Government Polytechnic Mumbai

(Academically Autonomous Institute of Govt. of Maharashtra)

Information Technology Department

P23 Curriculum

Fourth Semester

Government Polytechnic Mumbai

(Academically Autonomous Institute, Government of Maharashtra)

Programme Name	Diploma In Information Technology		
Programme Code	IF	Year	2023-24
Duration Of Programme	6 Semester	Duration	16 WEEKS
Semester	Fourth	Scheme	P23

SR.NO	CourseTitle	Course Type	course code	Total IKS Hrs.for sem	Learning Scheme: Atual contact Hrs./Week CL	TL	LL	self learning (TW+ASSIGNMENT)	Notional learning /week	credits	paper Duration	Examination Scheme(Marks): Theory FA-TH T1 MAX	FA-TH T2 MAX	SA-TH MAX	Total MAX	Total MIN	BASED ON LL & TL PRACTICAL FA-PR MAX	FA-PR MIN	SA-PR OR MAX	SA-PR OR MIN	SA-PR PR MAX	SA-PR PR MIN	Based on Self learning SLA MAX	SLA MIN	TOTAL MARKS
								Total																	
1	Operating System	DSC	CO23109		3		2	1	6	3	3	20	20	60	100	40	25	10	25#	10	_	_	25	10	175
2	Advanced programming in Java	DSC	CO23111		2		4		6	3							50	20	_		50#	20			100
4	Entrepenuarship and start - ups	DSC	IT23402		1		2	1	4	2							25	10	25@	20			25	10	75
5	Computer Networks	DSC	CO23107		3		2	1	6	3	3	20	20	60	100	40	25	10	25#	10	_	_	25	10	175
6	User Interface Design	DSC	IT23109		1		4	1	6	3							25	10	_		25@	20	25	10	75
7	Python Programming/ Next Generation Database	DSC	IT23201/ IT23203		3		4	1	8	4	3	20	20	60	100	40	25	10			25#	10	25	10	175
8	Linux OS (Mooc)	SEC	IT23605					4	4	2															
	Total			0	13	0	18	9	40	20															775

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

SLA - Self Learning Assessment Legends : @ Internal Assessment, # External Assessment

Note: 1. FA-TH represents two class tests of 20 marks each conducted during the semester

2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.

3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.

4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks

5. 1 credit is equivalent to 30 Notional hrs.

6. * Self learning hours shall not be reflected in the Time Table.

Course Category : 1. Discipline Specific Course Core (DSC) : 2, Discipline Specific Elective (DSE) : 0, 3:Value Education Course (VEC) : 1, 4:Intern./Apprenti./Project./Community (INP) : 0,

5. AbilityEnhancement Course (AEC) : 2, 6 Skill Enhancement Course (SEC) : 2, 7.GenericElective (GE) : 0

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Coordinator	In-Charge	Head of Department	Principal
Curriculum Development	Curriculum Development Cell	Department of Information Technology	
Department of Information Technology			

Programme : Diploma in Computer Engineering and Information Technology (Sandwich pattern)													
Course Code:CO23109					**Course Title : Operating System**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2Hrs.30 Min)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR**	**OR**		
3	--	2	1	6	3	20	20	60	25	25#	--	25	175

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

An Operating system is the basic system software that makes a computers system operational. It acts an interface between the user and the computer system. It is the essential software that manages computer hardware and software resources and provides common services for computer programs. Operating system is a core technology subject, it familiarizes the students with the concepts, structure and functions of Operating System.This course is aimed to teach and practice the concept of Operating System design.

II. Industry/Employer Expected Outcome

Engineers applying operating system concepts should proficiently solve real world problems and develop real life project.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Demonstrate basic knowledge about operating system
CO2	Identify various OS components, services & structure
CO3	Describe the concept of Process and Threads
CO4	Apply various CPU Scheduling Algorithm.
CO5	Estimate efficiency of various memory management techniques
CO6	Illustrate File allocation and access methods

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IV. Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Explain the function of Operating System. TLO 1.2- Explain characteristics of the given type of operating system. TLO 1.3 Identify type of OS suitable for given type of application.	**Operating System Overview** 1.1 Introduction to Operating System :Concept, Components of Computer System 1.2 Role of Operating System 1.3 Different Types of Operating Systems- Batch Operating System, Multiprogramming System, Multitasking Operating System, Time Shared System, Multiprocessor Systems, Cluster Systems, Distributed Systems, Real Time Systems, Open Source Operating System, Mobile Operating System 1.4 Command line based OS – DOS ,UNIX GUI based OS -WINDOWS,LINUX **Course Outcome: CO1 Teaching Hours : 05 Marks: 05**
2	TLO 2.1 Start, stop, and restart the given Different Services of Operating System. TLO 2.2 Explain use of the given Components of OS. TLO 2.3 Explain use of the given operating system tool.	**Operating System Components & Structure** 2.1 Operating System Components: Process Management, Main Memory Management, Secondary Storage Management, I/O System Management, File Management. 2.2 Operating-System Services 2.3 Operating System Structure: Simple Structure, Layered, Monolithic, Microkernel 2.4 System Calls - Concept, Types & Uses of System Call: Process Control, File Management, Device Management, Information Maintenance, Communication. **Course Outcome: CO2 Teaching Hours : 06 Marks: 07**
3	TLO3.1 Explain functions carried out in the given process state. TLO 3.2 Describe the function of the given component of process stack In PCB. TLO 3.3 Explain characteristics of the given multithreading model. TLO 3.4 Describe method of executing the given process command with example.	**Process Management** 3.1 Process-Concept, Process States, Process Control Block 3.2 Process Scheduling- Scheduling Queues, Schedulers, Context Switch. 3.3 Inter-Process Communication- Introduction, Shared Memory System & Message Passing System 3.4 Threads – Benefits, Users And Kernel Threads 3.5 Multithreading Models – Many To One, One To One, Many To Many. **Course Outcome: CO3 Teaching Hours : 06 Marks: 08**

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4	TLO4.1 Justify the need and objective of given job scheduling criteria with relevant example. TLO 4.2 Explain with example the procedure of allocating CPU to the given process using the specified OS. TLO 4.3 Calculate turnaround time and average waiting time of the given scheduling algorithm. TLO 4.4 Explain functioning of the given necessary condition leading to deadlock.	**CPU Scheduling & Deadlock** 4.1 Scheduling Objectives, Concept, CPU and I/O Burst Cycles, Pre-Emptive & Non- Pre-Emptive Scheduling, Scheduling Criteria. 4.2 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 4.3 Deadlock: System Model, Necessary Conditions Leading to Deadlocks, Deadlock Handling, Deadlock Prevention 4.4 Deadlock Avoidance: Safe State, Resource allocation Graph Bankers Algorithm , Data Structure Of Banker's algorithm, Safety algorithm, Resource-Request Algorithm, Illustrative Examples **Course Outcome: CO4 Teaching Hours : 12 Marks: 18**
5	TLO 5.1 Describe the working of specified memory management function. TLO 5.2 Explain characteristic of the given memory management techniques. TLO 5.3Write algorithm for the given page replacement technique. TLO5.4 Calculate Page fault for the given page reference string	**Memory Management** 5.1 Background – Basic Memory Hardware, Address Binding, Logical& Physical Address Space, 5.2 Swapping 5.3 Contiguous Memory Allocation, Fragmentation. 5.4 Paging, Page Table, Page Fault, Segmentation 5.5 Virtual Memory – Concept, Demand Paging. 5.6 Page Replacement Algorithms- First In First Out (FIFO), Least Recently Used (LRU), Optimal Page Replacement, Not Recently Used (NRU). **Course Outcome: CO5 Teaching Hours : 12 Marks: 18**
6	TLO 6.1 Explain structure of the given file system with example. TLO 6.2 Descrlbe mechanism of the given file access method. TLO 6.3 Explain procedure to create and access directories and assign the given files access permissions.	**File System** 6.1 File – Concepts, Attributes, Operations, Types, File System Structure, 6.2 Access Methods – Sequential, Direct, Swapping 6.3 File Allocation Methods- Contiguous , Linked, Indexed 6.4 Directory Structure – Single Level, Two Level ,tree-structured directory **Course Outcome: CO6 Teaching Hours : 04 Marks: 04**

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V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr. No.	Laboratory Learning Outcome	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 Identify type of OS suitable for given type of application	Compare various operating systems according to different criteria **Operating systems to be considered** - MS-DOS, Windows selected versions, OS/2, Mac OS, Linux, Android, iOS etc. **Criteria-** Creator/ Produced by, Initial Public release, Target system type, File system supported, Kernel type, GUI default ,Update management, Native APIs, Non-native APIs supported through subsystems, etc.	2	CO1
2	LLO2.1 Install and Configure different Operating systems.	Install and configure Windows, Linux (or alike) operating system.	4	CO1
3	LLO3.1 Execute Linux basic commands	3.1 Execute general purpose commands date, time, cal, clear, banner, tty, script, man. 3.2 Work with multiple linux terminals and basic commands: who, who am I, login, passwd, su, pwd. 3.3 Execute text processing commands tr, wc, cut, paste, sort, cmp, diff.	2	CO2
4	LLO4.1 Execute File and directory commands in Linux.	Execute file and directory manipulation commands ls, rm, mv, cp, join, split, cat (file saving and redirection operator), head, tail, touch, diff, comm., pr, chmod, mkdir, rmdir, cd, pwd, dir, cmp. (Use wild card character).	4	CO2
5	LLO5.1 Execute process commands	Execute process commands- ps, wait, sleep, exit, kill.	2	CO3
6	LLO6.1 Implementation of IPC	Write a program to implement IPC through Shared Memory.	2	CO3
7	LLO7.1 Use Operating system services	7.1 Use Operating system services(Editor, GUI, File handling.) 7.2 Run commands to start, stop, and restart the specified service in Linux	2	CO2
8	LLO8.1Implement CPU Scheduling algorithms	Write a program to implement First Come First Serve, Shortest job first and Round Robin Scheduling Algorithm. Calculate average waiting time, average turnaround time and throughput.(Given the list of Processes, their CPU burst times) Process | Burst Time P1 | 6 P2 | 8 P3 | 7 P4 | 3	6	CO4

9	LLO9.1 Implement Page Replacement Algorithms	Write a program to implement First in first out (FIFO) Page replacement algorithm. Calculate number of page fault and page fault rate for following reference string sequence and 3 memory frames. (Course Teacher may give different reference Strings to students) 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6	2	CO5
10	LLO10.1 Implement Page Replacement Algorithms	Write a program to implement Last in first out (LIFO) Page replacement algorithm. Calculate number of page fault and page fault rate for following reference string sequence and 3 memory frames. (Course Teacher may give different reference Strings to students) 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6	2	CO5

VI. Micro Project :

1. Design a file Explorer having advanced features like file Compression, Encryption and permission.
2. Develop a Process Scheduling Simulator.
3. Design a chat Application.

Any other microproject suggested by Subject Faculty.

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- TH- Progressive /Periodic Test each of 20 Marks
- FA - Continuous Assessment of Practicals for 25 Marks
- SL - Continuous Assessment of Self Learning for 25 Marks

Summative Assessment (Assessment of Learning)

- TH - Term End examination of 60 Marks
- PR- Term End Practical examination of 25 Marks

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VIII. Suggested CO-PO Matrix form

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

IX. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Operating System Concepts	Abraham Silberschatz, Greg Gagne, Peter B. Galvin Wiley India Limited 10th Edition, April 2018	ISBN: 978-1-119-32091-3/ ISBN: 978-1-119-75313-1
2	Operating Systems: Internals and Design Principles	William Stallings Pearson Education, India, 9th Edition, March 2018	ISBN-13: 9789332518803
3	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos, Prentice Hall of India 4th Edition, September 2014	ISBN:1292061421 (ISBN13: 9781292061429)
4	Operating system	Godbole Atchyut S. Tata McGraw-Hill Education, 3rd Edition, 2015	ISBN-13: 9780070702035

X. Learning Websites & Portals

https://www.javatpoint.com/os-tutorial
https://courses.cs.vt.edu/csonline/OS/Lessons/Processes/index.html
https://en.wikipedia.org/wiki/Operating_system
https://computer.howstuffworks.com/operating-system.htm

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XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Ms. Bhakti R. Khajone	Senior Project Engineer	WIPRO Technology, Pune
2	Mrs. Poonam Vegurlekar	Lecturer in Computer Engg.	Thakur Polytechnic Mumbai
3	Mrs. N. H. Vachani	Lecturer in Computer Engineering	Government Polytechnic

Coordinator,
Curriculum Development,
Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

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Programme: Diploma in Computer Engineering and Information Technology (Sandwich Pattern)													
Course Code : CO23111						Course Title : Advanced Programming in Java							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NL H	Credits	FA-TH		SA-TH (2Hrs.30 Min)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
2	--	4	--	6	3	--	--	--	50	50#	--	--	100

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

This course makes students learn higher level application programming using Java and make the use of latest features in it for better quality of software. This course includes Concurrency, Fork/ Join Framework, Network Programming, Java Remote Method Invocation, web development in Java using Servlet and JSP technology.

II Industry / Employer Expected Outcomes : Students will be able to

1. Develop Network Programming.
2. Develop web applications using servlet and JSP

III Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Develop Multithreading programs.
CO2	Develop Networking applications using HTTP, UDP and TCP/IP Sockets
CO3	Develop Applications using Remote Method Invocation
CO4	Develop Web Applications using Servlets
CO5	Develop Web Applications using JSP

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IV Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Describe Java Thread Model TLO 1.2 Learn Thread Priorities TLO 1.3 Create Multiple Threads using Thread class and Runnable class TLO 1.4 Learn wait()notify and notifyAll() TLO1.5 .Understand ThreadPool and ExecutorService	**Multithreaded Programming** 1.1 The java Thread Model 1.2 Thread Priorities 1.3 Thread Class and Runnable Interface 1.4 wait, notify and notifyAll Methods 1.5 ThreadPool and ExecutorService
	Course Outcome : CO1	**Teaching Hours : 4hrs**
2	TLO 2.1 Learn Networking Classes and Interfaces TLO 2.2 Learn and apply InetAddress TCP/IP Client Sockets TLO 2.3 .Learn and apply URLand URLConnection , HttpURLConnection TLO 2.4 . Apply The URI Class TCP/IP Server Sockets Datagrams DatagramSocket , DatagramPacket Classes	**Networking** 2.1 The Networking Classes and Interfaces 2.2 InetAddress: Inet4Address and Inet6Address 2.3 TCP/IP Client Sockets 2.4 URL and URLConnection 2.5 HttpURLConnection The URI Class 2.6 TCP/IP Server Sockets 2.7 Datagrams: DatagramSocket , DatagramPacket Classes
	Course Outcome : CO2	**Teaching Hours : 6hrs**

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3	TLO 3.1 TLO Understand The RMI Architecture and Factory Design Pattern TLO 3.2 Understand Stub and Skeleton TLO 3.3 Learn and apply Remote Interface , Objects ,Class , RMIClient and RMIServer. TLO 3.4 Develop Client Server Application using RMI	**Java Remote Method Invocation** 3.1 The RMI Architecture and Factory Design Pattern 3.2 Stub and Skeleton 3.3 The Remote Interface 3.4 Naming Remote Objects, 3.5 Implementation class 3.6 RMIClient and RMIServer 3.7 Client Server Application Development using RMI
	Course Outcome : CO3	**Teaching Hours : 6hrs**
4	TLO 4.1 Learn The Life Cycle of a Servlet. TLO 4.2 Create a Simple Servlet TLO 4.3 Learn and apply the Servlet API TLO 4.4 Learn and apply Cookies TLO 4.5 Understand Session Tracking	**Servlets** 4.1 The Life Cycle of a Servlet. 4.2 Creating a Simple Servlet 4.3 The Servlet API: 4.4 The javax. servlet Package : • Servlet Interface, • ServletConfig Interface , • ServletContext Interface , • ServletRequest Interface , • ServletResponse Interface , • GenericServlet Class , • Servlet Exception Classes , • Reading Servlet Parameters 4.5 The javax.servlet.http Package 4.6 HttpServletRequest Interface 4.7 HttpServletResponse Interface 4.8 The HttpSession Interface 4.9 The Cookie Class 4.10 Session Tracking
	Course Outcome : CO4	**Teaching Hours : 8hrs**

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5	TLO 5.1 Understand basic concepts of JSP TLO 5.2 Learn Tab Based Approach TLO 5.3 Create Simple JSP TLO 5.4 Learn and apply JSP expressions, variables	**Introduction to Java Server Pages** 5.1 Understanding JSP: • Advantages of JSP over Servlet • Introduction the Tag-Based Approach 5.2 Creating a simple JSP Page 5.3 Using out and Page Directives 5.4 JSP expressions, variables 5.5 JSP-generated servlet 5.6 Implicit Objects 5.7 The JSP Life Cycle 5.8 A thought on Scriptlets 5.9 useBean , setProperty and getProperty Methods
	Course Outcome: CO5	**Teaching Hours : 6hrs**

V Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial	Number of hrs.	Relevant COs
1	LLO 1.1 Develop Programs to implement methods of Thread class LLO 1.2 Develop Multithreading program using Runnable interface	1.1 Write a Java program to implement following methods of Thread class . a)getName() b)getPriority() c)isAlive() d)join() e)run() f)sleep() g)start 1.2 Write a Java program to create Multiple Threads using Runnable Interface.	8	CO1
2	LLO 2.1 Develop Networking programs using TCP/IP Client Socket and TCP/IP Server Sockets	**Networking** 2.1 Develop a Java Application in which TCPClient will send a text message and TCPServer will receive it. 2.2 Add a functionality to the Java	12	CO2

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		Application in 2.1 using which TCPServer will send a text message and TCPClient will receive it. Add a functionality to the Java Application in 2.2 using which TCPServer will advertise the TCPCLients associated with it.		
3	LLO 3.1 Develop program using RMI Client and RMI server	**Java Remote Method Invocation** 3.1 Create a distributed application using RMI where the client will handshake with the server by invoking the remote method public void sayHello() where client and server are on different hosts in the same network. Create a distributed application using RMI, where an RMI client can download a text file from the RMI server. Also identify the design pattern being used.	12	CO3
4	LLO 4.1 Develop Web Application Development using Servlet LLO 4.2 Develop servlet programs using Prepared Statement and Result set interface. LLO 4.3 Develop servlet programs to create session using HttpSession LLO 4.4 Develop servlet program for session Tracking using Cookies	**Web Application Development using Servlet** 4.1 Create a Java Web Application in an IDE. 4.2 Create a client side HTML web page to input your name from textbox and display "Hello <your name>" on the servlet after clicking on the "Login" button. 4.3 Display the server port and protocol number in the browser in scrolling from right to left format. 4.4 Create an HTML page login.html and create two textboxes on the HTML page named userName and password. After clicking on the 'Login' button the servlet will be displayed. It will show 'Login Successful' when userName and password are same else 'authentication failure' will be displayed. 4.5 Write a program to demonstrate the use of PreparedStatement and Resultset interface. 4.6 Write a program to create Session using HttpSession class. 4.7 Write a program to implement Session tracking using Cookies.	12	CO4
5	LLO 5.1 Develop Web Application Development using JSP LLO 5.2 Create Java Beans.	**Web Application Development using JSP** 5.1 Create a Java Web Application in an IDE. 5.2 Create a JSP page registerEmployee.jsp for Employee Registration. The page will take inputs as First Name, Middle Name, Last Name, Email ID, Mobile No., Street, City, Pin code, Hire Date, Manager, Qualification, Designation and Experience. The page will also have a Submit button clicking on which all the inputs will be displayed on the userProfile.html page.	16	CO5

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		5.3 Modify registerEmployee.jsp in 6.2 to store the inputs in the 'employees' table you have created in the database in 3.2. 5.4 Create a Java Bean EmployeeBean with the properties given in 5.2. Modify registerEmployee.jsp to use the useBean, getProperty and setPropety.		

Note: if any

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

Micro Project

Students are required to make groups of two and develop a mini project which is using at least 2 of the given technology in the course contents. For example,

1. Client Server Application TCP/ IP or UDP
2. RMI Client Server Application
3. Web Application using Servlet.
4. Web Application using JSP .

VIII Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

End term External Practical examination, Viva-voce, Workshop performance (__marks)

IX. CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	3	1	-	1	3	1	2	2
CO2	1	3	3	2	-	3	3	2	2	3
CO3	1	3	3	2	-	3	3	3	3	3
CO4	-	3	3	2	1	3	3	3	3	3
CO5	-	3	3	2	1	3	3	3	3	3

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X. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Java: The Complete Reference, Eight and onward Edition	Herbert Schildt	978-0-071-80855-2

XI. Learning Websites & Portals

E-References:

1) https://docs.oracle.com/javase/tutorial/essential/concurrency/index.html
2) https://docs.oracle.com/javase/tutorial/essential/concurrency/forkjoin.html
3) https://docs.oracle.com/javase/tutorial/essential/concurrency/QandE/questions.html
4) https://docs.oracle.com/javase/tutorial/networking/overview/networking.html
5) https://docs.oracle.com/javase/7/docs/platform/rmi/spec/rmiTOC.html
6) https://docs.oracle.com/javaee/7/tutorial/servlets.htm
7) https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/wbapp/basics.html#GUID-41C6F1CE-5E16-49CC-9623-70C4199FFD9F
8) https://docs.oracle.com/javaee/7/tutorial/jsf-page.htm

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No.	Name	Designation	Institute/Organisation
1.	Ms. Varshali Cholake-Landge	Senior Software Engineer	Volkswagen IT Services India Pvt. Ltd.
2.	Mr. Mohan Khedkar	Lecturer in IT	Government Polytechnic, Nashik
3.	Mrs Vandana S. Lokhande	Lecturer in Computer Engineering	Government Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

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Programme: Diploma in Information Technology (Sandwich Pattern)												
Course Code: IT23402					Course Title: Entrepreneurship and Start-ups							
Compulsory / Optional: Compulsory												
Teaching Scheme and Credits						Examination Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
										PR	OR		
1	-	2	1	4	2				25	25#	-	25	75

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

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

Note:

1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

II. Entrepreneurs are often thought of as national assets to be refined, motivated and remunerated to the greatest possible extent. Entrepreneurs can change the way we live and work. If successful, their revolutions may improve our standard of living. In short, in addition to creating wealth from their entrepreneurial ventures, they also create jobs and the conditions for a flourishing society. This course will try to inculcate the values of Entrepreneurship and Start up among the students.

III. Industry / Employer Expected Outcome

Students should be able to understand concept Entrepreneurship and Start-ups.

IV. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand the dynamic role of entrepreneurship and small businesses.
CO2	Create business ideas / opportunities
CO3	Explain Financial Planning and Control
CO4	Illustrate Break Even Analysis
CO5	Choose Marketing Strategy
CO6	Explain New Product or Service development

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CDC Co-ordinator
G. P. Mumbai

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1.1:** Differentiate between Management and administration. **TLO 1.2** Define Human Resource Management **TLO 1.3:** Define Management, organization structure	**Introduction to Management** 1.1 Introduction to Management, organization structure 1.2 Difference between Management & Administration 1.3 Concept of Scientific Management 1.4 Functions of management 1.5 Introduction to Human Resource Management Staffing, training & induction to staff. **Course Outcome: CO5** **Teaching Hours: 03 hrs** **Marks: NA**
2	**TLO 2.1:** Understand financial management **TLO 2.2**: Define Project management **TLO 2.3:** Understand CPM ,PERT analysis & application Break even analysis, KAIZEN ,6S	**Financial & Project Management** 2.1 Importance of financial management 2.2 Financial organization and management 2.3 Budgets & their analysis 2.4 Project management 2.5 CPM, PERT analysis & application Break even analysis, KAIZEN ,6S. **Course Outcome: CO1, CO2** **Teaching Hours: 04 hrs** **Marks: NA**
3	**TLO 3.1:** Understand Types of Business Structures, differences between entrepreneur & manager **TLO 3.2:** State Business Ideas and their implementation **TLO 3.3:** Understand activity map and business plan.	**Introduction to Entrepreneurship** 3.1 Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation 3.2 Types of Business Structures, differences between entrepreneur & manager 3.3 Business Ideas and their implementation 3.4 Discovering ideas and visualizing the business 3.5 Activity map 3.6 Business Plan Double Diamond Approach **Course Outcome: CO3, CO4** **Teaching Hours: 4 hrs** **Marks: NA**

4	**TLO 4.1:** Understand Idea to Start-up **TLO 4.2:** Identifying the target market **TLO 4.3: Understand** Marketing and accounting, Risk analysis	**Start ups** 4.1 Introduction, Idea to Start-up 4.2 Market Analysis – Identifying the target market, 4.3 Competition evaluation and Strategy Development, 4.4 Marketing and accounting, Risk analysis **Course Outcome: CO6** **Teaching Hours: 04 hrs** **Marks: NA**
5	**TLO 5.1:** Understand Financing and Protection of Ideas **TLO 5.2:** Know Financing methods available for start-ups in India **TLO 5.3:** Know Communication of Ideas to potential investors	**Planning for Startup** 5.1 Financing and Protection of Ideas 5.2 Financing methods available for start-ups in India 5.3 Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses
6	**TLO 6.1:** Understand Exit strategies for entrepreneurs, and succession and harvesting strategy	**Strategies for Entrepreneurs** 6.1 Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy

V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

NOTE: Total 6 experiments (or turns) out of 9 experiments (or turns)

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO: Able to understand what is** Entrepreneur	Interactive session with an Entrepreneur	2	CO1
2	**LLO**: Understand start-up	Brain storming of ideas for start-up in current scenario	4	CO1, CO2
3	**LLO**: Understand Identification of business opportunity	Identification of business opportunity	2	CO1, CO2
4	**LLO**: Understand the concept of Financing the start up	Financing the start up	2	CO1, CO2
5	**LLO**: Able to run the start up	Running the startup	2	CO1, CO2
6	**LLO**: Understand Break even analysis	Break even analysis	2	CO3, CO4
7	**LLO**: Understand Marketing strategy	Marketing strategy.	2	CO3, CO4

8	**LLO**: Able to Write, test and debug applications using menu	Write, test and debug applications using menu	2	CO3, CO4
9	**LLO**: Prepare project report.	Preparing project report	4	CO3, CO4
		Total	60	

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Prepare journal of practical.
2. Prepare a presentation on the topic given by faculty.

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (60 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (140 marks)

VIII. 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 Log Learning	PSO-1	PSO-2	PSO-3
CO1	--	--	3	3	2	3	2	--	--	3
CO2	--	--	3	3	3	3	2	--	--	3
CO3	--	--	3	2	2	3	2	--	--	3
CO4	--	--	3	3	3	3	2	--	--	3
CO5	--	--	2	2	3	3	2	--	--	3
CO6	--	--	3	3	3	3	2	--	--	3

Legends: - High:03, Medium:02, Low:01, No Mapping: --

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IX. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	The Startup Owner's Manual: TheStep-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf, K & SRanch Publication	978-0984999392
2	The Lean Startup: How Today'sEntrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries, Penguin UK	978-0670921607
3	Demand: Creating What People LoveBefore They Know They Want It	Adrian J. Slywotzky with Karl Weber, Headline Book Publishing	978-0755388974
4	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Christensen, Harvardbusiness	978-142219602

X. Learning Websites & Portals

1. https://www.fundable.com/learn/resources/guides/startup
2. .https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Ms. Namrata A. Wankhade	Lecturer Information Technology Department	Government Polytechnic, Mumbai
2	Ms. Dipali Gosavi	Lecturer Information Technology Department	Government Polytechnic, Mumbai
3	Miss. Rohini Yadav	Associate Developer	MUFG Mumbai

Coordinator,
Curriculum Development,
Department of Information Technology

Head of Department
Department of Information Technology

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Computer Engineering (Sandwich Pattern)													
Course Code: CO23107						Course Title : Computer Networks							
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (02.30 Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
03	--	02	01	06	03	20	20	60	25	--	25#	25	175

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

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

Note:

1. FA-TH represents two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

In this era of globalization almost everyone is connected to each other using computers, smart devices, gadgets and appliances.. Everyone wants remote access of their gadgets and appliances. This is possible using the networks which connect all these devices, gadgets and appliances. Students of Computer Engineering should know how these devices are connected to each other. They should also understand what are networking protocols addressing, Internet, wired and wireless networking, etc. The knowledge of TCP / IP Protocol Suite is also essential for them. This course tries to encapsulate all possible concepts of computer networking. Despite of the concepts of computer networking being very vast some concepts are covered in details and some are covered superficially. Considering the grasping level of students and limited time given to learn the course.

II. Industry / Employer Expected Outcome

Students will be able to

1. Understand the OSI and TCP/IP reference models of networking
2. Understand different layers in TCP/IP reference model.
3. Understand different networking protocols.
4. Solve problems regarding networking based on different protocol.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	To understand the TCP/ IP Protocol Suite
CO2	To understand underlying wired and wireless technology of TCP/ IP Protocol Suite
CO3	To understand the network layer protocols of TCP/ IP Protocol Suite
CO4	To understand the transport layer protocols of TCP/ IP Protocol Suite
CO5	To understand the application layer protocols of TCP/ IP Protocol Suite

IV. Course Content Details:

Unit No.	Learning Outcome	Topics / Sub-topics
1	**Course Outcome:** CO 1 TLO1.1To Understand the today's Internet TLO1.2To Understand Protocol And Standards TLO1.3To understand Protocol Layers of TCP/ IP Protocol Suite TLO1.4Compare and Contrast TCP/IP Protocol Suite and OSI Model TLO1.5To Understand Physical, Logical, Port AND Application Specific Addresses	**The TCP / IP Protocol Suite** 1.1 The Internet Today, World Wide web 1.2 Protocols and Standards ,Standards Organizations 1.3 Protocol Layers: Hierarchy, Services 1.4 Reference Models: Introduction to OSI Reference Model and TCP/IP Protocol Suite: 1.5 Comparison between OSI and TCP/IP Protocol Suite, 1.6 Layers in TCP/IP Protocol Suite 1.7 Addressing: Physical Addresses, Logical Addresses, Port Addresses, Application-Specific Addresses **Course Outcome : CO1 Teaching Hours :04 hrs Marks: 06**
2	**Course Outcome:** CO 2 TLO2.1 To understand Ethernet Frame Format and Addressing TLO2.2 To understand types of Ethernet TLO2.3 To understand Fiber Optic LAN TLO2.4 To understand Wi-Fi technology 802.11 and its extensions TLO2.5 To understand MAC Sublayer and Addressing TLO2.6 To understand Bluetooth and Wi-Fi Direct	**Underlying Technologies** 2.1 Wired LANs 2.1.1 IEEE Standards (802.3) 2.1.2 Ethernet Frame Format 2.1.3 Addressing 2.1.4 Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Ten-Gigabit Ethernet 2.1.5 Fiber Optic LAN 2.2 Wireless LANs 2.2.1 IEEE 802.11 (Wi-Fi) 2.2.2 Extensions of IEEE 802.11: b/a/g/n/ac/ax/be/bn 2.2.3 MAC Sublayer 2.2.4 Addressing 2.2.5 Bluetooth and Wi-Fi Direct **Course Outcome : CO2 Teaching Hours :04 hrs Marks: 06**

3	**Course Outcome**: CO 3 TLO3.1To understand connectionless and connection oriented services TLO3.2To understand network layer services TLO3.3To understand network layer issues TLO3.4To understand IPv4 Addressing TLO3.5To understand Classful and Classless Addressing TLO3.6To understand Special Addresses TLO3.7To understand NAT TLO3.8To understand IPv4 Protocol in details TLO3.9To understand ARP in brief TLO3.10 To understand Inter- and Intra-domain routing TLO3.11 To understand Unicasting, Multicasting and Broadcasting To understand multicast routing in brief	**Network Layer** 3.1 Introduction 3.1.1 Packet Switching at Network Layer: Connectionless Service, Connection-Oriented Service 3.1.2 Network Layer Services: 3.2 Network Layer Issues: 3.3 IPv4 Addresses 3.3.1 Address Space, Notation, Range of Addresses, Operations 3.3.2 Classful Addressing: Classes, Classes of Blocks, Two Level Addressing, Three Level Addressing: Subnetting, Supernetting 3.3.3 Classless Addressing: Variable Length Blocks, Two Level Addressing, Block Allocation, Subnetting 3.3.4 Special Addresses 3.4 Network Address Translation (NAT) 3.5 Internet Protocol Version 4 (IPv4): 3.5.1 Datagrams 3.5.2 Fragmentation: Maximum Transfer Unit (MTU), Fields related to Fragmentation 3.5.3 Options: Format, Option Types 3.5.4 Checksum: Calculation at Sender and Receiver, Checksum in the IP Packet 3.6 IPV6 Addressing and IPV6 protocol 3.7 Address Resolution Protocol (ARP): Introduction 3.8 Unicast Routing Protocols 3.8.1 Cost or Metric, Static versus Dynamic Routing Tables, Routing Protocol 3.8.2 Intra- and Inter-Domain Routing 3.8.3 Distance Vector Routing 3.9 Link State Routing 3.10 Multicast Addresses 3.11 Virtual Private Network (VPN)
4	**Course Outcome**: CO 4 TLO4.1To understand Transport Layer Services and Protocols TLO4.2To understand UDP Protocol in details TLO4.3To understand TCP Protocol in details TLO4.4To understand QUIC Protocol in brief	**Course Outcome : CO3 Teaching Hours :15 hrs Marks: 18** **Transport Layer** 4.1 Introduction to Transport Layer 4.1.1 Transport Layer Services 4.1.2 Transport Layer Protocols 4.2 User Datagram Protocol (UDP) 4.2.1 User Datagram 4.2.2 UDP Services: Process-To-Process Communication, Connectionless Services, Flow Control, Error Control, Congestion Control, Encapsulation and Decapsulation 4.3 Transmission Control Protocol (TCP) 4.3.1 TCP Services 4.3.2 TCP Features 4.3.3 Segment

		4.3.4 A TCP Connection 4.3.5 Windows in TCP 4.3.6 Flow Control 4.3.7 Error Control 4.3.8 Congestion Control 4.3.9 TCP Timers 4.3.10 Options 4.4 QUIC Protocol **Course Outcome : CO4 Teaching Hours :06 hrs Marks: 08**
5	**Course Outcome**: CO 5 TLO 5.1 To understand client server and peer-to-peer paradigms TLO 5.2 To understand world Wide Web in details TLO 5.3 To understand web documents TLO 5.4 To understand HTTP Protocol TLO 5.5 To understand HTTP versions TLO 5.6 To understand TLS, VPN, SSL, in brief TLO 5.7 To understand HTTPS To understand Digital Certificates Issuing Authorities	**HTTP and HTTPS** 5.1 Introduction to Application Layer 5.1.1 Client-Server Paradigm 5.1.2 Peer-To-Peer Paradigm 5.2 World Wide Web Architecture: Hypertext and Hypermedia, Web Client (Browser), Web Server, Uniform Resource Locator (URL) 5.3 Web Document: Static, Dynamic, Active Documents 5.4 HTTP: HTTP Transaction, Conditional Request, Persistence, Cookies, Web Caching (Proxy Server), HTTP Security 5.5 Versions of HTTP 5.5.1 HTTP1.0 and HTTP1.1 5.5.2 HTTP2 5.5.3 HTTP3 5.6 Overview of TLS, SSL, Websocket 5.7 HTTPS 5.8 Certificate Issuing Authority,: Let's encrypt (free), digicert, digisign, verisign 5.9 **Course Outcome : CO5 Teaching Hours :08 hrs Marks: 10**
6	**Course Outcome**: CO 5 TLO 6.1 To understand DHCP Protocol in details TLO 6.2 To understand DNS in details TLO 6.3 To perform remote login using TELNET and SSH. TLO 6.4 To understand FTP in details TLO 6.5 To understand Electronic Mail TLO 6.6 To understand Packet Filter and Proxy Firewalls	**Other Application Layer Protocols** 6.1 Host Configuration: DHCP 6.1.1 Overview of Protocols: RARP, BOOTP, DHCP 6.1.2 Configuration: Static & Dynamic Address Allocation 6.2 Domain Name System (DNS): Need for DNS, Domain, Generic Domain, Country Domain, Registrar, Resolution: Mapping Names to Addresses, Mapping Addresses to Names 6.3 Introduction to Remote Login: 6.3.1 TELNET 6.3.2 Secured Shell (SSH) 6.4 File Transfer Protocol: FTP, TFTP, SFTP 6.4.1 FTP: Connection, File Transfer 6.4.2 Overview of TFTP and SFTP 6.5 Overview of Electronic Mail: User Agent, Message Transfer Agents (SMTP), Message Access Agent (POP, IMAP) 6.6 Firewalls: Packet Filter Firewall and Proxy Firewall **Course Outcome : CO5 Teaching Hours :09 hrs Marks: 12**

V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1 Download and install WireShark Network Traffic Analyzer and Cisco Packet Tracer Software.	Download and install WireShark Network Traffic Analyzer and Cisco Packet Tracer Software.	02	CO1
2	LLO2 Download and install GNS3 Software.	Download and install GNS3 Software.	02	CO1
3	LLO3 Check and setup network settings on a computer.	3.1 Check the Physical Address, Logical Address of a computer. 3.2 Check the manual proxy setup of a computer.	02	CO1
4	LLO4 Configure a wired LAN in Packet Tracer.	Configure a wired LAN in Packet Tracer.	02	CO2
5	LLO5 Configure a wireless LAN in Packet Tracer.	Configure a wireless LAN in Packet Tracer.	02	CO2
6	LLO6 Simulate the networking topology of the institute in Packet Tracer	Simulate the networking topology of the institute in Packet Tracer	02	CO2
7	LLO7 Assign the IP classful addresses to the the computing and networking devidces	Assign the IP classful addresses to the the computing and networking devidces simulated in previous experiment.	02	CO3
8	LLO8 Perform initial switch configuration in Packet Tracer. LLO9 Perform initial router configuration in Packet Tracer.	Perform initial switch configuration in Packet Tracer. Performinitial router configuration.	02	CO3
9	LLO10Analyze the network traffic and capture the packets of IP, ARP, ICMP protocols and analyze them in Packet Tracer or Wireshark.	Analyze the network traffic and capture the packets of IP, ARP, ICMP protocols and analyze them in Packet Tracer or Wireshark.	02	CO3
10	LLO11Analyze the network traffic and capture the packets of UDP, TCP, SCTP QUIC protocols and analyze them in Packet Tracer or Wireshark	Analyze the network traffic and capture the packets of UDP, TCP, SCTP QUIC protocols and analyze them in Packet Tracer or Wireshark	02	CO4
11	LLO12Execute nslookup, traceroute/ tracert and netstat commands on command prompt / terminal	Execute nslookup, traceroute/ tracert and netstat commands on command prompt / terminal	02	CO4
12	LLO13Download and install Caddy Server. Create a Caddy file and Perform the actions such as start, stop, restart the server, etc.	Download and install Caddy Server. Create a Caddy file and Perform the actions such as start, stop, restart the server, etc.	02	CO5

13	LLO14 Write a program to send emails.	Write a program to send emails.	02	CO5
14	LLO15 Perform remote login using TELNET and SSH. in Packet Tracer	Perform remote login using TELNET and SSH in Packet Tracer	02	CO5
15	LLO16 Create your own FTP server to download and upload files using FTP Protocol in Packet Tracer	Create your own FTP server to download and upload files using FTP Protocol in Packet Tracer	02	CO5

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Market survey of networking devices
2. Numerical problems on Ethernet Frame format
3. Numerical Problems on IP Addressing
4. Numerical Problems on Header formats of given protocols
5. Explore Caddy Server
6. Create a proxy server
7. Create a VPN

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	The TCP/ IP Protocol Suite	04	02	--	06
2	Underlying Technologies	02	04	--	06
3	Network Layer	02	06	10	18
4	Transport Layer	02	06	--	08
5	HTTP and HTTPS	--	04	06	10
6	Other Application Layer Protocols	02	04	06	12
	Total	**12**	**26**	**22**	**60**

VIII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (__marks)

IX. 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	03	03	01	03	01	--	03	03	03	03
CO2	03	03	01	03	01	--	03	03	03	03
CO3	03	03	03	03	--	02	03	03	03	03
CO4	03	03	03	03	--	02	03	03	03	03
CO5	03	03	03	03	--	03	03	03	03	03

Legends: - High:03, Medium:02, Low:01, No Mapping: --

X. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Behrouz A. Forouzan	The TCP/ IP Protocol Suite, Fourth Edition	McGraw-Hill Forouzan Networking Series
2	Andrew Taninbaum	Computer Networks, Sixth Edition	Pearson Education

XI. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	Wireshark · Download	Link to download WireShark Network Traffic Analyzer Software and its documentation
2	Cisco Packet Tracer - Networking Simulation Tool (netacad.com)	Link to download Cisco Packet Tracer Software and its documentation
3	GNS3 Windows Install | GNS3 Documentation	Link to download GNS3 Software and its documentation
4	Caddyfile Quick-start — Caddy Documentation (caddyserver.com)	Link to download Caddy Server and its documentation
5	Configuring LAN in Packet Tracer - CCNA TUTORIALS	Configure a wired LAN in Packer Tracer
6	https://www.computernetworkingnotes.com/ccna-study-guide/how-to-configure-wireless-network-in-packet-tracer.html	Configure a wireless LAN in Packer Tracer

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Vivek Pawar	Director and CEO	Atoconn Systems Pvt. Ltd.
2	Prof. Nirmala Shinde-Baloorkar	Assistant Professor, Department of Computer Engineering	K. J. Somaiya College of Engineering
3	Mrs. Jijnasa S. Patil	Lecturer in Computer Engineering	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

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CDC Co-ordinator
G. P. Mumbai

Programme: Diploma in Information Technology (Sandwich Pattern)												
Course Code: IT23109					Course Title: User Interface Design							
Compulsory / Optional: Compulsory												
Teaching Scheme and Credits							Examination Scheme					
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
										PR	OR		
1	-	4	1	6	3				25	25@	-	25	75

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

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

Note:
1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

This subject is the technology subject, Web Page Design and Visual Basic is essential for studying this subject. **UID** is based on dot net technology, which is a framework, which supports many languages. C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic object oriented, and component oriented programming language. ADO.NET is a set of computer software components that programmers can use to access data and data services from the database ASP.NET is an open-source server-side web application framework designed for web development to produce dynamic web pages.

II. Industry / Employer Expected Outcome

This course develops necessary skills in students to apply .net techniques so that students will be able to develop complete applications using .Net technologies.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Use GUI tools of . NET framework
CO2	Use basic and advance . NET controls.
CO3	Interface back-end and front-end.
CO4	Build applications integrated with .NET Framework.
CO5	Build applications using C#
CO6	Build ASP.NET based applications.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1.1:** Understand .NET framework architecture **TLO 1.2** Study different Data Types **TLO 1.3:** understand different flow Controls.	**Introduction to C# and .Net framework.** 1.1 Review of .NET frameworks 1.2 Introduction to C# 1.3 Data Types Literals and Variables in C# 1.4 Operators in C# 1.5 Flow controls in C# **Course Outcome: CO5** **Teaching Hours: 03 hrs** **Marks: NA**
2	**TLO 2.1: Study of classes and objetcs** **TLO 2.2**: understand OOP concepts in python **TLO 2.3:** Exception Handling concepts.. **TLO 2.4:** Understand Generics ,Evets .	**Implementation of C#** 2.1 Classes and Objects 2.2 Arrays and Strings 2.3 Operator Overloading 2.4 Inheritance 2.5 Debugging and error handling in C# 2.6 C# - Events, Properties, and Methods 2.7 C# and the CLR 2.8 C# and Generics **Course Outcome: CO1, CO2** **Teaching Hours: 04 hrs** **Marks: NA**

3	**TLO 3.1: Understand XMl in .NET** **TLO 3.2:** Accessing Database in ADO.NET **TLO 3.3:** Study of different controls	**Introduction to ADO.Net and data manipulation** 3.1 Introduction to ADO.Net - What is database? - Writing XML file. - ADO.Net architecture. - Creating connection. - Dataset and Data-reader. - Types of Data adapter and ADO controls. - Reading data into dataset and data adapter. Binding data to controls. - Data table and Data row. 3.2 Accessing and manipulating data - Selecting data. - Insertion, deletion, updation, sorting. - How to fill dataset with multiple tables. **Course Outcome: CO3, CO4** **Teaching Hours: 4 hrs** **Marks: NA**
4	**TLO 4.1:** study concept of ASP **TLO 4.2:** Difference between ASP and .Net ASP **TLO 4.3:** Study of IDE creation and Web forms	**Introduction and implementation of ASP.Net** 4.1 Introduction to ASP.Net - Difference between ASP and ASP.Net - Introduction to IIS. - What is web application? Why it is used? 4.2 Implementation of ASP.Net - ASP.Net IDE. - Creation of web forms. - Using web form controls **Course Outcome: CO6** **Teaching Hours: 04 hrs** **Marks: NA**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

NOTE: Total 10 experiments (or turns) out of 18 experiments (or turns)

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO:** unsertand IDE and Layouts	Observe and draw visual .net IDE layout and hands on practice to create, save and open the project	2	CO1
2	**LLO**: Study of loop and array in C#	Write, test and debug at least 5 loop, array and operator based C# programs.	4	CO1, CO2
3	**LLO**: Study designing of forms ,methos and events on it	Design forms and write, test and debug programs to test its various properties , methods, events.	2	CO1, CO2
4	**LLO**: understand input and message box	Write, test and debug program to test input box and message box	2	CO1, CO2
5	**LLO**: study of debug application	Write, test and debug applications to use textbox, label, button	2	CO1, CO2
6	**LLO**: create control programs	Write, test and debug applications to use radio button, checkbox, numeric updown and group box controls	2	CO3, CO4

7	**LLO**: create scroll bar and timer	Write, test and debug application using checked list box, scroll bars, timer control.	2	CO3, CO4
8	**LLO**: creation of menu bar	Write, test and debug applications using menu	2	CO3, CO4
9	**LLO**: study of SQL connections in MS access	Create and test connection using ado.net to view SQL express server/Microsoft Access data in textbox etc controls	4	CO3, CO4
10	**LLO**: understanding layout control	Create connection view controls like data-grid view controls	2	CO3, CO4
11	**LLO**: creation of small application like add	Write, test and debug small application to add, edit, search, delete record in database in bounded mode	4	CO5
12	**LLO**: manipulation of data in database	Write, test and debug small application to add, edit, search, delete record in database.	4	CO5
13	**LLO**: study of creation of data report	Write, test and debug small application to demonstrate data reports.	2	CO5
14	**LLO**: Understand debugging in ASP.NET	Write, test and debug small web application using asp.net	4	CO6
15	**LLO**: Create small mini project	Mini Project	6	CO6
		Total	60	

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Prepare journal of practical.
2. Undertake mini project. Develop a Java application for the requirement given by faculty.
3. Prepare a presentation on the topic given by faculty.

VI. Specification Table:

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction to C# and .Net framework.**	3	NA			
2	**Implementation of C#**	4				
3	**Introduction to ADO.Net and data manipulation**	4				
4	**Introduction and implementation of ASP.Net**	4				
	Total	15				

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance indicators (60 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (140 marks)

VIII. 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 Log Learning	PSO-1	PSO-2	PSO-3
CO1	1	2					2	3		1
CO2	1			1			2	3	1	2
CO3	1		1				2	3		
CO4	1	3	3	2		3		3	2	2
CO5	2	2	2	1		3	3		2	3
CO6		3	1		1			1		1

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr.No	Author/ Publisher	Title	ISBN
1	The Complete Reference C#	Herbert Schildt Mc. Graw Hill	9780070703681
2	ASP.Net 4.0 Step By step	George Shepherd Microsoft	0735627010
3	The Complete Reference ADO.Net	Herbert Schildt Mc. Graw Hill	978-0072228984

X. Learning Websites & Portals

Sr.No	Link / Portal
1	https://www.w3schools.com
2	https://www.geeksforgeeks.org

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Ms. Namrata A. Wankhade	Lecturer Information Technology Department	Government Polytechnic, Mumbai
2	Ms.Dipali Gosavi	Lecturer Information Technology Department	Government Polytechnic, Mumbai
3	Mr.Parth Gragh	Project Technical assistant	IITB X IOCL

Coordinator,
Curriculum Development,
Department of Information Technology

Head of Department
Department of Information Technology

I/C, Curriculum Development Cell

Principal

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Computer Engineering and Information Technology (Sandwich Pattern)													
Course Code: IT23202					**Course Title: Next Generation Database**								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						**Examination Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH** (2Hrs.30 Min)	**FA-PR**	**SA**		**SLA**	**Total**
						TH1	**TH2**			**PR**	**OR**		
3	--	4	1	8	3	20	20	60	25	25#	--	25	175

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

Note:
1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self-learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

A key component of information systems is its database management system. This course encompasses the study of advanced technologies in databases. It introduces a non-relational database solution to work with semi-structured or unstructured data. This course helps students enhance their skills & competencies to implement database systems using advanced technologies.

II. Industry / Employer Expected Outcome

Engineers applying DBMS concepts should proficiently solve real-world problems, enhancing decision- making, design and innovation with precision and efficiency.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Describe the concept of non-relational database system.
CO2	Execute different MongoDB operations on database.
CO3	Execute different methods and advanced MongoDB operations on collection.
CO4	Configure MongoDB cluster on Cloud.
CO5	Understand the concept of Distributed database Systems.

IV. Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Understand the difference between relational and non-relational database system. TLO 1.2 Describe the types of NoSQL. TLO 1.3 Describe CAP theorem. TLO 1.4 Describe BASE properties. TLO 1.5 State the benefits and applications of NoSQL databases.	**Non-relational database system** 1.1 Relational (RDBMS) Vs. Non-relational database system (NoSQL). Introduction to NoSQL. 1.2 Types of NoSQL. Key-value database. • Column Oriented database. • Graph Oriented database. • Document Oriented database. • CAP theorem. • BASE properties. • Benefits of NoSQL. • Applications of non-relational databases.
	Course Outcome: CO1	**Teaching Hours: 06** **Marks: 10**
2	TLO 2.1 Understand the basics of MongoDB. TLO 2.2 Describe Basic operations in MongoDB. TLO 2.3 Describe MongoDB CRUD Operations TLO 2.4 Learn the validation of JSON schema. TLO 2.5 Understand Data Modeling and Data Relationships in MongoDB. TLO 2.6 Understand the concept of array in MongoDB.	**Introduction to MongoDB** 2.1 MongoDB overview. • Features of MongoDB. • RDBMS concepts mapping to MongoDB. • BSON and JSON document formats. o MongoDB Datatypes 2.2 Basic operations in MongoDB • Create and Drop Database. • Create and Drop Collection. 2.3 MongoDB CRUD Operations • Create • Read • Update • Delete • JSON Schema Validation 2.4 MongoDB Data Modeling and Data Relationships • Embedded document. • Normalized model (Reference document.) • Arrays in MongoDB • Querying Array elements.
	Course Outcome: CO2	**Teaching Hours: 13** **Marks: 16**

3	TLO 3.1 Study the methods in MongoDB. TLO 3.2 Describe indexing in MongoDB. TLO 3.3 Describe aggregation framework. TLO 3.4 Describe CAPPED collection. TLO 3.5 Describe replication in MongoDB. TLO 3.6 Describe Sharding in MongoDB. TLO 3.7 Study database backup and restore concepts.	**Advanced MongoDB** 3.1 Methods in MongoDB • Projection • Skip • Limit • Sort • Save • Gridfs 3.2 Indexing • Types of Index • Covered queries • Aggregation Framework • Pipeline operations • MapReduce • CAPPED Collection • Replication- Replica Set Configuration, Components of Replica Set • MongoDB Scaling Horizontal Scaling-Sharding • Vertical Scaling • Database backup and restore
	Course Outcome: CO3	**Teaching Hours: 12** **Marks: 16**
4	TLO 4.1 Learn the concept of Cloud Databases. TLO 4.2 Describe benefits of Cloud database. TLO 4.3 Learn to deploy MongoDB on cloud.	**Hosting MongoDB on Cloud** 4.1 Introduction to Cloud database. • Benefits of Cloud database/DBaaS • MongoDB Atlas 4.2 Deployment of Free Cluster using MongoDB Atlas. • Cluster Configuration. • Connect Cluster to Mongo Shell. • Access and modify databases on Cloud through • Mongo Shell.
	Course Outcome : CO4	**Teaching Hours : 05** **Marks: 08**

5	TLO 5.1 Understand the difference between Distributed database system and Centralized database system. TLO 5.2 Describe the classification of distributed database. TLO 5.3 Describe Architectural models of DDBMS. TLO 5.4 Describe Distributed data storage Techniques.	**Distributed databases** 5.1 Introduction • Distributed database system vs. Centralized database system. o Features of distributed database o Classification • Homogeneous DDBMS • Heterogeneous DDBMS 5.2 Architectural models of DDBMS • Client –Server architecture • Peer to Peer architecture • Multi DBMS (MDBS) architecture 5.3 Distributed data storage techniques • Fragmentation: Horizontal, Vertical, Hybrid • Replication 5.4 Applications of Distributed databases.
	Course Outcome: CO5	**Teaching Hours: 09** **Marks: 10**

V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial	Number of hrs.	Relevant COs
1	LLO 1.1 Install MongoDB.	Installation of MongoDB.	04	CO1
2	LLO 2.1 Create MongoDB database. LLO 2.2 Perform CRUD operations on created collections.	Create Database and Collections in MongoDB. 2.2 Perform CRUD-Create, Read, Update and Delete operations on created collections.	04	CO2
3	LLO 3.1 Implement different MongoDB methods on document.	Implementation of different MongoDB methods on document: Projection, Skip, Limit, Sort and Save.	04	CO3
4	LLO 4.1 Deploy MongoDB database on cloud. LLO 4.2 Perform CRUD operations on database.	4.1 Host MongoDB on Cloud: Create MongoDB Atlas account. Create a new Cluster. Configure Cluster. Create Database users. Connect created cluster with Mongo Shell Create Database and Collection. 4.2 Perform CRUD operations on created Collection (through Mongo Shell and through MongoDB Atlas)	06	CO4

5	LLO 5.1 Perform fragmentation operation on database.	Perform fragmentation operation on database (Distributed database using SQL queries): Vertical fragmentation. Horizontal fragmentation. Hybrid fragmentation.	06	CO5
6	LLO 6.1 Create MongoDB Collection containing embedded documents and reference documents. LLO 6.2 Perform CRUD operations on created Collection.	Create a Collection containing embedded documents and arrays. Perform CRUD operations on created Collection. 6.3 Create Collections with reference documents.	06	CO2
7	LLO 7.1 Use GridFS method to store MP3 file.	Store any MP3 file using Gridfs method.	04	CO3
8	LLO 8.1 Execute aggregate functions on collection. LLO 8.2 Implement pipeline operations on collection.	Execute aggregate functions on collection. 8.2 Implement pipeline operations on collection.	04	CO3
9	LLO 9.1 Create different types of Index on Collection. LLO 9.2 Execute Covered queries on Collection.	Create different types of Index on Collection: Simple/Single index, Compound index, Multikey index. 9.2 Execute Covered queries on Collection.	06	CO3
10	LLO 10.1 Create database backup and restore data.	Execute commands to create database backup and to restore data.	04	CO3
11	LLO 11.1 Execute replication operation on database.	Perform Replication operation on database.	04	CO3
12	LLO 12.1: Apply all concepts of MongoDB	Mini Project	08	All

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Write a report on different types of NoSQL databases and its applications.
2. Create database to store data of an organization and perform different operations on it.
3. Create a database to store data from any social media site.

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Non-relational database system	4	6	-	10
2	Introduction to MongoDB	4	4	8	16
3	Advanced MongoDB	2	6	8	16
4	Hosting MongoDB on Cloud	4	-	4	8
5	Distributed databases	2	4	4	10

Total	**16**	**24**	**20**	**60**

VIII. Assessment Methodologies/Tools

Formative Assessment (Assessment for Learning)

- TH- Progressive /Periodic Test each of 20 Marks
- TL - Continuous Assessment of Tutorials for 25 Marks
- SL - Continuous Assessment of Self Learning for 25 Marks

Summative Assessment (Assessment of Learning)

- **TH** - Term End examination of 60 Marks

IX. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)						
	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**
CO1	3	-	-	-	-	-	2
CO2	3	2	2	-	-	2	2
CO3	3	2	2	-	-	2	2
CO4	2	2	2	-	-	2	2
CO5	2	2	2	-	-	2	1

X. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	MongoDB- The Definitive Guide	Kristina Chodorow, O'Reilly, May 2013	ISBN: 978-1-449-34468-9
2	Data Modeling for MongoDB	Steve Hoberman, Technics Publications	9781634620413
3	Principals of Distributed Database Systems.	M. Tamer Ozsu; Patrick Valduriez, Springer	

XI. Learning Websites & Portals

1. www.MongoDB.com
2. https://docs.oracle.com

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mrs. Vrushali A. Patil	Lecturer in Computer Engineering	Govt. Polytechnic Mumbai
2	Ms. Samit Kumar Shukla	Project Manager	Cognizant Technology Services
3	Mrs. Namrata A. Wankhade	Lecturer in Information Technology	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Information Technology

Head of Department
Department of Information Technology

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

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CDC Co-ordinator
G. P. Mumbai

Programme: Diploma in Information Technology (Sandwich Pattern)													
Course Code: IT23201					Course Title: Python Programming								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
										PR	OR		
3	-	4	1	8	4	20	20	60	25	25#	-	25	175

Total IKS Hrs. for course:

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

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

Note:
1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Python is powerful programming language. It has efficient high level data structure 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 to beginners. It's elegant syntax and dynamic typing together with its interpreted nature make it ideal language for scripting and rapid application development in many areas and most platforms.

II. Industry / Employer Expected Outcome

This course develops necessary skills in students to apply object oriented programming techniques in Python so that students will be able to develop complete applications using Python Programming.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Perform different operation on data structures in python with decision making and functions
CO2	Apply object oriented concept in python programming.
CO3	Perform file handling with exceptions.
CO4	Validate the fields using regular expression
CO5	Design GUI forms and Database connectivity

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1.1:**understand python programming concept **TLO 1.2**: study different sequence data types **TLO 1.3:** understand difference between array and list . **TLO 1.4:** understand membership operator	**Introduction to Python** 1.1 Features of Python 1.2 Python building blocks: Identifiers ,Keywords , Indention ,Variables ,Comments 1.3 Python Environment setup: Installation and working on IDE. 1.4 Python Data Types: Number, String, Tuple, Array, List, Dictionary Declaration and use of data types. 1.5 Basic Operations: Arithmetic ,Comparison/Relational ,Logical ,Assignment , Bitwise ,Membership ,Identity Operator **Course Outcome: CO1** **Teaching Hours: 05 hrs** **Marks: 10**
2	**TLO 2.1:**. understand syntax of if..elif …else condition . **TLO 2.2**: utudy for loop different syntax **TLO 2.3:**. understand definition of function. **TLO 2.4**: explore the concept of function as object in python. **TLO 2.5:** understand creating user defined modules and library .	**Decision Making and Functions** 2.1 decision making statements(if ….elif…else , Nested if) 2.2 looping statement(for ,while) 2.3 Loop Manipulation using continue, break, pass statements 2.4 Functions 2.5 Use Of Python Built –in -Functions: type/data conversion functions, Maths Functions **Course Outcome: CO1,** **Teaching Hours: 10 hrs** **Marks: 10**

3	**TLO 3.1**: understand concept of OOP in python **TLO 3.2:** understand self variable in class **TLO 3.3**: study of Inheritance and Polymorphism in python **TLO 3.4:**Exception handling except block syntax in python **TLO 3.5**: understand multithreading in python	**Object Oriented Programming in Python** 3.1 Creating a Class 3.2 Self Variables, Types of Methods, Constructors, Inheritance, Polymorphism 3.3 Operator Overloading 3.4 Method Overloading & Overriding 3.5 Exception Handling Errors in a Python Program. Types of Exceptions The Except Block 3.6 Introduction to Multithreading. **Course Outcome: CO2** **Teaching Hours: 10 hrs** **Marks: 10**
4	**TLO 4.1:** understand syntax of file handling **TLO 4.2:** file handling with exception **TLO 4.3:** working on binary file	**File Handling** 4.1 Types of Files in Python Opening a File Closing a File 4.2 Knowing Whether a File Exists or Not 4.3 Working with Binary Files 4.4 Appending Text to a File 4.5 Understanding read functions, read(), readline() and readlines() 4.6 Understanding write functions, write() and writelines() 4.7 Manipulating file pointer using seek 4.8 File Exceptions **Course Outcome: CO3** **Teaching Hours: 05 hrs** **Marks: 8**
5	**TLO 5.1**: understand regex in python **TLO 5.2**: study different method of regex **TLO 5.3**:apply regex in real life examples	**Python Regular Expressions** 5.1 Powerful pattern matching and searching 5.2 Power of pattern searching using regex in python 5.3 Password, email, url validation using regular expression **Course Outcome: CO4** **Teaching Hours: 05 hrs** **Marks: 10**

6	**TLO 6.1:**understand GUI packages in python **TLO 6.2:** study Tkinter package in python **TLO 6.3:**create different shapes on Canvas container **TLO 6.4:** create different widgets on Frame **TLO 6.5:** python with different Data base connectivity.	**GUI Programming and Databases** 6.1 GUI Programming: 6.2 Writing a GUI with Python GUI Programming Toolkits Creating GUI Widgets with Tkinter Creating GUI using Turtle Creating Layouts, Radio Buttons and Checkboxes, Dialog Boxes. 6.3 Database Access Python's Database Connectivity Types of Databases Used with Python Mysql database Connectivity with Python Performing Insert, Deleting & Update operations on database **Course Outcome: CO5** **Teaching Hours: 10 hrs** **Marks: 12**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

NOTE: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO**: Install Python IDLE and study of operators .	Write python programs to understand Expressions, Variables, Basic Math operations, Strings: Basic String Operations & String Methods. (Minimum four Programs based on math operations, Strings)	4	CO1
2	**LLO**: Develop program for looping and decision making concept	Develop programs to understand the control structures of python (minimum 4 programs on decision making and looping) 1.Armstrong Number 2. factorial number 3. Array calculations 4.even odd number OR any other suggested by teacher	4	CO2
3	**LLO**: Develop program for OOP implementation .	Write python programs to understand classes and objects. (minimum 2 programs to create classes and objects)	4	CO2
4	**LLO**: Program of file handling from local machine	Write python programs to understand different File handling operations 1. Create a file Copy contents from one file to another file.	4	CO3

5	**LLO**: Understand exception handling in regex	Develop programs to validate the fields using regular expressions in python.	4	CO4
6	**LLO**: Create Canvas to draw different objects on it.	1. Develop programs to learn GUI programming using Tkinter 2. Develop a program to draw different shapes on Canvas using Tkinter	4	CO5
7	**LLO**: Develop program to study different operations on sequence data types.	Develop programs to learn different types of structures and operations on (list, dictionary, tuples, arrays) in python. 1. Add 2. Delete 3. Merge 4. Sort 5. Membership Operator	4	CO1
8	**LLO**: underatnd function return multiple values concept	Develop a python programs for function 1. Returing result from a function Returing multiple values from a function (minimum 4 similar programs for practice)	4	CO1
9	**LLO**: Understand function as object in python	Develop a program for Functions are First class objects 1. Assign function to a variable 2. to define one function inside another function 3. to pass a function as parameter to another function a function can return another function	4	CO1
10	**LLO**: understand call by value and reference difference.	Develop a program for 1. pass by value or call by value 2. pass by reference or call by reference 3. Types of arguments lambda Functions	4	CO2
11	**LLO** :understand inderitance in python	Write a python program to implement multiple inheritances.	4	CO3
12	**LLO :** use of Regex in back end technology	Develop a program for validating the fields in file using regular expression	4	CO4
13	**LLO**: use of Turtle tool to draw objects	Draw graphics using Turtle.	4	CO5
14	**LLO**: Different types of widgets to create Desktop application.	Develop a program to add different Widgets on Frame 1.Button 2. Label 3. Message/text Scrollbar 5.Checkbutton	4	CO5
15	**LLO:** Understand connectivity of python program with Different Databases.	Write python programs to understand database connectivity	4	CO6
		Total	60	

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Prepare journal of practical.
2. Undertake mini project. Develop a Pthon application for the requirement given by faculty.
3. Prepare a presentation on the topic given by faculty.

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Python	2	2	6	10
2	Decision Making and Functions	2	4	4	10
3	Object Oriented Programming in Python	4	4	2	10
4	File Handling	2	4	2	08
5	Python Regular Expressions	2	4	4	10
6	GUI Programming and Databases	2	4	6	12
Total		14	22	24	60

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (60 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (140 marks)

VIII. 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 Log Learning	PSO-1	PSO-2	PSO-3
CO1	1	2				2	2	3		1
CO2	1			1		2	2	3	1	2
CO3	1		1				2	3		
CO4	1	3	3	1		3	3	3	2	2
CO5	1	2	2	1		3	3	3	2	3

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr.No	Author/ Publisher	Title	ISBN
1	Core Python Programming	Dr.R.Nageswara Rao 2017 Edition Dreamtech Press.	978-93-5119-942-7
2	Python: The Complete Reference	Martin C Brown , McGraw Hill Publication	9780072127188
3	Learning Python	Mark Lutz, David Ascher , O'Reilly Publication	ISBN-13 :978-0-596-00281-7

X. Learning Websites & Portals

Sr.No	Link / Portal
1	https://www.javatpoint.com/java-tutorial
2	https://www.w3schools.com/java/
3	https://www.geeksforgeeks.org/java/
4	https://www.programiz.com/java-programming

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mrs Dipali Gosavi	Lecturer Information Technology Department	Government Polytechnic, Mumbai
2	Ms.N.A.Wankhede	Lecturer Information Technology Department	Government Polytechnic, Mumbai
3	Mr.Pratap Bangosavi	Software Developer	Lauren Information Technologies Pvt Ltd ,Khar Road East Mumbai

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G. P. Mumbai