of computer system and operating system.

Note:

1. The above is suggestive list of case studies for Micro project.
2. The faculty must allocate any 1case study in group of 2 students. Considering the students technical skills.

Assignment

Prepare a journal of practical performed in the laboratory.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Linux like anyOperatingsystemSoftwarec)AnyBrowser(AnyGeneralPurposeComputeravailable in the Institute)	ALL

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

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction	CO1	08	04	04	02	10
2	II	OS Services and components	CO2	10	02	04	04	10
3	III	Process Management	CO3	10	02	04	06	12
4	IV	CPU Scheduling and Deadlock	CO4	12	02	04	08	14
5	V	Memory Management	CO5	10	04	06	04	14
6	VI	File Management	CO6	10	04	04	02	10
		Grand Total		60	18	26	26	70

IX. ASSESSMENT METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment ,Self-learning and Seminar/Presentation	Lab. Performance, viva voce

X. SUGGESTEDCOS-POSMATRIXFORM

Course Outcome	Programme Outcomes(Pos)	Programme Specific Outcomes *(PSOs)	

IX. ASSESSMENT METHODOLOGIES /TOOLS

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

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Silberschatz Galvin, Gagne,John Wisley&Sons	Operating System Concepts	Wiley and Sons, Ninth Edition, Galvin. 2015, ISBN: 978-5 1-265-5427-0 2 **ISBN-13:**978-0470128725
2	Achyut S. Godbole, Tata McGraw-Hill	Operating Systems	TataMcGrawHillEducation,2015, ISBN: 97800705911343
3	D.M. Dhamdhere, TMH	System Programming &Operating System	McGraw-Hill Education;ISBN:9780074635797
4	Milan Milenkovic, TMH	Operating System Concept &Design	McGraw Hill Education **ISBN-10:**0074632728 **ISBN-13:**978-0074632727

XII. LEARNINGWEBSITES& PORTALS

1. www.cs.wisc.edu/~bart/537lecturenotes-UniversityofWisconsin Madison.
2. www.cs.kent.edu/osf03/notes/index.html-ViliniusGediminasTechnicalUniversity
3. http://www.howstuffworks.com/operating-system1.htm
4. www.tutorialspoint.com/opeartingsystem
5. www.geeksforgeeks.org/operatingsystem

Name&Signature:

Dr.Shankar B.Nikam
Lecturer in Computer Engineering

Smt.PriyaK.Zade
Lecturer in Computer Engineering

Smt.V.M.Khanapure
Lecturer in Information Technology

(CourseExperts)

Name&Signature:

Dr.D.N.Rewadkar
(Programme Head)

Name&Signature:

Shri. S.B. Kulkarni
(CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CM/IT
PROGRAMME CODE	06/07
COURSE TITLE	PYTHON PROGRAMMING
COURSE CODE	CM41202
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	YES

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CM41202	PYTHON PROGRAMMING	SEC	2	-	4	2	8	4	2	15	35*#	50	20	50	20	25#	10	25	10	150

Total IKS Hrs for Term: 0 Hrs

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

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

Note:

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

II. RATIONALE:

Python is a 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.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Develop Python programs using control flow statements.
CO2: Perform operations on various data structures.
CO3: Use packages to solve real-time problems
CO4: Apply an object-oriented approach to problem-solving
CO5: Write code for File and Exception Handling.
CO6: Develop Python applications using database connectivity

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		SECTION -I		
		UNIT-I INTRODUCTION TO PYTHON AND CONTROL FLOW STATEMENTS (CL-5 Hrs, Marks- 5)		
1	**TLO 1.1** Explain the given feature of Python. **TLO 1.2** Write a Python program to perform basic input-output operations. **TLO 1.3** Write a Python program to solve a given expression. **TLO 1.4** Implement given decision-making statements and looping statements in the Python program. **TLO 1.5:** Write a Python program using control statements.	**1.1** Introduction: Features, History and Applications of Python, Python IDE's **1.2** Pythn on building blocks: Indentation, Identifiers, Variable, Comments, Keywords **1.3** Basic input output operations: input(),print() **1.4** Operators: Arithmetic, Relational, Assignment, Logical, Bitwise, Membership and Identity operator **1.5** Control flow statements: Conditional statements (if, if-else, if-elif-else, nested if), Loops in Python (while, for, nested loops), Loop manipulation statements (continue, pass, break, else)	Hands-on Demonstration Presentations	**CO1**
		UNIT-II DATA STRUCTURES IN PYTHON (CL -6 Hrs , Marks-7)		
2	**TLO 2.1** Write a Python program to manipulate lists. **TLO 2.2** Write a Python program to manipulate tuples. **TLO 2.3** Write a Python program to manipulate sets. **TLO 2.4** Write a Python program to manipulate dictionaries.	**2.1** Lists: Defining Lists, Accessing values in lists, deleting values from lists, updating lists. Basic List Operations, Built-in List Functions. **2.2** Tuples: Accessing values in Tuples, deleting values from Tuples and updating Tuples. Basic Tuple operations, Built-in Tuple Functions. **2.3** Sets: Accessing values in Set, deleting values from Set and updating Sets. Basic Set operations, Built-in Set Functions. **2.4** Dictionaries: Accessing values in Dictionary, deleting values from Dictionary and updating Dictionary. Basic Dictionary operations and built-in Dictionary Functions.	Hands-on Demonstration Presentations	**CO2**
		UNIT-III PYTHON FUNCTIONS, MODULES AND PACKAGES (CL-5 Hrs , Marks- 5)		

3	**TLO 3.1** Write relevant user-defined functions for the given problem. **TLO 3.2** Write a relevant user-defined module for the given problem. **TLO 3.3** Write packages for the given problem	**3.1** Use of Python built-in functions (Eg. type/data conversion functions, math functions etc.). **3.2** User-defined functions: Function definition, Function call, function arguments and parameter passing, return statement, scope of variable: Global variable and Local variable. **3.3** Modules: Writing modules, importing modules, importing objects from modules, Python built-in modules, (Eg. Numerical and mathematical module, Functional programming module, statistic module), Namespace and Scoping. **3.4** Python Packages: Introduction, Writing Python Packages, using standard (Eg.math, scipy, Numpy, matplotlib, pandas, pandas series etc.) and user-defined Packages.	Hands-on Demonstration Presentations	**CO3**
	SECTION II			
	UNIT- IV OBJECT ORIENTED PROGRAMMING IN PYTHON (CL-4 Hrs , Marks-6)			
4	**TLO 4.1** Write a Python program using classes and objects to solve a given problem. **TLO 4.2** Implement Python program using different types of constructors. **TLO 4.3** Write a program to demonstrate polymorphism. **TLO 4.4** Write Python code using data abstraction for a given problem. **TLO 4.5** Apply inheritance for the given problem.	**4.1** Object-oriented Concepts: Creating class, Creating object **4.2** Constructors in Python (Parameterized & Non-Parameterized), the self parameter **4.3** Polymorphism: Method Overloading and Overriding **4.4** Data Hiding / Abstraction **4.5** Inheritance: Single Inheritance, Multiple Inheritance, Multilevel Inheritance	Hands-on Demonstration Presentations	**CO4**
	UNIT –V FILE HANDLING AND EXCEPTION HANDLING (CL-4 Hrs , Marks-4)			
5	**TLO 5.1** Write Python code for the given reading values from the keyboard. **TLO 5.2** Read data from the given file. **TLO 5.3.1** Write the given data to a file. **TLO 5.3.2** Handle the given exceptions through the Python program.	**5.1** I/O operations: Reading keyboard input, printing to screen. **5.2** File Handling: Opening files in different modes, accessing file contents using standard library functions, reading and writing files, closing files renaming and deleting files. **5.3** Exception Handling: Introduction, 'try: except:' statement, 'raise' statement, user-defined exceptions.	Hands-on Demonstration Presentations	**CO5**

UNIT -VI BUILT-IN GUI PACKAGES AND DATABASE CONNECTIVITY (CL-6 Hrs , Marks-8)				
	TLO 6.1 Create a GUI application using the Tkinter package for the given problem. **TLO 6.2** Create a Python application to connect with the database.	**6.1** Creating GUI using Tkinter: Introduction to Tkinter, Widgets (Entry, Label, Button, RadioButton, Checkbutton), Creating a simple GUI application **6.2** Connecting to Database using MySQL: Installing mysql-connector, cursor() object, execute() method, fetchall() method, Creating simple program to connect database	Hands-on Demonstration Presentations	**CO6**

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO1.1** Install the given Python IDE.	*Install the given Python IDE.	2	CO1
2	**LLO2.1** Write a Python program for performing basic input and output operations in a given problem.	*1. Write a Python program that displays a welcome message on the screen. 2. Implement the Python program to read data from the user and display data on the screen.	2	CO1
3	**LLO3.1** Write a Python program to solve a given expression.	*Implement a Python program using the following operators: 1. Arithmetic 2. Relational & Logical 3. Assignment 4. Bitwise 5. Membership 6. Identity	2	CO1
4	**LLO4.1** a. Write a Python program for solving a given problem using various If statements b. Write a Python program for solving a given problem using various Looping statements.	*1.Implement a Python program to demonstrate the use of the following conditional statements: a. Simple IF b. IF..ELSE c. IF..ELIF..ELSE d. nested IF 2. Implement a Python program to demonstrate the use of the following looping statements: a. while loop b. for loop c. nested loop	4	CO1
5	**LLO5.1** Use loop control statements in Python to solve a given problem.	Implement a Python program to demonstrate the use of loop control statements. [continue, pass, break, else]	2	CO1
6	**LLO6.1** Write a Python program to perform operations on a list.	*Create an account on wikipedia.Implement a Python program to perform the following operations on the List: 1. Create a List 2. Access List 3. Update List 4. Delete List	2	CO2
7	**LLO7.1** Write a Python program to use built-in functions on the list. Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods)	Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods) Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods)	2	CO2

	Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods)			
8	**LLO 8.1** Write a Python program to perform operations on a tuple.	*Implement a Python program to perform the following operations on the Tuple: 1. Create a Tuple 2. Access Tuple 3. Print Tuple 4. Delete Tuple 5. Convert the tuple into a list and vice-versa	2	CO2
9	**LLO 9.1** Write a Python program to manipulate the set.	*Implement a Python program to perform the following operations on the Set: 1. Create a Set 2. Access Set 3. Update Set 4. Delete Set	2	CO2
10	**LLO 10.1** Use built-in functions/methods on sets in Python for solving given problems.	*Implement a Python program to perform the following functions on Set: 1. Union 2. Intersection 3. Difference 4. Symmetric Difference	2	CO2
11	**LLO 11.1** Write a Python program to perform operations on a dictionary.	*Implement a Python program to perform the following operations on the Dictionary: 1. Create Dictionary 2. Access Dictionary 3. Update Dictionary 4. Delete Dictionary 5. Looping through Dictionary 6. Create a Dictionary from a list	2	CO2
12	**LLO 12.1** Write a function to solve a given problem.	*Write a user-defined function to implement the following features: 1. Function without argument 2. Function with argument 3. Function returning value 4. Function positional/required argument 5. Function with keyword argument 6. Function with default argument 7. Function with a variable length argument	2	CO3
13	**LLO 13.1** Write a Python program using an anonymous function. LLO 13.2 Write a Python program to use the function in the argument.	*Write a Python program to demonstrate the use of the following advanced functions: 1. Lambda 2. Map 3. Reduce	2	CO3
14	**LLO 14.1** Write user user-defined module to solve a given problem.	Write a Python program to create and use a user-defined module for a given problem.	2	CO3
15	**LLO 15.1** Select the appropriate module to solve the given problem. **LLO 15.2** Use the given module to solve the problem.	*Write a Python program to demonstrate the use of the following module: 1. math module 2. random module 3. os module 4. static module	2	CO3
16	**LLO 16.1** Write a user-defined package to solve a given problem	*Write a Python program to create and use a user-defined package for a given problem.	2	CO3
17	**LLO 17.1** Write a Python program using classes and objects to solve a given problem.	*Develop a Python program to perform the following operations: 1. Creating a Class with the method 2. Creating Objects of class	2	CO4

		3. Accessing method using object		
18	**LLO18.1** Write a Python program to initialize objects of class using various types of constructors.	*Write a Python program to demonstrate the use of constructors: 1. Default 2. Parameterized 3. Constructor Overloading	2	CO4
19	**LLO19.1** Write a Python program to implement polymorphism.	*Implement a Python program to demonstrate 1. Method Overloading 2. Method Overriding	2	CO4
20	**LLO20.1** Write a Python program that uses data-hiding concepts in Python.	Write a Python program to demonstrate data hiding.	2	CO4
21	**LLO 21.1** Select the appropriate type of inheritance to solve a given problem. **LLO 21.2** Write a Python program using inheritance to solve a given problem.	*Write a Python program to implement 1. Single inheritance 2. Multiple Inheritance 3. Multilevel inheritance	2	CO4
22	**LLO 22.1** Write a Python program using file handling to solve a given problem. **LLO22.2** Write a Python program to implement exceptions.	*Write a Python Program to demonstrate File Handling through: 1. Opening files in different modes 2. Accessing file Reading and Writing file 3. Closing file 4. Renaming and Deleting file	2	CO5
23	**LLO23.1** Write a Python program to implement exceptions.	Implement Python program to demonstrate 1. user-defined exception	2	CO5
24	**LLO24.1** Use appropriate packages in a Python program to create GUI applications.	*1. Write a Python GUI program to import the Tkinter package create a window and set its title. 2. Write a Python GUI program that adds labels and buttons to the Tkinter window.	4	CO6
25	**LLO25.1** Write a Python program to connect the database.	*Write a program to create a connection between the database and Python.	4	CO6
26	**LLO26.1** Write a Python program to display the content from the database.	*Implement a Python program to select records from the database table and display the result.	4	CO6

Note: Out of the above suggestive LLOs –

1. '*' Marked Practicals (LLOs) Are mandatory.
2. A judicial mix of LLOs is to be performed to achieve the desired outcomes

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

Self Learning: Yes

Suggestive list of case studies for self learning:

1. Manage small online book store and create a program to manage inventory. Implement a system where store information about each book, such as its title, author, genre, and price. Additionally, Perform

operations such as adding new books, removing books, updating book information, and searching for books by title or author.

2. Develop a program to store information about students in a class. Each student has a unique ID, name, age, and grade. create a system to manage this information efficiently.
3. Developing a project where students need to store unique employee IDs. Each employee has a unique ID assigned to them, and ensure that there are no duplicate IDs in your system.
4. Create a simple dice rolling game where a player rolls two dice, and the sum of the numbers rolled determines their score. The player can continue rolling until they decide to stop, at which point their total score is calculated.
5. Develop an application that calculates the area of different geometric shapes such as rectangles, squares, circles, and triangles.
6. Develop an application that analyzes the frequency of words in a text file and provides basic statistics about the text.
7. Dataset containing information about students' grades in different subjects, and perform various data analysis tasks such as calculating averages, finding the highest and lowest scores, and filtering data based on specific criteria.
8. A Text file containing a list of student names and their corresponding scores. Read this data, calculate the average score for each student, and write the results to another file.
9. Develop an application to detects whether a given phrase or sentence is a palindrome, ignoring spaces, punctuation, and capitalization.
10. Develop a graphical user interface (GUI) application for managing a to-do list. The application should allow users to add tasks, view tasks, mark tasks as completed, and remove tasks from the list.
11. Create a graphical user interface (GUI) calculator application that performs basic arithmetic operations such as addition, subtraction, multiplication, and division.
12. Develop a graphical user interface (GUI) weather application that allows users to enter a city name and get the current weather conditions for that city.
13. Build application that acts as an alarm clock. Allow users to set alarms with specific times and optional messages.
14. Develop an application that generates a random strong password based on user-defined criteria (length, inclusion of numbers/symbols).
15. Develop a basic chatbot that can engage in simple conversations, answer questions, and provide information on specific topics.
16. Create a Hangman Game. where the computer selects a word and the player has to guess it letter by letter.Display the progress of the word and the number of guesses remaining.
17. Create a command-line version of the Tic-Tac-Toe game where two players can play against each other.
18. Develop a command-line tool that fetches weather data from an API (like Open Weather Map) based on user input (city name).
19. Create a simple quiz game with multiple-choice questions. Keep track of scores and provide feedback on answers.
20. Develop a contact management system that allows users to add contacts with details like name, phone number, and email address. Implement basic CRUD operations (Create, Read, Update, Delete).
21. Develop a application to generate home automation dash board.

22. Build a COVID-19 tracker that fetches data from a COVID-19 API (such as the one provided bykaggle).Display statistics such as total cases, deaths, and recoveries globally or for a specific country.
23. Build a stock price checker that retrieves real-time stock prices and information from a financial data API (e.g., Alpha Vantage or Yahoo Finance).Display stock prices, historical data, and trends for specified stocks.
24. Develop a recipe management system that stores recipes (name, ingredients, instructions) in a database. Users can add new recipes, search for recipes by name or ingredients, and update existing recipes.
25. Build an expense tracking application that stores expense records (date, category, amount) in a database. Users can add new expenses, categorize them, and view expense summaries.

Activities

- Students are encouraged to use online tools to improve their learning, such as the e-Kumbh from AICTE and the virtual Labs from IIT.
- Students should be encouraged to participate in various coding competitions, such as hackathons, and online coding contests on websites like Hackerrank, Codechef etc.
- At the department level, encourage students to start a coding club
- Students are encouraged to register themselves in various MOOCs such as Infosys Springboard, Swayam etc. to further enhance their learning.

Note:

1. The above is suggestive list of case studies for SLA
2. The faculty must allocate any 2 case studies to individual student. Considering the students technical skills.

Assignment

Prepare a journal of practicals performed in the laboratory.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System with all necessary Peripherals and Internet connectivity (Any General Purpose Computer available in the Institute)	ALL
2	Any open-source tool (SPYDER / Eclipse IDE), Python Interpreter	
3	Any database software	25,26

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

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
SECTION-I								
1	I	Introduction to Python and control flow statement	CO1	5	2	3	0	5
2	II	Data Structures in Python	CO2	6	2	2	3	7
3	III	Python Functions, Modules and Packages	CO3	5	0	2	3	5
		Grand Total		**16**	**4**	**7**	**6**	**17**

SECTION-II								
4	IV	Object Oriented Programming in Python	CO4	4	0	2	4	6
5	V	File Handling and Exception Handling	CO5	4	0	2	2	4
6	VI	Built-in GUI packages and Database connectivity	CO6	6	2	2	4	8
Grand Total				**14**	**2**	**6**	**10**	**18**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

X. SUGGESTED COS- POS MATRIX FORM

	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
Course Outcomes (Cos)	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainabilityand Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	-	-	1	-	2	3
CO2	2	1	1	1	-	-	1	-	2	3
CO3	3	3	3	2	2	-	2	-	3	3
CO4	2	2	3	2	-	-	1	-	3	3
CO5	2	2	2	2	-	-	1	-	2	3
CO6	3	2	3	3	2	2	2	-	3	3
	Legends:- High:03, Medium:02, Low:01, No Mapping: - *PSOs are to be formulated at the institute level									

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	K. Nageswara Rao, Shaikh Akbar	Python Programming	Scitech Publications (India) Pvt.Ltd ISBN:9789385983450
2	Mark Lutz	Learning Python	O'Reilly Publication, 5th Edition ISBN13:9781449355739
3	Paul, Barry	Head First Python	O'Reilly Publication, 2nd Edition ISBN: 1491919531
4	David Amos, Dan Bader, Joanna,Jablonski, Fletcher Heisler	Python Basics	Real Python ISBN-13: 9781775093329

XI. LEARNING WEBSITES & PORTALS

1 https://ekumbh.aicte-india.org/allbook.php Python Programming
2 https://Python-iitk.vlabs.ac.in/ Python Programming Lab
3 https://spoken-tutorial.org/watch/Python+3.4.3/Input-output/English/
Introduction to Python and control flow statements, Data Structures in Python, Function and module
4 https://onlinecourses.nptel.ac.in/noc19_cs41/preview Python Programming Course
5https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094439793500160259 2_shared/overview Python for Beginners
6 https://wiki.Python.org/moin/BeginnersGuide Basics of Python
7 https://www.geeksforgeeks.org/Python-gui-tkinter/ Python GUI Programming
8https://www.w3schools.com/Python/Python_mysql_getstarted.asp Python MySQL Database Connectivity
9 https://www.tutorialspoint.com/Python_pandas/index.htm Python pandas package

Name & Signature:		
Smt. S. A. Ade Lecturer in Computer Engineering	**Smt. H. S. Pawar** Lecturer in Computer Engineering	**Smt.S.D.Raut** Lecturer in Information Technology
	(Course Experts)	
Name & Signature: **Dr.B.N.Rewadkar** (Programme Head)		Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM
PROGRAMME CODE	01/02/03/04/05/06/07/08
COURSE TITLE	SOCIAL AND LIFE SKILLS
COURSE CODE	HU21204
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	NO

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
HU21204	SOCIAL AND LIFE SKILLS	VEC	1	--	2	1	4	2	--	--	--	--	--	25	10	--	--	25	10	50

Total IKS Hrs for Term: 0 Hrs

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

Legends: @-Internal Assessment, # - External Assessment,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
1. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
3. **1 credit** is equivalent to **30 Notional hours**.
4. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

The introduction of a social and life skills course for diploma engineers is indeed a significant step forward in shaping well-rounded professionals. By integrating soft skills training with technical education, this curriculum addresses the growing need for engineers who are not only experts in their field but also adept in interpersonal communication, collaboration, and leadership. Such skills are crucial for success in the modern workforce, where the ability to navigate complex social dynamics can be just as important as technical know-how. Moreover, the emphasis on ethical decision-making prepares engineers to approach their work with integrity and responsibility. As these professionals progress in their careers, the benefits of this comprehensive education will manifest in their ability to innovate, lead, and contribute positively to their communities and the broader society. This forward-thinking approach ensures that the engineers of tomorrow are equipped not just with the tools to excel in their careers, but also with the vision to drive societal progress.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Achieve shared goals through effective teamwork in executing sustainable community development projects.
CO2: Improve cooperation and understanding through refined communication skills.
CO3: Encourage ethical choices and compassionate behaviour by nurturing moral values.
CO4: Foster ethical judgment, honesty, and societal accountability to shape principled and conscientious professionals.
CO5: Equip students with practical financial literacy skills for efficient financial management.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	TheoryLearning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I ENGAGEMENTS WITHIN UNNAT MAHARASHTRA ABHIYAN (UMA) (CL Hrs-03, Marks-NIL)			
1.	**TLO1.1:** Recognize the importance of addressing societal needs and involving relevant stakeholders in problem-solving efforts. **TLO1.2:** Integrate academia, society, and technology to devise comprehensive solutions for complex societal issues. **TLO1.3:**Enhance communication and negotiation skills to effectively engage stakeholders, ensuring diverse perspectives and productive collaboration in problem-solving. **TLO1.4:** Utilize critical data sources such as economic surveys, and environmental data to guide decision-making and solution development in problem-solving endeavours. **TLO1.5:** Identify key stakeholders and delineate their roles and interests in addressing societal challenges. **TLO1.6:** Identify essential attributes for measurement in the problem-solving process. **TLO1.7:** Explore diverse	**1.1 Identifying Regional Societal Challenges:** Recognizing Community Needs Requiring Engineering Solutions. **1.2Integrating Multidisciplinary Approaches:** Linking Academia, Society, and Technology **1.3 Involving Diverse Stakeholders:** Engaging Various Actors in the Problem-Solving Process **1.4Accessing Secondary Data Sources:** Utilizing Resources like Census and Economic Surveys **1.5Mapping Problems and Stakeholders:** Understanding Activities' Relevance to System Components and Key Stakeholders **1.6Defining Measurement Metrics:** Identifying Essential Attributes for Evaluation **1.7 Employing Data Collection Tools:** Exploring Surveys and Measurement Equipment **1.8Establishing Measurement Standards:** Developing Survey Forms and Piloting Processes **1.9Conducting Field Surveys:** Quantifying Local Systems such as Agriculture and Transportation **1.10Analyzing Data and Creating**	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the course. iii) A team of course faculty will visit local governing bodies like Municipal Corporations, Villages, Panchayats, Zilla Parishads, and Panchayat Samitis to assess small-scale technological or engineering needs within their jurisdiction. iv) The team of course instructors will conduct initial field visits to explore various	**CO1**

	tools and templates for data collection, including surveys and measurement equipment. **TLO1.8:** Establish a structured framework for measuring identified attributes, including the development of survey forms and piloting the measurement process. **TLO1.9:** Gain practical experience in conducting fieldwork to gather primary data, such as agricultural output, rainfall, and transportation networks. **TLO1.10:** Develop proficiency in data analysis to draw meaningful conclusions, informing decision-making and solution development processes.	**Reports:** Summarizing Data and Reflections in Reports, Utilizing Various Formats like Tables and Graphs	scenarios and options for student-led fieldwork to assess and quantify different parameters and characteristics. **a) Session I** will introduce the development approach, fieldwork methodology, and the utilization of case studies as instructional tools. **b) Sessions II** - VII will cover topics such as societal dynamics, stakeholder engagement, value creation, establishing metrics, basic analysis, and preliminary reporting. **c) Session VIII** will wrap up the program with feedback collection and assessment. **d) Field Work:** **1. Pilot Visit** - Testing the survey instrument **2. Survey Visit 1** - Gathering data/information Survey. **3. Visit 2**- Further data collection. **4.SummaryVisit-** Concluding activities post-analysis.	
UNIT - II NATIONAL SERVICE SCHEME (NSS) (CL Hrs-03, Marks- NIL)				
2	**TLO2.1:** Enhance communication and leadership abilities to effectively interact with local leaders. **TLO2.2:** Develop proficiency in conducting socio-economic surveys using appropriate data collection techniques and analysis methods to understand community needs. **TLO2.3:** Identify suitable villages and devise activity	2.1 Engaging with Village/Area 2.2 Conducting initial socio-economic surveys in nearby villages. 2.3 Selecting villages for adoption and initiating project activities. 2.4 Conducting thorough socio-economic surveys in the adopted village or area. 2.5 Identifying key issues and challenges within the community. 2.6 Raising awareness about advancements in agriculture, watershed management, wasteland reclamation, renewable energy,	Considering the unit design, it's vital to consider the following factors during the implementation of the unit: i) Organize students into smaller groups of 5-6 members to carry out fieldwork within the larger cohort. ii) Allocate multiple student groups evenly among all faculty members involved in the	**CO2**

	plans based on community needs and available resources. **TLO2.4:** Analyze survey findings to discern socio-economic patterns, obstacles, and potential avenues for progress. **TLO2.5:**Prioritize community issues according to their significance and impact on community welfare. **TLO2.6:** Communicate information on agriculture, watershed management, renewable energy, housing, sanitation, nutrition, and hygiene effectively. **TLO2.7:** Cultivate networking and advocacy skills to foster collaboration among government agencies, development organizations, and the community.	affordable housing, sanitation, nutrition, and personal hygiene. Also, informing about skill enhancement programs, income generation opportunities, government initiatives, legal aid, consumer rights, and related topics. 2.7 Facilitating collaboration between the government and development agencies to implement various schemes in the adopted village or slum.	course. iii) Before selecting a village or slum for NSS activities, it's advisable for teachers to conduct an initial visit. iv)The selected area should have a dense population. iv)Community members should exhibit a willingness to improve their living conditions and actively engage in projects initiated by the NSS for their benefit. vi) NSS units should avoid areas with a history of political conflicts. vii) The chosen area should be conveniently accessible for NSS volunteers to conduct regular visits to the slums.	
UNIT - III UNIVERSAL HUMAN VALUES (CL Hrs-03, Marks- NIL)				
3	**TL03.1:** Apply love and compassion to promote harmony and well-being. **TL03.2:** Demonstrate honesty and transparency to build trust and authenticity. **TL03.3:** Utilize non-violent approaches to resolve conflicts and enhance empathy. **TL03.4:** Align actions with moral principles to promote justice and fairness. **TL03.5:** Employ peace-building strategies for harmony and reconciliation. **TL03.6:** Engage in acts of service to cultivate empathy and social responsibility. **TL03.7:** Prioritize others' needs to foster altruism and	**4.1 Exploring Love and Compassion (Prem and Karuna):** Learning about and embodying the principles of love and compassion in daily life. **4.2 Embracing Truth (Satya):** Understanding the significance of truthfulness and integrating it into one's actions and interactions. **4.3 Embracing Non-Violence (Ahimsa):** Understanding the importance of non-violence and applying it in personal and societal contexts. **4.4 Upholding Righteousness (Dharma):** Exploring the concept of righteousness and practising it through ethical conduct and moral values. **4.5 Cultivating Peace (Shanti):** Reflecting on the	Proposed Learning Approaches for: i) Lecture Delivery ii) Demonstrations iii) Case Studies iv)Role-playing exercises v)Observational Learning vi)Portfolio Development vii) Simulations viii) Inspirational Talks from Industry Professionals ix) On-site Visits to sites or Industries	**CO3**

	generosity. **TL03.8:** Exhibit behaviours that uphold gender equality and respect for diversity to create an inclusive	essence of peace and cultivating inner tranquillity while promoting harmony in relationships and communities. **4.6 Embracing Service (Seva):** Understanding the value of selfless service and actively engaging in acts of kindness and support for others. **4.7 Embracing Renunciation (Sacrifice) Tyaga:** Understanding the concept of renunciation and willingly **letting go of self-interest for the greater good. and attitudes.** **4.8 Promoting Gender Equality and Sensitivity:** Recognizing the importance of gender equality and fostering an environment of inclusivity and respect for all genders through actions and attitudes.		
UNIT - IV VALUE EDUCATION (UNNATI FOUNDATION) (CL Hrs-03, Marks- NIL)				
4	**TLO4.1:** Display comprehension of one's own identity, values, and beliefs. **TLO4.2:** Recognize and express personal strengths and weaknesses effectively. **TLO4.3:**Demonstrate adeptness in active listening by providing feedback and demonstrating empathy. **TLO4.4:**Acquire strategies for handling conflicts constructively and respectfully. **TLO4.5:** Assess and reflect on moral values and principles that influence personal actions and choices. **TLO4.6:** Analyze and assess the moral values and principles guiding individual actions and decisions.	**4.1. Self-awareness and Personal Development** Self-understanding, Identification of strengths and weaknesses, Setting goals and devising plans, Building self-esteem and confidence **4.2.Interpersonal Skills and Effective Communication** Engaging in active listening, Resolving conflicts, Cultivating healthy relationships **4.3. Ethics and Morality** Grasping ethical concepts, Upholding moral values and principles, Making ethical decisions, Demonstrating integrity and honesty **4.4. Social Values and Responsibility** Being punctual and initiating conversation, Managing emotions effectively, Introducing oneself and others, Maintaining a positive attitude Valuing family bonds, Creating	i)Video Demonstrations ii)Flipped Learning Environment iii) Case Studies iv)Role-playing Activities v)Group-based Learning vi)Team-based Learning vii)Utilization of Chalkboard	**CO4**

		favourable impressions, Communicating effectively, Emphasizing cleanliness, hygiene, and organization. Expressing preferences, Fostering confidence Enhancing listening skills, Demonstrating appropriate greetings, Promoting gender equality and sensitivity, Exercising responsibility, Integrating visual and verbal learning, Establishing and pursuing goals, Observing social media etiquette, Efficiently managing time and daily routines		
UNIT - V FINANCIAL LITERACY(CL Hrs-03, Marks- NIL)				
5	**TLO5.1:**Comprehending Savings and Investment Practices. **TLO5.2:**Cultivating Proficiency in Financial Planning. **TLO 5.3:**Developing Competence in Transaction Handling. **TLO5.4:**Achieving Proficiency in Income, Spending, and Budget Management. **TLO 5.5:**Attaining Understanding of Inflation Concepts. **TLO 5.6:** Fostering Competence in Loan Administration. **TLO5.7:** Acknowledging the Significance of Insurance.	**5.1. Fundamentals of Finances:** Grasping concepts of income, expenses, and savings, Employing budgeting techniques, Understanding assets and liabilities, and Recognizing the significance of emergency funds. **5.2. Banking Essentials** Initiating and managing bank accounts, Familiarizing oneself with various account types (savings, checking, etc.), Comprehending interest rates, and Safely utilizing ATMs. **5.3. Management of Credit and Debt** Interpreting credit scores and reports, Identifying different credit types (credit cards, loans, etc.), Responsible debt management, and Preventing involvement in predatory lending. **5.4. Foundations of Investment** Understanding investment types (stocks, bonds, mutual funds, etc.), Assessing risk and return, Implementing diversification strategies, and Formulating investment approaches. **5.5. Financial Planning and Goal Establishment** Establishing financial objectives, Crafting a personalized financial blueprint, Continuously monitoring and adjusting financial goals, and	i) Video Demonstrations ii) Presentations iii) Case Studies iv) Chalkboard Utilization v) Collaborative Learning	**CO5**

		Engaging in long-term financial strategizing. **5.6. Consumer Rights and Duties** Familiarizing oneself with consumer entitlements, Safeguarding against financial scams and fraudulent activities Exercising responsible borrowing and spending practices, Upholding financial privacy and security measures. **5.7. Essentials of Insurance** Exploring different insurance categories (health, life, auto, home, etc.), Understanding insurance policy specifics, Recognizing the importance of insurance coverage, and Navigating the insurance claims process. **5.8. Economic Literacy** Grasping fundamental economic principles, Understanding the concepts of inflation and deflation, Analyzing market trends, and Interpreting economic indicators.		

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLOI.1.1:** Communicating and interacting with residents or children with compassion and empathy, demonstrating an understanding of their needs and emotions.	1.1 Encouraging empathy and kindness through volunteer work at: i) a nearby nursing home ii)a care centre for children from disadvantaged families or similar types of facilities.	2	CO3
2	**LLO 2.1** Enhance goal-setting abilities by engaging in collaborative planning, analyzing obstacles, and reflecting on personal aspirations to align them with broader academic or career goals.	2.1 Pathway to Success: Goal-Setting Exercise	2	CO4
3	**LLO3.1:** Develop effective communication skills by demonstrating compassion, empathy, and understanding towards residents or children, while acknowledging and addressing their needs and emotions.	3.1 Exploring Your Inner World: Self-Reflection Activity	2	CO4

4	**LLO4.1:** Laboratory Learning Outcome: Cultivate structured self-reflection skills to assess personal strengths and weaknesses.	4.1 Strengths and Weaknesses Identification and Analysis Exercise	2	CO4
5	**LLO 5.1:** Display proficiency in time management through the creation and adherence to structured timelines for task coordination.	5.1 Time Management Simulation for Coordinating Industrial Visits	2	CO4
6	**LLO 6.1**: Demonstrate competency in social media etiquette through engaging in activities and adhering to established norms and guidelines.	6.1 Activity on Social Media Etiquette	2	CO4
7	**LLO 7.1:** Develop skills in mapping and analyzing family income and expenses through structured exercises.	7.1. Exercise on Mapping and Analyzing Family Income and Expenses	2	CO5
8	**LLO 8.1**: Apply their knowledge of interest rate calculation to real-world financial situations, improving decision-making skills.	8.1 Exploring Simple and Compound Interest: A Hands-On Exercise on Interest Rate Calculation and Its Impact on Savings and Loans.	2	CO5
9	**LLO9.1:** Enhance comprehension of interest rates and their impact on financial dealings, encompassing savings accounts, Fixed Deposits (FDs), and loans.	9.1 Interest Rate Comparison Exercise: Analyzing Rates for Savings, Fixed Deposits, and Loans.	2	CO5
10	**LLO10.1:** Mastering and implementing safety protocols for ensuring secure ATM transactions.	10.1 Safety Precautions for ATM Usage: Exploring Tips for Secure Transactions	2	CO5

Note: Out of the above suggestive LLOs –

1. A judicial mix of LLOs is to be performed to achieve the desired outcomes

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

SELF-LEARNING - MICRO PROJECT/ASSIGNMENT/ACTIVITIES (ANYONE)

The following list provides examples of activities that can be pursued under the program. Each group has the flexibility to choose from these options or undertake any other activity deemed suitable based on local requirements. The group focuses on the holistic development of the selected area, whether it is a village or a slum.

a) Community clean-up drives

Group tasks for community clean-up drives are,

1. Site Survey and Planning: Identify areas needing attention and plan tasks.
2. Logistics Management: Coordinate supply distribution to volunteers.

3. Volunteer Coordination: Welcome, register, and assign tasks to volunteers.
4. Trash Collection and Segregation: Collect and sort waste into categories.
5. Street Sweeping and Cleaning: Sweep and clean streets, sidewalks, and public areas.
6. Beautification and Landscaping: Enhance aesthetics by planting and trimming.
7. Safety and First Aid: Ensure volunteer safety and manage emergencies.
8. Documentation and Reporting: Capture progress through photos and reports.
9. Community Engagement: Educate and raise awareness among residents.
10. Post-Clean-up Evaluation: Review success and plan future initiatives.

b) Tree plantation initiatives

Group tasks for Tree plantation initiatives,

1. Community Awareness: Workshops to educate on tree benefits.
2. Community Participation: Engage locals in all planting
3. Team Building: Group activities to strengthen community bonds.
4. Leadership Development: Empower individuals to lead initiatives.
5. Communication Workshops: Enhance effective messaging.
6. Problem-solving Discussions: Address planting challenges.
7. Environmental Responsibility: Foster care for green spaces.
8. Cultural Integration: Incorporate local traditions into initiatives.
9. Sustainability Education: Teach sustainable planting practices.
10. Monitoring and Evaluation: Assess impact and plan improvements.

c) Environmental conservation awareness

Group tasks for Environmental conservation awareness

1. Educational Workshops: Teach about conservation methods.
2. Art Competitions: Promote environmental themes through art.
3. Street Plays: Perform interactive skits in public spaces.
4. Awareness Walks: Organize marches with environmental messages.
5. Tree Plantation: Plant trees to enhance green spaces.
6. Clean-up Campaigns: Remove litter from local areas.
7. Guest Lectures: Invite experts to discuss environmental issues.
8. Film Screenings: Show documentaries on conservation topics.
9. Social Media Campaigns: Spread awareness through online platforms.
10. Community Workshops: Educate on waste management and sustainability.

d) Health and sanitation programs

1. Health Education Sessions: Conduct informative sessions on hygiene, disease prevention, and nutrition.
2. Sanitation Infrastructure Evaluation: Assess the effectiveness of existing sanitation facilities and propose improvements.
3. Community Clean-up Events: Organize collective efforts to clean and maintain public spaces for better health outcomes.
4. Distribution of Hygiene Kits: Provide essential hygiene items such as soap, toothpaste, and sanitary products to community members.
5. Vaccination Drives: Coordinate vaccination campaigns to protect against prevalent diseases and promote community health.

6. Water Quality Testing: Conduct regular testing of water sources to ensure safe drinking water for residents.
8. Personal Hygiene Workshops: Offer workshops focusing on personal grooming, handwashing techniques, and menstrual hygiene.
9. First Aid Training: Provide basic first aid training to community members to equip them with life-saving skills.
10. Community Health Surveys: Conduct surveys to assess health needs and gather feedback for future program planning.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications	Relevant LLO Number
1	Basic engineering measurement instruments, GPS data collection devices, and open-sour GIS software like Google Earth and QGIS, along with the Microsoft Office suite.	ALL

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

NOT APPLICABLE

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self- Learning (Assignment)	--

X. SUGGESTED COS- POS MATRIX FORM

NOT APPLICABLE

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Mark Stafford Smith and Pamela Matson	Sustainable Development: Principles, Frameworks, and Case Studies	Oxford University Press, ISBN: 9780199588952
2	Katar Singh	Rural Development: Principles, Policies and Management	SAGE Publications Pvt. Ltd, ISBN:978-9351502867.
3	Anand Kumar, Asim Kumar Mandal, and R. Venkata Rao	Maharashtra: Governance and Development"	Routledge India, ISBN: 978-0367709133
4	Dalai Lama and Howard C. Cutler	The Art of Happiness	Riverhead Books, and the ISBN: 978-1594488894.
5	Stephen R. Covey	The 7 Habits of Highly Effective People	Simon & Schuster, ISBN : 978-1982137274.

6	Local college students, UMA staff	Sample Case Studies on the UMA website	IITB-UMA team

XI. LEARNING WEBSITES & PORTALS

Sr.No.	Link/Portal	Description
1	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skills. Unit 4 i.e. Course 4 is to be referred
2	https://nss.gov.in/	The National Service Scheme (NSS) website provides information about the NSS program in India. It includes details about the objectives, history, and structure of NSS. Additionally, the website offers resources for NSS volunteers and coordinators, such as program guidelines, training materials, and reports.
3	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
4	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
5	https://www.humanvaluesfoundation.com/.	The Human Values Foundation website offers educators resources for teaching human values and social-emotional learning to children and youth. It provides curriculum-based programs, lesson plans, and activities to foster character development, resilience, and positive behaviour. Additionally, the website shares insights into the foundation's mission, values, and the global impact of its programs in schools.

Name & Signature:

Mr. S.B.Kulkarni
Lecturer in Mechanical Engineering
(Course Experts)

Name & Signature:	Name & Signature:
Dr.D.N.Rewadkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN INFORMATION TECHNOLOGY
PROGRAMME CODE	07
COURSE TITLE	DATA COMMUNICATION AND NETWORKING
COURSE CODE	IT31203
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
IT31203	DATA COMMUNICATION AND NETWORKING	DSC	3	--	4	1	8	4	3	30	70	100	40	25	10	25 @	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

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

Legends: @-Internal Assessment, # - External Assessment,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Data communication is the transmission of digital data through a network or to a device external to the sending device. It is the basis of modern Computer networks, which is growing with rapid technological progress. Computer communication through networking becomes essential part of our life. The Information technology diploma pass outs are required to handle the data communication related problems. By considering importance of concepts and techniques related to data communication and networking enable students to have an insight in to technology involved to make the network

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1 Set up a small network using various transmission media.
- CO2 Describe various Analog and Digital signal transmissions.
- CO3 Identify various Multiplexing and Switching techniques in digital communication.
- CO4 Describe error detection and correction techniques.

CO5 Describe various internetworking devices and TCP/IP protocol suits.
CO6 Describe various IEEE wireless standards

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		SECTION I		
		UNIT 1. INTRODUCTION TO DATA COMMUNICATION AND NETWORKING (CL Hrs- 06, Marks-10)		
1	**TLO1.1** Describe the data communication process and its components. **TLO1.2** Enlist various categories of networks. **TLO1.3** Describe different modes of data transmission **TLO1.4** Describe various Network Models	**1.1** Data communication process and its components: Transmitter, Receiver, Medium, Message, Protocol. **1.2** Data Representation: Text, Image, Numbers, Video. **1.3** Categories of Networks. LAN, MAN, WAN. **1.4** Communication Media: Guided Transmission Media, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable. **1.5** Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite. **1.6** Line-of-Sight Transmission, Point to Point, Broadcast. **1.7** Modes of Communication: Simplex, Half duplex, Full Duplex. **1.8** Protocols and Standards	Hands-on Demonstration Presentations	**CO1**
		UNIT 2: SIGNAL TRANSMISSION & CONVERSION (CL Hrs- 08, Marks-12)		
2	**TLO2.1** Explain Various Transmission Impairments **TLO2.2** Describe various coding schemes **TLO2.3** State various network performance criteria **TLO2.4**Compare ASK, FSK, PSK	2.1 Analog and Digital Data: Analog Signal and Digital Signal, Periodic and non-periodic signals. 2.2 Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency domain, Composite Signals, Bandwidth. 2.3 Digital Signals: Bit Rate, Bit Length, 2.4 Transmission Impairment: Attenuation, Distortion, Noise. 2.4 Performance: Bandwidth, Throughput, Latency.	Hands-on Demonstration Presentations	**CO2**
		UNIT 3: MULTIPLEXING & SWITCHING (CL Hrs- 08, Marks-14)		
3	**TLO3.1** Describe types of Multiplexing **TLO3.2** Describe Spread Spectrum Technique **TLO3.3** Compare various Switching techniques	3.1 THE OSI MODEL: Layered Architecture, Layers in OSI Model. 3.2 Multiplexing: Introduction, Categories of Multiplexing: Frequency- Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing. 3.3 Spread Spectrum: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS). 3.4 Switching: Circuit-switched networks, Datagram networks, Virtual-circuit networks.	Hands-on Demonstration Presentations	**CO3**

		SECTION II		
		UNIT 4:ERROR DETECTION, CORRECTION AND OSI MODEL(CL Hrs- 08, Marks-12)		
4	TLO 4.1 Identify the major functions of the OSI Reference Model. TLO4.2 Describe Error detection and correction methods with examples. TLO4.3 Describe the process of fixed and variable types of Framing. TLO4. Identify characteristics of the flow control technique	4.1 Types of Errors, Forward Error Correction Versus Retransmission. 4.2 Error Detection: Repetition codes,Parity bits, Checksums, CRC. 4.3 Error Correction: Automatic repeat request (ARQ), Error-correcting code. 4.4 Framing: Fixed-Size Framing, Variable-Size Framing. 4.5 Flow and error control techniques: stop and wait, sliding window, Go-back-n ARQ, Selective Reject ARQ.	Hands-on Demonstration Presentations	
		UNIT 5: NETWORKING PROTOCOL AND INTERNETWORKING BASICS (CL Hrs- 09, Marks-12)		
5	**TLO 5.1** Describe the TCP/IP protocol suite. **TLO 5.2** Describe IPV4 and IPV6 packet format. **TLO 5.3** List and explain classes of IP address. **TLO 5.4** Identify problems in internetworking. **TLO 5.5** Describe given networking devices.	5.1 TCP/IP PROTOCOL SUITE, IPv4, IPv6. Addressing: physical addresses, logical addresses, port addresses, and specific Addresses. 5.1 IPv4 Addresses: Addresses, Notations, Classless, Classful, NAT. 5.2 IPv6 Addresses: Structure, Address Space. 5.3 Internetworking, Problems in Internetworking, internetworking Devices, Repeaters, Bridges, Routers, Gateways.	Hands-on Demonstration Presentations	**CO5**
		UNIT 6: WIRELESS COMMUNICATION (CL Hrs- 06, Marks-10)		
6.	**TLO 6.1** Illustrate the given IEEE standard of communication. **TLO 6.2** Identify the Characteristics of a given layer in IEEE 802.11 Architecture **TLO 6.3** Identify the Characteristics of a given layer in Bluetooth architecture **TLO 6.4** Compare Functional/Operating Parameters and Different Generations of Mobile Telephone Systems.	6.1 IEEE Standards. 6.2 Wireless LANs: 802.11 Architecture, MAC Sublayer, Addressing Mechanism. 6.3 Bluetooth Architecture, Bluetooth Layers, Radio Layer. 6.4 The Mobile Telephone System, First-Generation: Analog Voice, Second-Generation: Digital Voice, Third-Generation: Digital Voice and Data. 6.5 4G & VoLTE: Introduction to 4G and VoLTE, Features of 4G and VoLTE, Introduction to 5G technology.	Hands-on Demonstration Presentations	**CO6**

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.1:** Identify the type and use of transmission media. LLO 1.2:List characteristics of guided and unguided media.	Demonstrate various transmission media.	04	CO1
2	**LLO 2.1:** Design a network for a small organization with components to be used.	Observe components of the network in your network laboratory and state their specifications like transmission media and network control devices	04	CO1
3	**LLO 3.1**: Identify the physical topology and cabling (coaxial, OFC, UTP, STP) of a network.	Recognize the physical topology and cabling of a network.	04	CO1
4	**LLO 4.1:** Identify and use of various types of connectors RJ-45, RJ-11, BNC, and SCST.	Recognition and use of various types of connectors .	04	
5	**LLO 5.1**: Observeserial communication between two devices.	Demonstrate RS232 standard.	04	CO2
6	**LLO 6.1:** Set up a LAN cable with RJ 45 crimped on both ends.	Prepare and Test Straight and Cross UTP Cable.	04	CO2
7	**LLO 7.1:** Crate layout of a network depending on building structure and given topology.	Designing the layout of a Network for small organizations. 1. Deciding upon the type of network, Floor designing/ building designing 2. Deciding upon the number/ length of components	04	CO3
8	**LLO 8.1**: Install and configure the Telnet client-server environment.	Configure and use Telnet Client-server.	04	CO4
9	**LLO 9.1:** Execute TCP/IPcommands and observe the output.	Run the following TCP/IP commands with options and record their output: Arp, rarp, ipconfig, ping, tracert.	04	CO4
10	**LLO 10.1:** Locate the network interface card attached to the CPU and list the properties.	Install and Configure the Network Interface Card and identify its MAC address	04	CO5
11	**LLO 11.1:** Connect two machines inthe same network and transfer files and other resources.	Share Files/Folders and Printers in the network and access the resources from other nodes.	04	CO5
12	**LLO 12.1:** Install and configure theFTP client-server environment.	Set up FTP client-server and transfer the file using FTP.	04	CO6
13	**LLO 131:** Use Packet sniffer software to capture FTP packet details.	Use Wireshark Packet Sniffer Software and capture TCP, IP, UDP, ARP, ICMP, Telnet, and FTP packets.	04	CO5

14	**LLO 14.1:** Create and configure Subnet.	Create two subnets and implement them with calculated subnet masking.	04	CO5
15	**LLO 15.1:** Configuring DHCP and DNS server.	Configuring Dynamic Host configuration protocol and Domain Name system server.	04	CO6

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

Self-Learning

1. Design and set up a network using star /ring/bus topologies.
2. Case studies on topics given by respective faculty teaching the course.
3. Install and Configure Network Interface Card, connect 2 or 3 machines in the network using a workgroup. Then share files among these computers.
4. Configure telnet and execute all commands with options and in different operating modes.
5. Prepare an animation clip of at least 10 minutes on Transmission Media/Signal Transmission/Multiplexing/Switching/Error detection and Correction/Packet flow in the TCP/IP protocol suite. (And many other Topics given by respective faculty teaching the course.
6. Prepare charts, comparison tables or models on the topics given by the respective faculty teaching the course.

Assignment

Prepare a journal of practicals performed in the laboratory.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Desktop PC with Windows 7 or higher version, LAN Tester, Cat6 cables, NIC Card, Crimping tool	ALL

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

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	INTRODUCTION TO DATA COMMUNICATION AND NETWORKING	CO1	06	05	05	--	10
2	II	SIGNAL TRANSMISSION & CONVERSION	CO2	08	04	04	04	12
3	III	MULTIPLEXING & SWITCHING	CO3	08	06	04	04	14
4	IV	ERROR DETECTION, CORRECTION AND OSI MODEL	CO4	08	02	04	06	12
5	V	NETWORKING PROTOCOL AND INTERNETWORKING BASICS	CO5	09	04	04	04	12
6	VI	WIRELESS COMMUNICATION	CO6	06	05	05	--	10
		Grand Total		45	26	26	18	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

X. SUGGESTED COS- POS MATRIX FORM

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

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Behroz A. Forouzan	Data Communication and Networking	McGraw Hill; Standard Edition (3 August 2022) ISBN : 9355320949
2	Andrew Tanenbaum	Computer Network	Pearson Education; Sixth edition (1 April 2022) ISBN : 935606360
3	William Stallings	Data and Computer Communications	Pearson Prentice Hall Pearson Education,Inc ISBN: 0132433109
4	William Stallings	Wireless Communications and Networking	Prentice Hall, 2002 ISBN: 0130408646
5	William D. Stanley	Digital Signal Processing	Reston Publishing Company, ISBN: 879091991

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	www.nptelvideos.in/2012/11/data-communication.html	Introduction to data Communication, Components, Types of network,Topologies
2	http://www.tutorial-reports.com/wireless/wlanwifi/wifi_architecture.php	Wireless LAN 802.11, Architecture, Types
3	www.tutorialspoint.com/data_communication_computer_network	Line and block codes, Multiplexing and Demultiplexing

Name & Signature: **Mrs. V. M. Khanapure** Lecturer in Information Technology	**Mrs.S. P. Dudhe** Lecturer in Information Technology
(Course Experts)	
Name & Signature: **Dr.D.N.Rewadkar** (Programme Head)	Name & Signature: **Shri.S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN INFORMATION TECHNOLOGY**
PROGRAMME CODE	**07**
COURSE TITLE	**SOFTWARE ENGINEERING AND TESTING**
COURSE CODE	**IT41201**
PREREQUISITE COURSE CODE & TITLE	**NA**
CLASS DECLARATION	**NO**

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration in Hrs.	Theory			Based on LL & TSL.		Based on SL		Total Marks		
													Practical						
			CL	TL	LL					FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA				
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
IT41201	SOFTWARE ENGINEERING AND TESTING	DSC	3	1	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

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

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

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

The main objective of this course is to introduce the students to software engineering- the fundamentals of software engineering principles and practices, including project management, configurations management, requirements definition, system analysis, design, testing, and deployment.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Identify relevant software process model for software development.

CO2: Prepare appropriate Software Requirement Specifications.

CO3: Use Software modeling to create data designs with effective use of UML tools..

CO4: Estimate the size and cost of the Software Project.

CO5: Identify and handle risk management and software configuration management

CO6: Apply different software testing types to ensure the quality of software product.

IV.THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I INTRODUCTION TO SOFTWARE ENGINEERING (CL Hrs-8, Marks-10)			
1.	TLO 1.1: Define Software. TLO 1.2: Explain the process framework. TLO 1.3: Describe the prescriptive process models. TLO 1.4: Suggest the relevant activities in the Agile Development process in the given situation with justification.	1.1: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. 1.2 Software Process: A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement. 1.3 Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models 1.4 Agile Process Model: Extreme Programming, Adaptive Software Development (ASD), Scrum, dynamic System development method (DSDM), CRYSTAL.	Hands-on Demonstration Presentations.	CO1
	UNIT-II SOFTWARE REQUIREMENTS ENGINEERING AND ANALYSIS (CL Hrs-8 Marks-12)			
2	TLO 2.1: Apply the principles of Software engineering to the given situation problem. TLO 2.2: Choose the relevant requirement engineering steps in the given problem. TLO 2.3: Represent the requirement engineering model in the given problem TLO 2.4: Prepare SRS for the given problem	2.1 Software Engineering practices and importance. 2.2 Communication Practices, Planning Practices, Modelling practices construction practices, and software deployment (statement and meaning of each principle for each practice). 2.3 Requirement Engineering: Requirement Gathering and Analysis, types of requirements(functional, products, organizational, external requirements), Eliciting Requirements, Building requirements negotiation, Validation. 2.4 Software Requirement Specification: Need of SRS, format, and its characteristics.	Hands-on Demonstration Presentations	CO2
	UNIT-III DESIGN ENGINEERING (CL Hrs-8, Marks-12)			
3	TLO 3.1: Explain software quality guidelines and attributes. TLO 3.2 Describe the design concepts. TLO 3.3: Explain different design elements. TLO 3.4: Understand software architecture.	3.1: Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes. 3.2 Design Concepts-Abstraction, Architecture, Design Patterns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, 3.3 Design Classes, The Design Model, Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Component Level Design for Web Apps, Content Design at the Component	Hands-on Demonstration Presentations	CO3

		Level, Functional Design at the Component Level, Deployment-Level Design Elements 3.4 Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A Brief Taxonomy of Architectural Styles.		
UNIT-IV PROJECT MANAGEMENT AND ESTIMATION (CL Hrs-7, Marks-12)				
4	**TLO 4.1:** Explain 4P's in Management Spectrum **TLO 4.2:** Estimate the size of the software product using the given method **TLO 4.3:** Estimate the cost of the software product using the given method. **TLO 4.4:** Evaluate the size of the given software using the COCOMO model. **TLO 4.5:** Apply the RMMM strategy to identified risks for the given software development problem.	4.1The management spectrum-4p's 4.2Metrics for size Estimation: Line of Code (LoC), Function Points (FP). 4.3 Project Cost Estimation Approaches using COCOMO (Constructive Cost Model), COCOMO II. 4.4 Overview of Heuristic, Analytical and Empirical Estimation. 4.5 Define risk, types of risk, RMMM strategy.	Hands-on Demonstration Presentations	**CO4**
UNIT –V PROJECT SCHEDULING & QUALITY ASSURANCE(CL Hrs-8, Marks-14)				
5	**TLO 5.1.** Use the given scheduling technique for the identified project. **TLO 5.2** Draw the activity network for the given task. **TLO 5.3** Prepare the timeline chart/Gantt chart to track the progress of the given project. **TLO 5.4** Describe the given software Quality Assurance (SQA) activity **TLO 5.5** Describe the feature of the given software quality evaluation standard **TLO 5.6** Explain Software Configuration Management	5.1 Project scheduling: Basic Principles Work breakdown structure, activity network and Critical Path Method 'scheduling techniques (CPM, PERT). 5.2 Project tracking: Timeline charts, Gantt charts 5.3 Quality Assurance: Quality concepts, Phases of SQA: Planning, activities, audit, reviews. 5.4 Defect amplification and removal: Formal technical reviews, the review meeting, Review reporting and record keeping. 5.5 Quality Evaluation standards: Six Sigma, ISO for software, CMMI: Levels, Process areas. 5.6 Software Configuration Management: Software Configuration Management, The SCM Repository ,The SCM Process, Configuration Management for any suitable software system.	Hands-on Demonstration Presentations	**CO5**

UNIT –VI BASICS OF SOFTWARE TESTING(CL Hrs-6, Marks-10)				
6	**TLO 6.1** State the importance of software testing. **TLO 6.2** Identify errors and bugs in the program. **TLO 6.3** Prepare test case for the application. **TLO 6.4** Identify the entry and exit criteria for the given test application. **TLO 6.5** Describe features of the given testing method. **TLO 6.6** Apply specified testing levels for the given application	**6.1** Software testing, objective of testing, software testing life cycle (STLC) **6.2** Failure, fault, error, defect, bug terminology **6.3** Test case, when to start and stop testing **6.4** Static and dynamic testing **6.5** The box approaches: Compare white box testing, black box testing **6.6** Levels of testing: Unit testing, integration testing, system testing, acceptance testing	Hands-on Demonstration Presentations	**CO6**

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.1:** Write the problem statement for the selected project.	Write problem statements to define the project title with a bounded scope of the project	2	CO1
2	**LLO 2.1:** Study SRS format.	Write SRS for the selected project statement.	2	CO2
3	**LLO 3.1:** Draw the ER Diagram	Develop data design using DFD, Decision Table & ER (Entity Relationship) Diagram.	4	CO3
4	**LLO 4.1:** Understand the design of Biometric Authentication software	Study design of Biometric Authentication software	4	CO3
5	**LLO 5.1:** Prepare RMMM plan	Identify the risk involved in the project and prepare RMMM plan.	4	CO4
6	**LLO 6.1:** Understand Risk Management in food delivery software.	Study Risk management in Food delivery software	2	CO4
7	**LLO 7.1:** Implement a CPM/PERT chart for a given problem.	Use CPM/PERT for scheduling the assigned project.	4	CO5
8	**LLO 8.1:** Implement a Timeline/Gantt chart for a given problem.	Use a Timeline chart or Gantt chart to track the progress of the project.	2	CO5
9	**LLO 9.1:** Prepare SQA plan.	Prepare SQA plan that facilitates various attributes of quality for process & product.	2	CO5

10	**LLO 10.1:** Design test cases for Web Page Testing for any Web Site.	Prepare test case for any Web Application	4	CO6
11	**LLO 11.1:** Execute test cases for any e-commerce application login form using an Automation Tool.	Prepare test case for any Automation Tool	2	CO6

Note: Out of the above suggestive LLOs –

1.'*' Marked Practicals (LLOs) Are mandatory.

2.A judicial mix of LLOs is to be performed to achieve the desired outcomes

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

MICRO PROJECT

1. Design a system for students to enroll in courses, demonstrating use-case diagrams and design patterns
2. Create a design blueprint for managing orders, payments, and inventory using UML diagrams.
3. Visit any restaurant, collect requirements from manager and prepare SRS document.
4. Visit your Institute library, Collect the functional requirements for a Library Management System and estimate cost and size of the project
5. Visit any medical shop, gather information about purchasing and selling medicines, maintaining their inventory, generating sales invoices and generating reminders of expiry date about medicines. Write the Functional and non-functional requirements for the medical shop management system.

ASSIGNMENT

Prepare a journal of practicals performed in the laboratory.

OTHER : Any course related to SOFTWARE ENGINEERING AND TESTING from Infosys Spring Board.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Hardware: Personal Computer (i3-i5 preferable), RAM minimum 2 GB.	ALL
2	Operating System: Windows 7/Windows 8/Windows10/Linux or any other.	ALL
3	**Suggested Free Open Source tools:** a) StarUML, Modelio, SmartDraw. b) Gantt Project, Agantty, Project Libre. c) CF Engine Configuration Tool, Puppet Configuration Tool. d) Software Tools : Selenium or any other automation testing tool.	ALL

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Sr. No	Unit	Unit Title	Aligned Cos	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	INTRODUCTION TO SOFTWARE ENGINEERING	CO1	8	2	4	4	10
2	II	SOFTWARE REQUIREMENTS ENGINEERING AND ANALYSIS	CO2	8	2	4	6	12
3	III	DESIGN ENGINEERING	CO3	8	2	4	6	12
4	IV	PROJECT MANAGEMENT & ESTIMATION	CO4	7	2	4	6	12
5	V	PROJECT SCHEDULING & QUALITY ASSURANCE	CO5	8	4	4	6	14
6	VI	BASICS OF SOFTWARE TESTING	CO6	6	2	4	4	10
			Grand Total	45	14	24	32	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment and Seminar/Presentation	Lab. Performance, viva voce

X. SUGGESTED COS- POS MATRIX FORM

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

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1.	Pressman, Roger S.	Software Engineering: A practitioners approach	McGraw Hill Higher Education, New Delhi,(Seventh Edition) ISBN 978-0-07-337597-7
2	Ian Sommerville	Software Engineering	Addison and Wesley, ISBN 0-13-703515-2
3	Naresh Chauhan	Software Testing: Principles and Practices	Oxford University Press Noida. ISBN: 9780198061847
4	Ron Patton	Software Testing	Sams Publishing; 2nd edition, 2005 ISBN: 0672327988
5	M. G. Limaye	Software Testing: Principles, Techniques and Tools	Tata McGraw Hill Education, New Delhi., 2009 ISBN 13: 9780070139909

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/106105087	All Practicals
2	www.tutorialspoint.com//software_engineering/	Software Engineering Tutorial
3	https://www.geeksforgeeks.org/software-testing-basics/	Software Testing Tutorial
4	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842970114113536282 69_shared/overview	Software engineering and testing courses

Name & Signature:

Smt.P.C.Fafat
Lecturer in Information Technology

Mr.Y.U Bodhe
Lecturer in Information Technology

(Course Experts)

Name & Signature:	Name & Signature:
Dr.D.N.Rewadkar (Programme Head)	**Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN INFORMATION TECHNOLOGY
PROGRAMME CODE	07
COURSE TITLE	DATABASE ADMINISTRATION
COURSE CODE	IT51201
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION	YES

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
IT51201	DATABASE ADMINISTRATION	DSE	3	0	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

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

Legends: @-Internal Assessment, # - External Assessment,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

The subject aims to teach students the fundamentals of Database Architecture, Database Creation and Administration, as well as techniques for Database Backup, Recovery and Security. It equips them with the skills necessary to create, manage, design, monitor, execute, and maintain any database system. This course provides essential knowledge for ensuring that database systems remain current and properly maintained.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1 Explain database architecture and its management.
CO2 Design and administer databases effectively.
CO3 Configure and maintain control files and redo log files
CO4 Perform database backup and recovery using the RMAN tool.
CO5 Manage tables, indexes and constraints.
CO6 Create and manage database users.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes(TLO's) aligned to CO's.	Learning content mappedwith TLO's	Suggested Learning Pedagogies	Relevant Cos
	UNIT 1 – Basic of DBA (CL Hrs-06, Marks-12)			
1	**TLO 1.1** Define Responsibilities of DBA **TLO 1.2** Define the purpose of tablespaces and data files **TLO 1.3** Create and Manage Tablespaces. **TLO 1.4** Describe Physical, Logical and memory structure of Oracle database. **TLO 1.5** Plan an Oracle installation	1.1 Responsibility of DBA, Oracle Architectural Components-Overview of Primary Components, Oracle server, Oracle instance, Establishing Connection and creating a session, Oracle Database. 1.2 Database Architecture: Physical Structure- Data File, Control File, Redo log File Memory structure: SGA,PGA, Shared Pool , Database Buffer cache, Redo log buffer, Large Pool , Process Structure –User Process, Background Process, Server Process, Database Writer, Log Writer, SMON , PMON,CKPT, ARCn, Logical Structure- Blocks ,Extents and Segments, Different Types of Segments, Tablespaces 1.3 Database Administrative Tools - Oracle Universal Installer, DBCA, SQL * plus,OEM 1.4 Managing Tablespaces : Types of Tablespaces , Creating , Altering and Dropping Tablespaces	Hands-on Demonstration Presentations	CO1

Unit 2:Oracle Instance and Database Management(CL Hrs. -08, Marks-12)				
2	**TLO 2.1 Create** a database with the Database Configuration Assistant (DBCA) tool. . **TLO 2.2** Create and Manage the database by writing command. **TLO 2.3** Start and stop the Oracle database and components. **TLO 2.3** Modify database initialization parameters.	2.1 Managing an Oracle Instance- Initialization Parameter Files, PFILE, SPFILE, Starting Up a Database. 2.2 Creating Database- Planning & Organizlng database, OFA, Prerequisites necessary for Database creation, Creating Database using DBCA, Creating Database Manually 2.3 Managing database- Alter Database, Opening a Database Restricted Mode and Read Only mode, Shutting down Database using Various Modes	Hands-on Demonstration Presentations	CO2
Unit 3: Control and Redo Log File(CL Hrs-08, Marks-11)				
3	**TLO 3.1** Modify database initialization parameters. **TLO 3.2** Create and Manage Redo Log Files and Control Files. **TLO 3.3** Describe the main concepts and functionality of Automatic Storage Management (ASM) **TLO 3.4** Describe the mechanism of OMF data file	3.1 Control File- Control File Contents, Creating Control File, Multiplexing Control File, Obtaining Control File Information 3.2 Redo Log Files- Structure of Online Redo Log File, Working of Online Redo Log Files , Creating Initial online Redo Log files, Altering Redo Log Files-Adding Online Redo Log File Groups & Members, Dropping Online Redo Log File Groups & Members, Renaming & Clearing Online Redo Log Files 3.3 Oracle Managed Files (OMFs). The mechanism of OMF, OMF Data File 3.4 Automatic Storage Management ASM Architecture, Data Dictionary, Data Dictionary Contents, Usage of Data Dictionary	Hands-on Demonstration Presentations	CO3

Unit 4: Backup & Recovery (CL Hrs-07, Marks-11)				
	TLO 4.1 Identify the types of failure that may occur in Database. TLO 4.2 Backup database without shutting it down. TLO 4.3 Backup database using RMAN tool. TLO 4.4 Recover Database using RMAN tool.	4.1 Database Backup: Factors impacting Backup and Recovery, Need of Database Backup, Different Types of Backup-Logical and physical Backups, Operating System Backup, Cold and Hot backup, Whole & Partial Database Backup,Flash Recovery Area-Benefits, Ways to create Flash Recovery Area, backing Up Flash recovery Area. 4.2 Database Recovery: Types of Database Failure, Different Recovery environment, The Oracle Recovery Process-Crash & Instance Recovery , Media Recovery 4.3 Performing Recovery with RMAN-Recovery Manager, Benefits of RMAN, RMAN Architecture, RMAN's Advantages for Recovery	Hands-on Demonstration Presentations	CO4
Unit 5: Managing Tables, Indexes and Constraints(CL Hrs-09, Marks-14)				
	TLO 5.1 Create and Manage tables. TLO 5.2 Create and manage Indexes on given data. TLO 5.3 Apply different constraints on table to maintain integrity.	5.1Managing Tables: Creating Table, Creating Table Guidelines, Create Table using OEM , Create Temporary table ,Altering Table- Changing Storage and Block utilization parameters, Manually Allocating Extents, Truncating & Dropping Table , Obtaining Table Information 5.2 Managing Index: Classification of Indexes, B-Tree Index, Bitmap index, Creating B-Tree Index & Bitmap Index ,Altering Index- Changing Storage Parameters , Allocating and Deallocating Index Space, Rebuilding Indexes, Checking Index validity, Dropping Index, Obtaining Index Information 5.3 Managing Constraints: Data Integrity, Different Types of Constraints, Primary key constraint, Foreign key constraint, unique constraint, Not Null constraint, Check constraint ,Defining Constraints while creating table, Altering Table ,Constraints- Enabling, Disabling & Renaming Constraints, Dropping Constraints, Obtaining constraint	Hands-on Demonstration Presentations	CO5

		Information		
Unit 6: Managing Users and Security (CL Hrs-07, Marks-10)				
	TLO 6.1 Create and Manage Users in Oracle database **TLO 6.2** Grant and revoke privileges **TLO 6.3** Create and Manage the User Roles **TLO 6.4** Create and manage profiles **TLO 6.5** Implement standard password security features on database.	6.1 Managing User : Creating Users, Altering Users, Dropping Users 6.2 System Privileges and Role: System privileges .Granting System Privileges, Revoking System Privileges, Object Privileges, Granting Object Privileges, Revoking Object Privileges, Obtaining Privileges information, Roles: Benefits of Roles, Creating Roles, Predefined Roles, Modifying Roles, Assigning Roles , Revoking Roles From Users, Removing Roles, Obtaining Role information 6.3 Password Management: Enabling Password Management, Password Account Locking, Creating Profile, Altering Profile, Dropping Profile with password setting 6.4 Auditing: Auditing Guidelines ,Statement Auditing, Schema Object Auditing, Fine Grained Auditing, Obtaining Auditing Information	Hands-on Demonstration Presentations	CO6

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

Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. of Hrs	Relevant COs
1	LLO1.1 Install latest Oracle software	Installation of Oracle Software.	2	1
2	LLO2.1 Identify Oracle Architecture and its Main components	Oracle Architecture and its Main components	2	1
3	LLO 7.1 Create Tablespace LLO 7.2 Manage Tablespace Create Different types of Tablespaces • To Extend the Size of a tablespace • To Decrease the size of a tablespace	Create and Manage Tablespace	2	1

	• Making a Tablespace Read only. • Renaming Tablespaces • Dropping Tablespaces • Change the storage settings of tablespaces • Adding Data files to a Tablespace • Manually resizing data files • Obtaining Tablespace Information			
4	LLO3.1 Design Oracle Database using DBCA	Creation of Oracle Database using DBCA.	2	2
5	LLO 4.1 Create SPFILE and PFILE LLO 4.2 Manage oracle instance	Management of Oracle Instance.	2	2
6	LLO 5.1 Create Control file in Oracle Database LLO 5.2 Maintain Control file in Oracle Database	Create and Maintain Control file in Oracle Database	2	3
7	LLO 6.1 Create Initial Online Redo Log File LLO 6.2 Alter Online Redo log file with adding Groups and Members in it.	Create Initial Online Redo Log File and Alter Online Redo log file with adding Groups and Members in it.	2	3
8	LLO 14.1 Configure RMAN LLO 14.2 Recovery with RMAN	Configure RMAN, Create Backup sets using RMAN and Manage Backup.	2	4
9	LLO 15.1 Recover database with RMAN	Perform Database Recovery with RMAN	2	4

10	LLO 8.1 Create Table LLO 8.2 Create Temporary Tables • Create Table • Create Table using Oracle Enterprise Manager • Create Table with Integrity Constraints • Alter Table • Create Temporary Tables Changing storage and Block Utilization parameters • Reorganize, truncate, drop a table, Drop a column within a table	Managing Tables with Data Integrity	2	5
11	LLO 9.1 Create various types of indexes LLO 9.2 Alter, Drop and show Index Index strcuture	Create and Manage Indexes	2	5
12	LLO 10.1 Create new database Users LLO 10.2 Alter and Drop existing database LLO 10.3 Monitor Information about existing Users. LLO 1.4 Display existing Users Information	Create and Manage Database Users.	2	6
13	LLO 11.1 Grant System and Object Privileges to Users LLO 11.2 Revoke System and Object Privileges from users	Managing Privileges: • Grant System and Object Privileges to Users • Revoke System and Object Privileges from users	2	6
14	LLO 12.1 Creating Profiles LLO 12.2 Altering Profiles	Managing Profiles: • Creating Profiles • Altering Profiles • Dropping Profiles	2	6

15	LLO 13.1 Create and modify Roles LLO 13.2 Control availability of Roles • Create and modify Roles • Enabling and Disabling Roles • Control availability of Roles • Removing Roles • Display Role Information	Managing Roles-	2	

NOTE: Practicals should be performed on any latest version of database software. Example: Oracle 11g and above, Sql Server and Mysql

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

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. 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. (Affective Domain Outcomes). Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission. 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:

MICRO PROJECT

Develop and maintain database for Employee Attendance System
Develop and maintain database for tracking patient history in a healthcare system.
Develop and maintain database for tracking issued and pending books in a library.

ASSIGNMENT:

Assignments covering all COs

OTHER:

Any course related to Database Administration from Infosys Springboard.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr.No.
1	Computer System.	All
2	Any Database Software.	All

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

Unit	Unit Title	Aligned Cos	Learning Hours	R Level	U Level	A Level	Total marks
01	Basic of the DBA	CO1	6	04	04	04	12
02	Managing an Oracle Instance AND Database	CO2	8	04	04	04	12
03	Maintaining Control and Redo Log files AND Storage Management	CO3	8	04	03	04	11
04	Overview of Backup & Recovery	CO4	7	04	03	04	11
05	Managing Tables, Indexes and Data Integrity	CO5	9	04	04	06	14
06	Database Security & Auditing	CO6	7	04	02	04	10

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Each Practical will be assessed considering 60% weightage to the process, 40% weightage to the product.	End Semester Exam based on Practical performance and Viva-voce.

X. SUGGESTED COS- POS MATRIX FORM

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

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Oracle Database Database Administrator's Guide, 19c	Oracle	
2	Oracle 9i:DBA Fundamentals	Oracle Education-Tutorialpoints	
3	Oracle 9i : Expert publication	APress	1590590228

Sr. No.	Link/Portal
1	https://docs.oracle.com/en/database/oracle/oracle-database/19/admin/toc.htm
2	https://www.oracletutorial.com/oracle-administration/

Name & Signature:

Smt.A.D.Kshirsagar
Lecturer in Information Technology

Smt.S.D.Raut
Lecturer in Information Technology

(Course Experts)

Name & Signature:

Dr. D A Rewadkar
(Programme Head)

Name & Signature:

(CDC In-charge)
G P Pune

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN INFORMATION TECHNOLOGY
PROGRAMME CODE	07
COURSE TITLE	DIGITAL FORENSICS AND ETHICAL HACKING
COURSE CODE	IT51202
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION	YES

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		Total Marks
														Practical						
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
IT51202	DIGITAL FORENSICS AND ETHICAL HACKING	DSE	3	0	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Term: 0 Hrs

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

Legends: @-Internal Assessment, # - External Assessment,*# - Online Examination,@S - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Digital forensic investigation is crucial for detecting and analyzing digital crimes. It involves preserving, identifying, analyzing, and reporting digital evidence stored on magnetically encoded media. This hidden data can only be accessed using specialized forensic tools and standardized methods. Hacking explores techniques to assess system security, identify vulnerabilities, and address them before malicious actors exploit them. Ethical hacking focuses on the lawful and professional safeguarding of systems. This course empowers students to implement security measures and protect against external threats and malicious users.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1 Describe models of digital forensic Investigation.
- CO2 Locate the digital evidences in file system.
- CO3 Follow evidence handling procedures.
- CO4 Select relevant tools for ethical hacking.
- CO5 Detect system and network vulnerabilities.
- CO6 Apply ethical hacking methodologies to get into the system.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes(TLO's) aligned to CO's.	Learning content mapped with TLO's	Suggested Learning Pedagogies	Relevant Cos
		SECTION I		
		UNIT 1 –Basics of Digital Forensics (CL Hrs. -07, Marks- 11)		
1	**TLO 1.1** Explain the given rule of digitalforensic. **TLO 1.2** Describe the given model of digital forensic investigation. **TLO 1.3** Identify whether the given issue in digital forensics is ethical or unethical **TLO 1.4** Explain the characteristics of the given Model of Digital Forensic Investigation.	1.1 Digital forensics: History of digital forensics, Rules of digital forensics, 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 modelling of digital forensic process model (UMDFPM) 1.3 Ethical issues in digital forensic: General ethical norms for investigators, Unethical norms for investigation.	Hands-on Demonstration Presentations	CO1
		UNIT 2- Hardware and Software Environments (CL Hrs. -08, Marks- 12)		
2	**TLO 2.1** Describe the given nature of digital information. **TLO 2.2** Show relationship between different categories in the given file system.	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)	Hands-on Demonstration Presentations	CO2

	TLO 2.3 Write steps to locate the given evidence in file system. TLO 2.4 Describe the indicators of confidentiality, integrity and availability for the given information.	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 3- Digital Evidence (CL Hrs. -08, Marks- 12)				
3	TLO 3.1 Describe the given rule of digital evidence. TLO 3.2 Explain characteristics of the given typeof digital evidence. TLO 3.3 Explain features of the given Challenge in evidence handling. TLO 3.4 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 3.8 Ethical issues/legal principle of digital evidence: Circumstantial and	Hands-on Demonstration Presentations	CO3

		hearsay nature of Digital Evidence, Authorization to conduct Digital Forensics investigation, authenticity of digital evidence, scientific method 3.9 Digital Evidence and metadata		
		SECTION II		
		UNIT 4- Basics of Hacking (CL Hrs. -07, Marks- 12)		
4	**TLO 4.1** Explain the characteristics of the given type of attack on computer system. **TLO 4.2** Describe the features of the given ethical hacking principle to be obeyed. **TLO 4.3** Explain the process of ethical hacking for the given problem. **TLO 4.4** Classify the given component of cracking the Hacker Mindset.	4.1 Ethical Hacking: How Hackers Beget Ethical Hackers, Defining hacker, Malicious users 4.2 Understanding the need to hack your own system 4.3 Understanding the dangers your systems face: Nontechnical attacks, Network-infrastructure attacks, Operating-system attacks, Application and other specialized attacks 4.4 Obeying the Ethical hacking Principles: Working ethically, Respecting privacy, Not crashing your systems 4.5 Ethical hacking Process: Formulating plan, Selecting tools, Executing the plan, Evaluating results 4.6 Cracking the Hacker Mindset: Understanding what you're up Against and who breaks in to computer systems, Identifying the purpose of hacking, Planning and Performing Attacks, Maintaining Anonymity	Hands-on Demonstration Presentations	CO4

UNIT 5- Types of Vulnerabilities (CL Hrs. -08, Marks- 12)				
	TLO 5.1 Describe the characteristics of the given type of Network Infrastructure Vulnerability. **TLO 5.2** Explain features of the given type of operating system Vulnerability. **TLO 5.3** Describe the given type of best practice followed to minimize e-mail security risk. **TLO 5.4** Describe the given type of best practice followed to minimize Database Vulnerability.	5.1 Network Hacking Network Infrastructure: Network Infrastructure Vulnerabilities, Scanning-Ports, Ping swiping, Scanning SNMP, Grabbing Banners, Analyzing Network Data and Network Analyzer, MAC-daddy attack Wireless LANs: Implications of Wireless Network Vulnerabilities, Wireless Network Attacks 5.2 Operating System Hacking: Introduction of Windows and Linux vulnerabilities 5.3 Applications Hacking: Messaging Systems: Vulnerabilities, E-Mail Attacks- E-Mail Bombs, Banners, Best practices for minimizing e-mail security risks Web Applications: Web Vulnerabilities, Directories Traversal and Countermeasures 5.4 Database system: Database Vulnerabilities, Best practices for minimizing database security risks	Hands-on Demonstration Presentations	CO5
UNIT 6- Ethical Hacking Plan and Hacking Methodologies (CL Hrs. -07, Marks- 11)				
6	**TLO 6.1** Write steps to develop ethical hacking plan **TLO 6.2** Select appropriate security assessment tool. TLO 6.3 Describe the given ethical hacking methodologies. TLO 6.4 Describe process to assess vulnerabilities in the given system.	6.1 Developing Ethical Hacking Plan: Establishing your Goal, Determining which system to hack, Creating testing standards, Selecting security assessment tools 6.2 Hacking Methodologies: Setting the stage for testing, Seeing what others see, Scanning systems, Determining what's running on open ports, Assessing vulnerabilities, Penetrating the system.	Hands-on Demonstration Presentations	CO6

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

Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/Tutorial Titles	No. of Hrs	Relevant COs
1	LLO 1.1 Monitor CPU and memory utilization, analyze for unauthorized process detection	Monitor CPU Utilization and Memory Utilization for detecting unauthorized process activations.	2	1
2	LLO 2.1 Use password-cracking tools to analyze system security and identify vulnerabilities.	Crack passwords using password cracking tools like LC4/John the Ripper/pwdump or any equivalent.	2	1
3	LLO 3.1 Create a complete memory dump on Windows by recalling and applying procedures. LLO 3.2 Use Windows Driver Toolkit to read memory dumps and analyze data.	a) Create complete memory dump using windows operating system. b) Read Memory Dump Using Windows Driver toolkit.	4	2
4	LLO 4.1 Analyze and interpret operating system logs on Windows/Linux file systems.	Read and Interpret Operating Systems logs on Windows/Linux file system.	2	2
5	LLO 5.1 Install Kali Linux operating systems by understanding requirements, configuring, troubleshooting, and customizing setup.	Install Kali Linux operating system.	2	2
6	LLO 6.1 Develop a response toolkit using cmd.exe, PsLoggedOn, and netstat utilities. LLO 6.2 Establish TCP connection with netcat by recalling, applying,	Collect live data on Windows: a) Create a response toolkit on windows having utility *cmd.exe, PsLoggedOn, netstat* b) Establish TCP connection between forensic workstation and the target system using *netcat*	4	3

	and testing configuration. LLO 6.3 Run cmd.exe, identify users, record file changes, and analyze modifications.	c) Run trusted *cmd.exe*, identify logged users and remote access users, Record creation, access times and all the modificationsmade to the files.		
7	LLO 7.1 Install Wireshark by recalling system requirements, applying installation steps and verifying setup. LLO 7.2 Capture network traffic with Wireshark, analyze packets and understand handshaking.	a) Install Wireshark tool on Windows/Kali Linux b) Use Wireshark tool to capture network traffic and to understand three-way handshaking concept/Analyze the packet.	2	4
8	LLO 8.1 Analyze email header to identify indicators of spam and malicious content. LLO 8.2 Install SpamAssassin by recalling installation steps and applying configurations. LLO 8.3 Analyze email headers with SpamAssassin by recalling features and applying filters	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	4	5
9	LLO 9.1 Perform ARP poisoning with Ettercap on Kali Linux by applying techniques.	Perform Arp poisoning on Kali Linux using Etercap or equivalent tool.	2	5
10	LLO 10.1 Initiate DoS attack with TCP/ICMP flooding and analyze target machine behavior. LLO 10.2 Write shell script for continuous ping flooding and observe network behavior.	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.	4	5

11	LLO 11.1 Perform port scanning with Nmap to identify open and vulnerable ports.	Perform port scanning using nmap utility to test whether ports are listening and vulnerable.	2	6

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

VI. Micro project:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. 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. (Affective Domain Outcomes). Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission. 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. Prepare report on case study of any Trojan attack.
   i. Identify the Trojan attack.
   ii. State the way Trojan got installed on particular Machine.
   iii. State the effects of the Trojan.
   iv. Elaborate/Mention/State protection/Blocking mechanism for this specific Trojan, examplespecification of any anti-threats platform which filters the Trojan.

b. Prepare report on case study of any 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. Prepare report on case study of any 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. Prepare report on case study of 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.

e. Case studies related to digital forensics
   i. Hosting obscene profile
   ii. Illegal money transfer
   iii. Fake travel agent
   iv. Creating fake profile

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with broad specifications	Relevant LLO
1	Computer system (Any computer system with basic configuration)	All
2	Windows/Linux (Kali Linux) operating system.	
3	Digital Forensic and Hacking Tools preferably Open source as mentioned in practical's	

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

Unit	Unit Title	Aligned Cos	Learning Hours	R Level	U Level	A Level	Total marks
1	Basics of Digital Forensics	CO1	7	04	04	03	11
2	Hardware and Software Environments	CO2	8	02	06	04	12
3	Digital Evidence	CO3	8	02	06	04	12
4	Basics of Hacking	CO4	7	04	06	02	12
5	Types of vulnerabilities	CO5	8	02	04	06	12
6	Ethical Hacking Plan and Hacking Methodologies	CO6	7	04	04	03	11

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Each Practical will be assessed considering 60% weightage to the process, 40% weightage to the product.	End Semester Exam based on Practical performance and Viva-voce.

X. SUGGESTED COS- POS MATRIX FORM

Course Outcomes (Cos)	Programme Outcomes(Pos)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	3	1	2	1	2	-	-	1
CO2	2	2	-	-	1	1	3	1	2	2
CO3	1	3	2	1	2	2	2	2	-	1
CO4	2	1	2	3	2	2	3	-	-	2
CO5	3	2	1	3	3	1	3	2	1	2
CO6	3	2	2	3	3	3	3	1	-	3
Legends:- High:03, Medium:02, Low:01, No Mapping: - *PSOs are to be formulated at the institute level										

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Jain,Nilakashi Kalbande, Dhananjat R.	Digital Forensic	Wiley Publishing, New Delhi, 2017, ISBN: 978-81-265-6574-0
2	Sammons,John	The Basics of Digital Forensic	Elsevier, Netherlands ISBN 978-1-59749-661-2
3	Kevin Beaver CISSP	Hacking for Dummies	Wiley Publishing, New Delhi ISBN: 978-81-265-6554-2
4	Jain,Nilakashi Kalbande, Dhananjat R.	Digital Forensic	Wiley Publishing, New Delhi, 2017, ISBN: 978-81-265-6574-0
5	Richard Boddington	Practical Digital Forensics	[PACKT] Publication, Open source community
6	Eoghan Casey	Digital Evidence and Computer Crime	Academic Press, ISBN: 9780123742681

VII. LEARNING WEBSITES & PORTALS

Sr. No.	Link/Portal	Description
1	https://resources.infosecinstitute.com/digital-forensics-models/#gref.	Digital forensics models and methodologies
2	https://docs.microsoft.com/en-us/sysinternals/downloads/psloggedon	It is a utility for determining which users are logged onto a computer and for tracking user activity on Windows systems.
3	https://docs.kali.org/introduction/download-official-kali-linux-images	Kali Linux official website
4	www.openwall.com/passwords/windows-pwdump	Windows utility designed for extracting password hashes from the Security Account Manager (SAM) database
5	https://onlinecourses.nptel.ac.in/noc23_cs127/preview	Cyber Security and Privacy course in NPTEL
6	https://archive.nptel.ac.in/courses/106/105/106105217/	Introduction to Ethical Hacking video lecture in NPTEL.
7	https://onlinecourses.swayam2.ac.in/cec20_lb06/preview	Digital Forensic course in NPTEL

Name & Signature: **Mr. O. R. Varma** Lecturer in Information Technology	Name & Signature: **Mr. Y. U. Bodhe** Lecturer in Information Technology
(Course Experts)	
Name & Signature: **Dr. D. N. Rewadkar** (Programme Head)	Name & Signature: **Shri. S.B.Kulkarni** (CDC In-charge)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN INFORMATION TECHNOLOGY
PROGRAMME CODE	07
COURSE TITLE	DATA ANALYTICS
COURSE CODE	IT51203
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION	YES

I. LEARNING & ASSESSMENT SCHEME

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

Total IKS Hrs for Term: 0 Hrs

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

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

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that course.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. * Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

Data Analytics equips individuals with the skills to process, analyze, and interpret data. It is essential for students and professionals, as it blends technical skills with critical thinking to address real-world challenges. A Data Analyst collects, cleans, and visualizes Datasets to solve problems.

III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1 - Elaborate the fundamental concepts of Data Analytics.
CO2 - Apply appropriate statistical techniques to analyze and interpret complex Datasets.
CO3 - Apply data cleaning techniques to handle missing values, duplicates and outliers.
CO4 - Analyze numerical data by creating pivot table.
CO5 - Represent data in terms of various types of charts.
CO6 - Visualize the data using a Python library.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		SECTION I		
		UNIT-I INTRODUCTION TO DATA ANALYTICS (CL Hrs-6, Marks-10)		
1.	**TLO 1.1** Describe the importance of data analytics. **TLO 1.2** Differentiate between types of data analytics. **TLO 1.3** Describe the quality and quantity of data. **TLO 1.4** Measures the central tendency of given dataset.	**1.1** Data Analytics: An Overview, Importance of Data Analytics **1.2** Types of Data Analytics: Descriptive Analysis, Diagnostic Analysis, Predictive Analysis, Prescriptive Analysis, Visual Analytics **1.3** Life cycle of Data Analytics, Quality and Quantity of data, Measurement **1.4** Data Sources: Structured and Unstructured Data.	Hands-on Demonstration Presentations.	CO1
		UNIT-II STATASTICAL ANALYSIS (CL Hrs-8 Marks-12)		
2	**TLO 2.1** Create a box plot of the test scores and interpret its key components. **TLO 2.2** Perform correlation and regression analysis. **TLO 2.3** Use various methods to address missing values in Dataset. **TLO 2.4** Apply Anova and Chi Square test. **TLO 2.5** Use scatter diagrams. **TLO 2.6** Test hypothesis. **TLO 2.7** Explain the concept of a sampling distribution. **TLO 2.8** Analyze the probability distribution.	**2.1** Graphical techniques, box plot, skewness and kurtosis, Descriptive Stats **2.2** Correlation and Regression **2.3** Imputation Techniques **2.4** Anova and Chi Square **2.5** Scatter Diagram **2.6** Estimation and Hypothesis Testing **2.7** Sampling Distributions, Counting **2.8** Probability, Probability Distributions	Hands-on Demonstration Presentations	CO2
		UNIT-III Data Preparation and Cleaning (CL Hrs-8 Marks-12)		
3	**TLO3.1** Explain the significance of data cleaning in ensuring data quality and reliability. **TLO 3.2** Identify different types of data issues such as missing data, duplicates and inconsistencies. **TLO 3.3** Differentiate between normalization and standardization techniques for data transformation **TLO 3.4** Explore the functionality of tools.	**3.1** Importance of Data Cleaning: Garbage in, garbage out (GIGO). **3.2** Data Cleaning Techniques: Handling missing data: Removing or imputing, dealing with duplicates, Removing inconsistencies and formatting errors. **3.3** Data Transformation: Normalization and Standardization, Encoding categorical variables. **3.4** Tools and Technologies: Introduction to tools like Excel, Python, Grafana and Power BI.	Hands-on Demonstration Presentations	CO3

SECTION II

UNIT - IV DATA ANALYTICS WITH EXCEL (CL Hrs-08 Marks-12)

4	**TLO 4.1** Describe the steps for making excel dashboard. **TLO 4.2** Create a pivot Table. **TLO 4.3** Sort and filter the pivot tables. **TLO 4.4** Create a pivot chart for different types of grouping items.	**4.1** Excel Dashboard: Tables and Data Grids, Dynamic Filters and Controls, Trend Analysis and Forecasting **4.2** Pivot Tables: Creating a Pivot Table Specifying Pivot Table Data **4.3** Changing a Pivot Tables, Calculation Filtering and Sorting a Pivot Table **4.4** Creating a Pivot Chart	Hands-on Demonstration Presentations	CO4

UNIT-V DATA VISUALIZATION (CL Hrs-07, Marks-12)

5	**TLO 5.1:** Create relevant chart based on requirement. **TLO 5.2** Describe the process of selecting the data range. **TLO 5.3** Explain the features of Chart Wizard. **TLO 5.4** Explain the steps to move an embedded chart to a new position within the same worksheet. **TLO 5.5** Format various components of given type of chart.	**5.1** Creating a Simple Chart, Charting Non-Adjacent Cells **5.2** Creating a Chart Using the Chart Wizard Modifying Charts, Moving an Embedded Chart, Sizing an Embedded Chart **5.3** Changing the Chart Type, Changing the Way Data is Displayed, Moving the Legend **5.4** Formatting Charts, Adding Chart Items, Formatting All Text, Formatting and Aligning Numbers, Formatting the Plot Area, Formatting Data Markers **5.5** Pie Charts, creating a Pie Chart Moving the Pie Chart to its Own Sheet	Hands-on Demonstration Presentations	CO5

UNIT –VI DATA VISUALIZATION USING PYTHON (CL Hrs-8, Marks-12)

6	**TLO 6.1** Describe the steps for Installing and setting up Matplotlib in Python. **TLO 6.2** Create various types of plots. **TLO 6.3** Customize Plots. **TLO 6.4** Write steps to Export plots in different formats	**6.1** Overview of Matplotlib and its role in data visualization, Installing and setting up Matplotlib in Python **6.2** Basic plotting with Matplotlib, Line plot, Scatter plots, Bar charts, Histograms, adding titles, labels, and legends to plots **6.3** Changing figure size and aspect ratio, Customizing axes (limits, ticks, and labels) **6.4** Exporting and Saving Visualizations: Saving plots in different formats (PNG, PDF, SVG).	Hands-on Demonstration Presentations	CO6

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

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 2.1:** Perform Statistical Analysis in Excel.	Calculate mean, median, and mode for a given dataset using Excel functions (AVERAGE, MEDIAN, MODE).	2	CO2
2	**LLO 2.2:** Construct box plot.	Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset.	2	CO2
3	**LLO 4.1:** Create a table to execute the function using dashboard.	a. Create a Data Table to import a sample dataset (e.g., sales data) into Excel. b. Convert the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles.	4	CO4
4	**LLO 4.2:** Create a pivot table to analyze the data set.	a. Create a basic Pivot Table from a dataset to Specify and filter data in a pivot table b. Add a calculated field to a pivot table	4	CO4
5	**LLO 5.1:** Customize your chart with titles, labels, colors, and legends as desired.	a. Create a basic pivot chart from a dataset b. Create a dynamic pivot chart that updates based on user selection	4	CO5
6	**LLO 5.2:** Create a simple chart to visualize the data sets.	a. Create a simple bar chart to visualize data sets. b. Create a bar chart using non-adjacent cells to visualize data from different ranges.	2	CO5
7	**LLO 5.3:** Change the chart type with adding data labels, axis format, and adjusting the gridlines.	a. Create a basic bar chart using a dataset and change its type to a different chart	4	CO5
8	**LLO 5.4:** Design a pie chart	a. Create a pie chart from a dataset b. Move the pie chart to a new worksheet for better visibility	2	CO5
9	**LLO 6.1:** Generate and Save the plot in various formats.	Create different types of plots. Write a Python script to save the plot in different formats: PNG, PDF, and SVG.	2	CO6

LLO 6.2: Analyze data analytics applications across various business domains.	Application of data analytics across various industries through case study	4	CO6

Note: **Out of the above suggestive LLOs –**

1. '*' Marked Practicals (LLOs) Are mandatory.
2. A judicial mix of LLOs is to be performed to achieve the desired outcomes

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

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. 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. (Affective Domain Outcomes). Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission. 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. Evaluate student performance based on exam scores and attendance.
   i) Use a dataset with student information (e.g., scores, attendance percentage, subject).
   ii) Analyze the correlation between attendance and performance.
   iii) Identify high-performing and low-performing subjects or students.
   iv) Visualize trends with bar or line charts.

b. Analyze movie ratings and genres to identify trends.
   i) Use a dataset with movie titles, genres, and user ratings.
   ii) Calculate average ratings for each genre.
   iii) Identify top-rated movies and trends over time.
   iv) Create bar charts or heatmaps for visualization.

c. Track the spread of COVID-19 and its impact.
   i) Use datasets on COVID-19 cases, recoveries, and deaths.
   ii) Perform time-series analysis to study trends.
   iii) Calculate recovery and mortality rates.
   iv) Create dashboards showing daily trends by country or region.

d. Analyze web traffic and user behavior on an e-commerce site.
   i) Use a sample dataset with user visits, page views, and bounce rates.
   ii) Identify peak traffic times and popular pages.
   iii) Suggest improvements to reduce bounce rates.
   iv) Visualize user behaviour trends.

e. Analyze patient demographics and treatment outcomes.
   i) Use a dataset with patient age, gender, diagnosis, and outcomes.
   ii) Calculate recovery rates based on treatments.
   iii) Analyze patterns in diseases by age or gender.
   iv) Create dashboards showing patient outcomes and insights.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Microsoft Office ,Office 365	ALL
2	Software: Editor: Python setup	ALL
3	Computer (i5 preferable), RAM minimum 8 GB onwards.	
4	Operating system: Windows 10 onward	ALL

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
SECTION I								
1	I	INTRODUCTION TO DATA ANALYTICS	CO1	6	4	4	2	10
2	II	STATISTICAL ANALYSIS	CO2	8	2	4	6	12
3	III	DATA PREPARATION AND CLEANING	CO3	8	4	4	4	12
SECTION II								
4	IV	DATA ANALYTICS WITH EXCEL	CO4	8	2	2	8	12
5	V	DATA VISUALIZATION	CO5	7	2	4	6	12
6	VI	DATA VISUALIZATION USING PYTHON	CO6	8	2	4	6	12
			Grand Total	45	16	22	32	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment and Seminar/Presentation	Lab. Performance, viva voce

X. SUGGESTED COS- POS MATRIX FORM

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

CO3	3	3	3	3	2	3	3	-	3	3
CO4	2	3	3	2	2	3	3	1	2	3
CO5	2	2	2	--	--	1	2	--	3	3
CO6	3	3	2	3	--	2	2	--	2	3

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

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1.	Jinjer Simon	Excel Data Analysis: Your visual blueprint for analyzing data, charts, and PivotTables	Wiley Publication Edition: 3rd ISBN: 978- 0-470-59160-4
2	A. J. Smalley	Data Analysis with Excel	SAGE Publications Edition: 1st, 2007 ISBN 10: 0070139903 / ISBN 13: 9780070139909
3	Fabio Nelli	Python Data Analytics: With Pandas. NumPy, and Matplotlib	Apress pubication ISBN-13 :978-1484239124 ISBN-13978-1484247372
4	Jake VanderPlas	Python Data Science Handbook	Shroff/O'Reilly Publication ISBN-10-9355422555 ISBN-13-978-9355422552
5	Business Analytics with MindTap	Jeffrey D. Camm | James J Cochran | Michael J. Fry | Jeffrey W. Ohlmann	Cengage Learning India Pvt. Ltd. Publication Edition:4th ISBN: 9789360533533

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://spreadsheetpoint.com/excel/dashboard-in-excel/	Advance Excel
2	https://www.javatpoint.com/how-to-create-a-dashboard-in-exce l	Excel Dashboard
3	https://www.simplilearn.com/tutorials/exce l-tutorial/data-an alysis-excel	Data Visualization
4	https://www.freecodecamp.org/news/introduct ion-to-data-vizua lization-using-matplotlib/	Matplotlib in Python
5	https://archive.nptel.ac.in/courses/106/107/106107220/	Introduction to Data Analytics

Name & Signature:

Smt. P.C. Fafat
Lecturer in Information Technology

Smt. V.M. Khanapure
Lecturer in Information Technology

(Course Experts)

Name & Signature:

Dr. D.N. Rewadkar
(Programme Head)

Name & Signature:

Shri. S.B. Kulkarni
(CDC In-charge)