GOVERNMENT POLYTECHNIC, PUNE
'120– NEP' SCHEME

PROGRAMME	**DIPLOMA IN CM/IT**
PROGRAMME CODE	**06/07**
COURSETITLE	**MOBILE APPLICATION DEVELOPMENT**
COURSECODE	**CM51203**
PREREQUISITE COURSECODE &TITLE	**NA**
CLASS DECLARATION	**YES**

I. LEARNING&ASSESSMENTSCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL &TSL Practical				Based on SL		Total Marks
			CL	TL	LL					FA-TH		SA-TH	Total			FA-PR		SA-PR		SLA		
										Max		Max	Max	Min		Max	Min	Max	Min	Max	Min	
CM51203	MOBILE APPLICATION DEVELOPMENT	SEC	2	-	4	2	8	4	-	-		-	-	-		50	20	50#	20	50	20	150

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: 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** fifth semester are**(CL+LL+TL+SL)hrs.*15Weeks**
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 use of mobile phones and Android apps is growing every day. As mobile apps grow in popularity for communication, entertainment, education, and shopping, there is high demand for app developers. This course covers the necessary concepts which are required for creating Android applications, key concepts and tools. Students will be able to design and build their own applications, laying a strong foundation for mobile development.

III. COURSE-LEVELLEARNINGOUTCOMES(CO'S)

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

CO1**:** Describe features of Android operating system.
CO2: Setup and configure the Android development environment.
CO3: Design user-friendly graphical interfaces.
CO4 : Build Android applications using standard UI components.
CO5: Develop Android applications with integrated database functionality.
CO6: Deploy Android application.

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 ANDROID OPERATING SYSTEM(CL Hrs-04)				
1	**TLO1.1**: Compare various android versions. **TLO** 1.2: Explain the need of Android Operating System. **TLO 1.3**: Describe android architecture with its features. **TLO 1.4** List the tools and softwares required for developing android application. **TLO 1.5** List Android OS Feature	**1.1** Introduction to Android Operating System, Android Ecosystem, Android versions. **1.2** Android versus iOS, Need of Android. **1.3** Android Architecture **1.4** Tools and software required for developing android application. Flutter for Android Developers. **1.5** Features Of Android.	Classroom Learning Collaborative Learning Program development tools	**CO1**
UNIT II-INSTALLATION AND CONFIGURATION OF ANDROID ENVIRONMENT (CL HRS-4)				
2	**TLO 2.1**: Explain steps to install Java JDK, Android SDK **TLO2.2:**Describe Virtual Devices(AVDs), Emulators **TLO2.3:** Differentiate between JVM and DVM. **TLO2.3**Explain various Android Terminologies	**2.1** Java JDK, Android SDK installation. **2.2** Android Development Tools(ADT), Android Virtual Devices(AVDs), Emulators,Dalvik Virtual Machine. **2.3** Difference between JVM and DVM. **2.4** Terminologies in Android: Android Run Time(ART) ,Over The Air(OTA),Global Positioning System(GPS),Google Cloud Messaging(GCM).	Classroom Learning Collaborative Learning Program development tools.	**CO2**
UNIT III- FUNDAMENTALS OF UI COMPONENTS AND LAYOUTS (CL HRS-4)				

3	**TLO3**.1:Describe android directory Structure . **TLO3**.2:Identify various screen Components. **TLO3**.3:Design GUI using various layouts.	**3.1** Control Flow, Directory Structure **3.2** Components of a screen, Fundamental UI design **3.3** Introduction to Layout and types of Layout: Constraint layout, Linear Layout, Frame Layout, Relative Layout, Table Layout.	Classroom Learning Collaborative Learning Program development tools.	**CO3**
SECTION-II				
UNIT IV-DESIGNING USER INTERFACE (CL HRS-6)				
4	**TLO 4.1**: Describe GUI Components to develop user interface for the given Android. **TLO 4.2** Use CustomToastAlert message, Time and Date Picker functionality. **TLO 4.3** Describe different views and its types	**4.1** Text View, Edit Text. Button, image button ,toggle button , Checkbox, Radio button, Radio button Group, Progress bar, Scrollbars, List. **4.2** Custom Toast Alert message, Time and Date Picker **4.3** Introduction to views and its types: List view, Grid view, Image view, Scroll view	Classroom Learning Collaborative Learning Program development tools.	**CO4**
UNIT V -ACTIVITY, MULTIMEDIA AND DATABASES (CL HRS-8)				
5	**TLO5**.1:Define Intent and List the types of intent. **TLO5.2**:Describe various Android Components **TLO5.3**:Implement various multimedia APIs **TLO5.4**:Perform different database transactions.	**5.1** Intent, its types and Intent Filter. **5.2** Activity Lifecycle, Broadcast Receiver ,Content Provider, Service Lifecycle, Fragments **5.3** Play audio and video ,Bluetooth, Camera ,Sensors, text to speech and speech to text, SMS Telephony SQLite Database, necessity of SQLite, Creation and connection of the database, extracting values from cursors and Transactions.	Classroom Learning Collaborative Learning Program development tools.	**CO5**
UNIT VI- SECURITY AND APPLICATION DEPLOYMENT (CL HRS-4)				
6	**TLO 6.1**:Describe the Android Security Model . **TLO 6.2**:Deploy android application.	**6.1** Understanding the Android Security Model, declaring and using Permissions, understanding and using Custom Permission. **6.2** Application Deployment: Creating small application, signing of application and steps of deploying app on Google Play Store.	Classroom Learning Collaborative Learning Program development tools	**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**: Study different operating systems and compare them with Android Operating System.	Compare various operating systems with Android OS.	2	**CO1**
2	**LLO 2.1:** Install and configure the Java Development Kit (JDK) **LLO 2.2:** Install and configure the Android Studio, Android SDK, and create an Android Virtual Device (AVD) for testing and development of Android applications.	*****Install and configure Java Development Kit (JDK), android SDK with android virtual device	2	**CO2**
3	**LLO3.1**:Develop Android app screens using LinearLayout. **LLO 3.2**: Develop Android app screens using Absolute Layout.	*a) Develop an Android app to create two different layouts using **LinearLayout**: • One with a vertical orientation(e.g.,a form with multiple fields). • One with a horizontal orientation (e.g.,a row of buttons). b) Create a screen where a button and text are placed at specific (x,y)coordinates using **AbsoluteLayout**.	4	**CO3**
4	**LLO4.1**Develop Android app screens using FrameLayout. **LLO4.2 1:** Develop Android app screens using RelativeLayout and TableLayout to arrange UI components.	*a)Create a layout where an ImageView and a TextView are stacked using **FrameLayout**. The ImageView should be at the background,and the TextView should be centered on top of it. b) Design and implement user interfaces in an Android application using RelativeLayout and TableLayout to arrange UI components.	4	**CO3**
5	**LLO 5.1:** Implement basic input and display components in an Android application using TextView, EditText. **LLO 5.2:** Use AutoCompleteTextView to interact with user input.	*a)Develop an Android app that uses TextView and EditText to get and display text from the user. b) Implement AutoComplete TextView in an Android application to provide user-friendly input suggestions based on partial user input.	4	**CO4**
6	**LLO6.1:** Use different types of buttons in Android application. **LLO 6.2** Develop an Android	*a) Develop an Android application that uses Button, ImageButton to perform actions based on user interactions.	4	**CO4**

	app that uses a ToggleButton to perform actions.	b) Develop an Android application that uses a ToggleButton to switch between two states(on/off)and perform actions based on the user's selection.		
7	**LLO7.1** Develop an Android app that uses a CheckBox	*a) Develop an Android application to implement CheckBox.	2	**CO4**
8	**LLO 8.1** Use an Android app that allows users to make multiple selections using RadioButton, and RadioGroup	)Develop a program to implement RadioButton and RadioGroup	2	**CO4**
9	**LLO 9.1:**. Implement ProgressBar control to show the status of the task.	*Develop an Android app that uses a Progress Bar to show the status of a task file uploading or downloading.	2	**CO4**
10	**LLO 10.1 :** Build an Android app that displays items in lists and grids.	*Develop a program to implement List View, Grid View.	4	**CO4**
11	**LLO 11.1**Implement ImageView and ScrollView .	Develop a program to Image View and Scroll View.	2	**CO4**
12	**LLO 12.1** : Develop an Android app that uses a CustomToastAlert ,Date and Time Picker.	Develop a program to implement CustomToastAlert and Date and Time Picker.	2	**CO4**
13	**LLO 13.1**: Implement activity lifecycle.	Develop a program to implement activity lifecycle.	2	**CO5**
14	**LLO 14.1:**Demonstrate the use of explicit intents.	* Develop an Android app that uses explicit intents to switch between activities and interact with external components.	2	**CO5**
15	**LLO 15.1:** Implement implicit intent to perform certain actions.	*Develop an Android app that uses implicit intents to perform actions like opening a web page, sending an email.	2	**CO5**
16	**LLO 16.1:** Develop an Android app that responds to specific intents	Design an app that responds to specific intents by configuring intent filters in the AndroidManifest.xml. (For eg, set up the app to handle shared text from other applications).	2	**CO5**
17	**LLO 17.1:** Develop an Android app using device's camera.	* Develop an Android app to capture image using device's camera.	2	**CO5**
18	**LLO 18.1:**Develop an Android app that uses horizontal and vertical fragments.	* Develop an Android app to implement horizontal and vertical fragments.	2	**CO5**
19	**LLO 19.1:** Develop an Android app that uses Broadcast receiver.	* Develop an Android app that receives and reacts to broadcast messages using Broadcast Receiver.	2	**CO5**
20	**LLO 20.1:** Develop an Android app that adds and	*Develop an Android application that performs basic database operations insert,	4	**CO5**

	deletes records in a local SQLite database.	delete, search and update using SQLite to manage structured data.		
21	**LLO 21.1:** Develop an Android app that sends SMS messages using user input and proper permissions.	*Develop an Android application that uses SMS functionality to send text messages by handling necessary permissions and using appropriate APIs.	2	**CO5**
22	**LLO 22.1:** Develop an Android app that enables Bluetooth functionality.	* Develop an Android app that enables Bluetooth connectivity, allowing devices to discover and connect with each other.	2	**CO5**
23	**LLO 23.1:** * Develop an Android app for Text and speech input and output	* Develop an Android app that converts user-inputted text into speech using the Text To Speech API.	2	**CO5**
24	**LLO 24.1:** * Develop an Android app for GPS Application	* Develop an Android app that uses location services and checks for permissions.	2	**CO6**
		TOTAL	**60**	

Note: Out of the aboves Suggestive LLOs–

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

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

Self-Learning YES

VI.SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIESFORSPECIFICLEARNING/SKILLS DEVELOPMENT (SELF-LEARNING Following are some suggestive topics for Self-learning):

1. **Mobile Banking App Prototype**-Simulate features like user login, balance check,mini statement, and fund transfer.
2. **Attendance Tracking App**-Mark student or employee attendance,view monthly reports,and generate summary.
3. **E-commerce Android App**-Users can browse products,add to cart,and place dummy orders.
4. **Health Tracking System**-Tracksteps,water intake,calories,and daily work out routines.
5. **Library Management System**-Students can view available books,issue/return books,and manage due dates.
6. **Student Management System**-Manage student details,course info,fees status,and performance.
7. **Employee Management System**-Store employee details,track leaves,attendance, and salaries.
8. **Product Inventory System**-Add,update, delete products and monitor stock levels.
9. **Hotel Management System**-Room booking, check-in/check-out, food ordering and bill generation.
10. **Bus Reservation Management System**-Book bus tickets,view schedules,and track bus locations.
11. **Travel Agency Management App**-Tour packages display,customer bookings,and feedback system.
12. **Bank Management System**-Manage account info,deposits, withdrawal ,and customer data.
13. **Airline Management System**-Search flights, book tickets and check seat availability.

14. **Blood Bank Management System**-View available blood types ,request blood and donor registration.
15. **Hospital Management System**-Patient registration,doctor appointments,and medical history tracking.
16. **Payroll Management System**-Calculate salary,deductions,and generate salary slips for employees.
17. **Hostel Management System**-Room allotment,student details, and mess bill management.
18. **Movie Ticket Reservation System**-Select movie,seat,and timing simulate ticket booking process.
19. **Electricity Bill Management System**-Calculate and display monthly usage and billpayment simulation.
20. **Insurance Management System**-Manage insurance policies,claims,and userdetails.
21. **ATM Management System**-Simulate ATM functionalities like PIN validation,cash withdrawal, and balance check.
22. **Patient Health Record System**-Record vitals,medication,reports,and schedule follow-up visits.
23. **Online Book store Management App**-Browse books,place dummy orders,manage reviews, and inventory.
24. **Car Rental Management System**-Browse cars,book rental,check availability,and view history.
25. **Student Grade Database App**-Input student marks,calculate grades,and generate report cards.

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 other case study 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 minimum 8GBRAM,256SSD installed with Windows10 onwards.	ALL
2.	Any compatible open source Android IDE(like-Android Studio ,Eclipse, Visual Studio with Xamarin with SQLite / Firebase database compatibility)	ALL COs

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 Android Operating System	CO1	04	--	--	--	--
2	II	Installation and configuration of Android Environment	CO2	04	--	--	--	--
3	III	Fundamentals of UI Components and Layouts	CO3	04	--	--	--	--
4	IV	Designing User Interface	CO4	06	--	--	--	--
5	V	Activity, Multimedia and Databases	CO5	08	--	--	--	--
6	VI	Security and Application Deployment	CO6	04	--	--	--	--

IX.ASSESSMENT METHODOLOGIES /TOOLS

Formative assessment (AssessmentforLearning)	Summative Assessment (AssessmentofLearning)
Lab performance, Assignment,Self-learning, and Seminar/Presentation	Lab Performance ,viva voce

X.SUGGESTED COS-POS MATRIXFORM

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
CO1	2	3	1	2	1	1	2	-	2
CO2	1	3	2	3	1	1	2	-	2
CO3	1	3	2	3	1	1	2	-	2
CO4	1	3	3	3	1	1	2	-	2

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Prasanna Kumar Dixit	ANDROID	Vikas Publications,First Edition,2014 ISBN NO :- 9789325977884
2	John Horton	Android Programming for Beginners	Packet Publication, First Edition ISBNNO:-2015978-1-78588-326-2
3	Pradeep Kothari	Android Application Development	Kogent Learning Solutions ISBN: 9789351194095
4	Maclean David , Komatineni Satya,Allen Grant	ProAndroid5	Apress Publications,2015,ISBN:978-1-4302-4680-0

XII. LEARNINGWEBSITES&PORTALS

1.https://www.tutorialspoint.com/android
2. https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf
3. https://developer.android.com/training/data-storage/sqlite
4. https://developer.android.com/guide/topics/permissions/overview

Name & Signature: **Mrs.Vaishali S.Pawar** Lecturer in Computer Engineering	**Mrs.Reshma J.Chavan** Lecturer in Computer Engineering	**Ms.Poonam C. Fafat** 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	INFORMATION TECHNOLOGY
PROGRAMME CODE	07
COURSE TITLE	INFORMATION SECURITY AND CYBER LAWS
COURSE CODE	IT51204
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	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	
IT51204	INFORMATION SECURITY AND CYBER LAWS	DSC	3	--	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	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, **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:

Information security is an important aspect in today's world. Now days due to various threats securing the Organization and Information is an important consideration. It is essential to understand basic security principles, various threats to security and techniques to address these threats. The student will be able to recognize potential threats to confidentiality, integrity and availability and also able to implement various computer security policies.

This course will introduce basic cryptographic techniques, fundamentals of Information security, risks faced by computers and networks, user authentication and control. Also it will create awareness about Cyber crimes and Cyber Laws

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 types of attacks which causes threat to Information Security.
CO2 - Apply multi-factor user authentication and access control mechanisms and applications.
CO3 - Apply basic encryption / decryption techniques for a given text.
CO4 - Apply various encryption algorithms used for information security.
CO5 - Understand the concepts of Cyber Crime & Cyber Laws.

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 1: Introduction to Information Security (CL Hrs. -08, Marks- 12)			
1	TLO 1.1 Explain Need of information security. TLO 1.2 State criteria for information classification. TLO 1.3 Explain basic principles of information security. TLO 1.4 Identify various types of attacks. TLO 1.5 Enlist types of malwares. TLO 1.6 Establish relationship between threat, vulnerability, risks with suitable example.	1.1 Information Security Overview: Introduction to information, need of information security 1.2 Information classification, Criteria for information classification 1.3 Basic principles of information security: Confidentiality, Authentication, Integrity, Availability, Access Controls, Repudiation 1.4 Type of Attacks: Active and Passive attacks, Denial of Service, DDOS, Backdoors and Trapdoors, Sniffing, phishing, Spoofing, Man in the Middle, Replay, TCP/IP Hacking, Encryption attacks, Social Engineering 1.5 Types of Malwares and their impact on security and prevention: - Virus, Worms, Trojan horse, Spyware, Adware, Ransomware, Logic Bombs, Rootkits, Backdoors, Keyloggers 1.6 Threat and Risk Analysis: Introduction to assets, vulnerability, threats, risks, relation between: threat, vulnerability, risks	Lecture Using Chalk-Board Presentations Video Demonstrations	CO1

	UNIT 2 : User Authentication and Access Control (CL Hrs. - 08, Marks-12)			
2	TLO 2.1 Use different types of authentication methods. TLO 2.2 Identify various types of password attacks. TLO 2.3 Illustrate the given biometric patterns. TLO 2.4 State goals of authorization. TLO 2.5 Compare DAC, MAC, RBAC and ABAC on the basis of given parameters.	2.1 Identification and Authentication methods : Electronic user authentication, username and password, multi-factor authentication, token-based authentication, biometrics 2.2 Guessing password, Password attacks: Piggybacking, Shoulder surfing, Dumpster diving 2.3 Biometrics: Finger prints, Hand prints, Retina scan patterns, Voice patterns 2.4 Authorization: Introduction to authorization, goals of authorization 2.5 Access controls: Access control principles, Access rights and permission 2.6 Access control policies: Discretionary access control (DAC), Mandatory access control (MAC), Role-based access control (RBAC), Attribute-based access control (ABAC)	Lecture Using Chalk-Board Presentations Video Demonstrations	CO2
	UNIT 3: Fundamentals of Cryptography (CL Hrs-10, Marks-16)			
3	TLO 3.1 Explain the process of encryption and decryption. TLO 3.2 Compare symmetric and asymmetric cryptography on the basis of given parameters. TLO 3.3 Apply given substitution techniques on text. TLO 3.4 Apply given transposition techniques on text. TLO 3.5 Explain step by step working of steganography.	3.1 Introduction : Plain text, Cipher text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption 3.2 Symmetric and Asymmetric cryptography : Introduction, working, key management, asymmetric cryptography - public key distribution 3.3 Substitution techniques : Caesar cipher, Playfair cipher, Vigenere cipher, Vernam cipher (One-time pad) 3.4 Transposition techniques : Rail fence technique , Simple columnar technique 3.5 Steganography : Introduction and working of steganography	Lecture Using Chalk-Board Presentations Video Demonstrations	CO3

UNIT4: Encryption Algorithms (CLHrs-08,Marks-14)				
4	TLO 4.1 Apply DES algorithm to encrypt given text. TLO 4.2 Apply AES algorithm to encrypt given text. TLO 4.3 Apply given algorithm to perform encryption on text. TLO 4.4 Apply hash function algorithm to generate hash value for given text. TLO 4.5 Explain working of Digital Signature. TLO 4.6 Enlist mobile security threats.	4.1 DES (Data Encryption Standard) algorithm 4.2 AES (Advanced Encryption Standard) algorithm 4.3 RSA algorithm 4.4 Diffie-Hellman key exchange algorithm 4.5 Hash Function : Introduction, Features of Hash Functions, MD5 and SHA algorithm 4.6 Digital Signature : Introduction and working of digital signature Threats to mobile phone and its security measures	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom	CO4
UNIT5: Internet Security and Cyber Law (CLHrs-11,Marks-16)				
5	TLO 5.1 Explain given type of firewalls. TLO 5.2 Enlist firewall policies. TLO 5.3 Compare Network Based and Host-Based IDS. TLO 5.4 Explain given protocol used for E-mail security. TLO 5.5 Identify type of cyber-crime for a given scenario. TLO 5.6 Explain categories of cyber laws.	5.1 Firewall : Need of firewall, Types of firewalls : Packet filters, Stateful packet filters, Application gateways, Circuit gateways 5.2 Intrusion Detection System(IDS) : Network-based IDS, Host-based IDS, Honeypots 5.3 E-mail security : Simple mail transfer protocol (SMTP), Pretty good privacy (PGP), S/MIME 5.4 Cyber Crime Introduction, Hacking , Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography , Identity Theft & Fraud , Cyber terrorism, Cyber Defamation, OS fingerprinting. 5.5 Cyber Laws : Introduction, need, Categories : Crime against Individual, Government, Property.	Lecture Using Chalk-Board Presentations Video Demonstrations	CO5

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 Install and configure Antivirus software on system. LLO 1.2 Apply privacy and security settings to protect operating system.	i. Install and configure Antivirus software on system (Licensed copy) ii. Use privacy and security settings on operating system	2	CO1
2	LLO 2.1 Set up and recover password of computer system.	i. Set up single level authentication for computer system ii. Recover the password of computer system using any freeware password recovery tool (Example- John the ripper)	4	CO2
3	LLO 3.1 Grant read , write and execute permission on file and folder.	i. Grant security to file, folder or application using access permissions and verify it ii. Grant access permission while sharing file and folder	2	CO2
4	LLO 4.1 Implement password authentication.	Write a utility using C/Shell programming to create strong password authentication (Password should be more than 8 characters, and combination of digits, letters and special characters #, %, &, @)	2	CO2
5	LLO 5.1 Implement Caesar cipher, Vernam cipher and Rail fence encryption technique.	i. Write a C program to implement the following technique to perform encryption and decryption of text i. Caesar cipher ii. Vernam cipher iii. Rail fence	4	CO3
6	LLO 6.1 Implement simple columnar transposition technique.	Implement simple Columnar Transposition encryption technique to perform encryption of text using C programming language	2	CO3
7	LLO 9.1 Implement steganography.	Use Steganography to encode and decode the message using any open-source tool (Example-OpenStego)	2	CO3
8	LLO 7.1 Generate Hash Code.	Create and verify Hash Code for given message using any Open-source tool. (Example-Cryptool)	2	CO4

9	LLO 8.1 Implement Diffie-Hellman key exchange encryption technique.	Write a C program to implement Diffie-Hellman key exchange algorithm to perform encryption of text	2	CO4
10	LLO 10.1 Generate digital signature	Create and verify digital signature using any Open- source tool (Example- Cryptool)	2	CO4
11	LLO 11.1 Configure firewall.	Configure firewall settings on any operating system	2	CO5
12	LLO 12.1 Apply browser settings.	Set up security policies for any web browser and Email account (Example: setting filter, spam for email security. Low security apps settings, cookies, synchronization for web browser))	4	CO1, CO5

Note: Out of the above suggestive LLOs –

1. 'All 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/SKILLSDEVELOPMENT (SELF-LEARNING)

Self-Learning

- User A wants to send message to user B securely on network.

i. Select any two techniques to encrypt message.
ii. Implement both the techniques.
iii. Evaluate result of implementation.
iv. Compare complexity of both techniques.
v. Prepare report.

- Prepare admin level report of company who wants to implement allocate fixed system to each employee for authentic access to maintain security.

i. Explain various single level authentication method available to access the system.
ii. Analyse the weakness and security threats to this problem.
iii. Suggest multi factor authentication for given problem situation.
iv. Compare impact of single and multi-factor authentication on given situation.

- A bank has more than 1000 user accounts. Around 100 users received message regarding deduction of specific amount without intimation and after that all authorized user are not able to access online banking service of that bank.

i. Identify type of crime and attack.
ii. Write procedure to investigate that crime.
iii. Write preventive measure to avoid such type of attack in future.
iv. Write punishment of such type of attacks and state cyber law act.
v. Write a report.

- Case study on Cyber Crime in Social Engineering in India.

i. Explain various Social Engineering attacks.
ii. Select topic for case study.
iii. Write problem statement of attack.
iv. Write procedure to investigate that attack.
v. Write a report.

- Case Study on Cyber-Physical System in Smart Traffic Management in India

i. Explain various Cyber-Physical System Components.
ii. Select topic for Case Study
iii. Write problem statement of CPS Deployment
iv. Write procedure to Investigate the CPS Deployment
v. Write a report on the Case

- Teacher shall allocate any other microproject relevant to COs.

Assignment

- Teacher shall give assignments covering all COs.

Other

- Complete any one course related to Information Security and Cyber Crime on Infosys Springboard , Virtual Lab , NPTEL.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications/Instrument Required	Relevant LLO
1	Computer System (Any computer system with basic configuration)	ALL
2	Antivirus software (Licensed copy)	ALL
3	Any compiler (TurboC / Online 'C' compiler)	4,5,6,7,8
4	Encryption and decryption tool. (Open-source tool)	7,10
5	Any freeware password recovery tool.	2
6	Web Browser. (Any Web Browser)	12
7	Steganography Tools. (Open-source tool)	9
8	Web Tracing Tools. (Open-source tool)	12

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	Introduction to Information Security	CO1	8	4	6	2	12
2	User Authentication and Access Control	CO2	8	4	4	4	12
3	Fundamentals of Cryptography	CO3	10	2	4	10	16
4	Encryption Algorithms	CO4	8	2	4	8	14
5	Internet Security and Cyber Law	CO5	11	6	6	4	16
	Grand Total		45	18	24	28	70

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment forLearning)	Summative Assessment (Assessment ofLearning)
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	-	-	-	1	1	2	1	1	-
CO2	1	1	1	1	2	2	2	1	1	-
CO3	1	2	2	2	2	1	2	1	2	2
CO4	1	2	2	2	2	1	2	1	2	3
CO5	1	1	1	2	2	1	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	William Stallings, Lawrie Brown	Computer Security Principles and Practice, Third Edition	Pearson. ISBN-13: 978-0-13-377392-7
2	Atul Kahate	Cryptography and Network security Third Edition	McGraw-Hill; Fourth edition ISBN-13: 978- 9353163303
3	Nina Godbole	Information Systems Security Second Edition	John Wiley ISBN-13: 978-8126564057
4	Mark Merkow, Jim Breithaupt	Information Security Principles and Practices	Pearson. ISBN 978-81-317-1288-7
5	V. K. Pachghare	Cryptography and Information Security	Prentice Hall India ISBN:978-81-203-5082-3
6	Harish Chander	Cyber Laws and IT Protection Second Edition	PHI Publication , ISBN : 9789391818463 eBook ISBN : 9789391818517

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=NlpnJE0m-NU	Simulation of Intrusion Detection System in MANET using NetSim
2	https://archive.nptel.ac.in/courses/106/106/106106129/	NPTEL course on Introduction to Information Security
3	https://onlinecourses.swayam2.ac.in/cec22_cs15/preview	Swayam course on Information Technology
4	https://www.youtube.com/watch?v=T9c5ZpT2FV0	Firewall configuration
5	https://cse29iiith.vlabs.ac.in/List%20of%20experiments.html	Virtual lab for cryptography

Name & Signature:

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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)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	**DIPLOMA IN INFORMATION TECHNOLOGY**
PROGRAMME CODE	**07**
COURSE TITLE	**EMERGING TRENDS IN INFORMATION TECHNOLOGY**
COURSE CODE	**IT51205**
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	
IT51205	EMERGING TRENDS IN INFORMATION TECHNOLOGY	DSC	4	--	--	2	6	3	2	30	70*#	100	40	--	--	--	--	25	10	125

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:

Emerging trends in Information Technology are driven by the need for efficiency, security and automation. Technologies like AI and blockchain enhance productivity and connectivity. Digital forensics is essential for investigating cybercrimes, while green computing promotes sustainability. This course creates awareness in students regarding emerging trends in the area of Information Technology.

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

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

CO1 - Elaborate the role of Artificial Intelligence, Machine Learning and Deep Learning in various domains.
CO2 – Understand the functions of Blockchain Technology.
CO3 – Characterize different Immersive Technologies.
CO4 - Enlist the Sustainable Computing features.
CO5 - Understand the concept of Quantum Computing
CO6 – Understand the process of Datafication.

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 OF AI and ML (CL Hrs-12, Marks-12)		
1.	TLO 1.1 Describe the concept of AI. TLO 1.2 List applications of AI. TLO 1.3 Define Machine Learning. TLO 1.4 Describe characteristics of different types of Machine learning. TLO1.5 Describe the concept of Deep learning. TLO 1.6 Describe importance of Neural Network. TLO 1.7 Differentiate the concepts of AI, ML ad DL. TLO 1.8 Explain the function of different key components of Generative AI. TLO 1.9 Describe the role of AI & ML to improve the effectiveness of security mechanisms.	**1.1** Introduction of AI: Concept, Scope of AI, Types of AI, Applications of AI **1.2** Machine Learning: Concept, Types: Supervised, Unsupervised, Reinforcement, Applications of Machine Learning, Concept of Deep Learning, Applications of Deep Learning, Concept of Neural Network, Difference between AI, ML and DL **1.3** Generative AI: Concept, Transformers: Key components of Transformers: Self-attention mechanism, multi-head attention, Positional encoding, Feed forward Neural Network, Layer Normalization, Encoder Decoder Structure, Types of Generative AI: Text Generation, Image Generation, Music and Audio Generation, Video Generation, Applications of Generative AI **1.4** Types of attacks: AI Powered cyber-attack, Adversarial AI attacks, Evasion AI Attack, AI poisoning attack, A powered attacks protection measures: Turn on Multi-Factor Authentication, Use Super Strong Password, Update Everything, Secure your Network, Use your mobile Device Securely	Presentations Case Study Lecture Using Chalk-Board Video Demonstrations	**CO1**

	UNIT-II BLOCKCHAIN TECHNOLOGY (CL Hrs-12 Marks-13)			
2	TLO 2.1 Explain the key features of Blockchain Technology. TLO 2.2 Describe Blockchain Architecture. TLO 2.3 Differentiate different types of Blockchain. TLO 2.4 List the Blockchain Applications. TLO 2.5 State the role of Smart Contracts & Cryptocurrencies. TLO 2.6 State the different challenges in Blockchain Technology.	2.1 Basics of Blockchain Technology- Definition, Key Features of Blockchain Decentralization, Transparency, Immutability, Traditional vs Blockchain System 2.2 Blockchain Architecture 2.3 Types of Blockchain- Public Blockchain, Private Blockchain, Consortium Blockchain and Hybrid Blockchain 2.4 Blockchain Applications- Finance, Healthcare, Supply chain and Gaming 2.5 Role of Blockchain in Smart Contracts & Cryptocurrencies - Definition, Key Features of Smart Contracts, Popular Cryptocurrencies 2.6 Challenges in Blockchain Technology	Collaborative learning Presentations Case Study Flipped Classroom Video Demonstrations	CO2
	UNIT - III IMMERSIVE TECHNOLOGY (CL Hrs-10 Marks-10)			
3	TLO 3.1 Describe Key features of different immersive technologies. TLO 3.2 Explain Augmented Reality (AR) and Virtual Reality (VR) TLO 3.3 Explain Mixed Reality (MR) and Extended Reality (XR) TLO 3.4 List applications of Immersive Technology.	3.1 Introduction to Immersive Technology 3.2 Types of immersive technologies 3.3 Augmented Reality (AR) 3.4 Virtual Reality (VR) 3.5 Mixed Reality (MR) 3.6 Extended Reality (XR) 3.7 Haptic Technology 3.8 Applications of Immersive Technology	Video Demonstrations Presentations Flipped Classroom Hands-on	CO3
	SECTION II			
	UNIT-IV GREEN COMPUTING AND SUSTAINABLE COMPUTING (CL Hrs-08, Marks-10)			
4	TLO 4.1 State the importance of Green Computing. TLO 4.2 Describe the characteristics of Energy efficient Computing. TLO 4.3 State the Green software design principles. TLO 4.4 Describe E-waste management and recycling	4.1 Green Computing- Definition and its importance 4.2 Environmental impact of technology 4.3 Energy efficient Computing 4.4 Eco friendly materials in hardware and software 4.5 Green software design principles 4.6 Geen data centers. 4.7 E-waste management and recycling	Case Study Presentations Video Demonstrations Collaborative learning Flipped Classroom	CO4

	UNIT-V QUANTUM COMPUTING (CL Hrs-08, Marks-10)			
5	TLO 5.1 Define Quantum Computing. TLO 5.2 Compare Classical vs Quantum Computation TLO 5.3 Enlist Quantum Computing Tools TLO 5.4 Describe various applications and challenges in Quantum Computing	5.1 Quantum Computing- Introduction 5.2 Classical vs Quantum Computation 5.3 Basics of Quantum mechanics 5.4 Quantum Computing Tools. 5.5 Applications of Quantum Computing Challenges in Quantum Computing	Case Study Presentations Video Demonstrations Collaborative learning Flipped Classroom	CO5
	UNIT-VI DATAFICATION (CL Hrs-10, Marks-15)			
6	TLO6.1Define Datafication. TLO 6.2 State the difference between digitization and datafication. TLO 6.3 Enlist Types of Data TLO 6.4 Describe Big data technologies. TLO 6.5 State the applications of Datafication.	6.1 Introduction to Datafication: Definition of datafication, Difference between digitization and datafication, Real-life examples (social media, fitness apps, smart homes) 6.2 Sources and Types of Data: Structured, unstructured, and semi-structured data, Machine-generated vs human-generated data, Behavioural data (clicks, views, interactions) 6.3. Technology Behind Datafication: Big data technologies (e.g., Hadoop, Spark basics), Cloud computing and data storage, Internet of Things (IoT) and sensors, Artificial Intelligence and machine learning 6.4 Applications of Datafication: Healthcare (wearables, health records), Marketing and personalization, Smart cities and traffic systems, Education (student performance analytics) 6.5. Benefits and Challenges: Benefits: better decision-making, automation, personalization, Challenges: data quality, volume, integration	Case Study Presentations Video Demonstrations Collaborative learning Flipped Classroom	CO6

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES

NOT APPLICABLE

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

Assignment

- Write assignment covering all COs given by Course Teacher

Micro project

- Prepare a report on given case for Healthcare Blockchain System. The healthcare industry faces numerous challenges, including data fragmentation, lack of interoperability, and security vulnerabilities. Blockchain technology has emerged as a potential solution to address these issues by providing a decentralized, secure, and transparent way to manage healthcare data. This case study explores the implementation of a blockchain-based healthcare system and its impact on data management, security, and patient outcomes.
- Prepare a report on given case for an Application of Artificial Intelligence in Education field. The goal is to leverage AI technologies to enhance teaching effectiveness, improve student outcomes, streamline administrative processes, and foster a more inclusive and engaging learning environment.
- Prepare a report on given case for Use of Immersive Technologies in Training. Walmart's Virtual Reality (VR) Training Program-Walmart implemented virtual reality (VR) technology to train employees across its stores in the United States. The goal was to improve employee preparedness for real-world scenarios, from managing Black Friday crowds to handling customer service issues.
- Prepare a report on given case for Copyright Challenges for Generative Artificial Intelligence Systems. This case study seeks to explore the evolving landscape of copyright challenges in generative AI, highlighting key legal disputes, emerging regulatory responses, and potential strategies for ensuring ethical and legally compliant deployment of these transformative technologies.

Other

- Complete any one course related to Artificial Intelligence, Machine Learning, Immersive Technology and Blockchain on Infosys Springboard, Virtual Lab , NPTEL.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	NOT APPLICABLE	

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 OF AI AND ML	CO1	12	4	4	4	12
2	II	BLOCKCHAIN TECHNOLOGY	CO2	12	3	4	6	13
3	III	IMMERSIVE TECHNOLOGY	CO3	10	2	4	4	10
SECTION II								
4	IV	GREEN COMPUTING AND SUSTAINABLE COMPUTING	CO4	08	2	4	4	10
5	V	QUANTUM COMPUTING	CO5	08	2	4	4	10
6	VI	DATAFICATION	CO6	10	6	4	5	15
			Grand Total	**60**	**19**	**24**	**27**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
NA	NA

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	1	–	–	1	1	--	2	3
CO2	2	2	1	-	-	1	1	2	1	3
CO3	2	2	1	--	--	1	1	-	3	3
CO4	2	3	3	2	2	3	3	1	2	3
CO5	2	2	2	--	--	1	2	--	3	3
CO6	2	2	1	--	--	1	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 with ISBN Number
1	R.B. Mishra	Artificial Intelligence	PHI ISBN:978-8-1203-3849-9
2	S Sridhar, M Vijayalakshmi	Machine Learning	Oxford University Press ISBN:978-0-1901-2727-5
3	Bikramaditya Singhal Gautam Dhameja Priyanshu Sekhar Panda	Beginning Blockchain-A Beginner's Guide to Building Blockchain Solutions	Apress, ISBN-13 (pbk): 978-1-4842-3443-3 ISBN-13 (electronic): 978-1-4842-3444-0
4	Tiana Laurence	Blockchain For Dummies	Wiley India ISBN: 9788126527755
5	Dr.Chuck Easttom	Quantum Computing Fundamentals	Pearson Education ISBN: 978-9356062597
6	John Sammons	The Basics of Digital Forensic	Elsevier ISBN: 978-1-59749-661-2
7	Sagaya Aurelia	Immersive Technologies	CRC Press ISBN: 978-10-327-5114-6
8	Githa S. Heggde,Santosh Kumar Patra,Rasananda Panda	Immersive Technology and Experiences	Palgrave Macmillan ISBN: 978-981- 99-8833-4
9	Shivakumar.R. Goniwada	Introduction to Datafication: Implement Datafication Using AI and ML Algorithms	Apress, ISBN-13:978-1484294956
10	Gerardus Blokdyk	Datafication A Complete Guide	5starcooks, ISBN-13 : 978-0655831860

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=iqjcNRJf-Nc	Immersive technology
2	https://freecomputerbooks.com/An-Introduction-to-Quantum-Machine-Learning-for-Engineers.html	An Introduction to Quantum Machine Learning for Engineers
3	https://microsoft.github.io/AI-For-Beginners/	Artificial intelligence for beginners course
4	https://developers.google.com/machine-learning/crash-course	Machine learning course
5	https://onlinecourses.nptel.ac.in/noc22_cs44/preview	Blockchain Technology course
6	https://www.youtube.com/watch?v=ScqopKqK6v0	Immersive technology
7	https://iterasec.com/blog/understanding-ai-attacks-and-their -types/	Types of AI attacks
8	https://www.cm-alliance.com/cybersecurity-blog/5-ways-to-avo id-ai-powered-hacking	AI powered attacks - protection measures

Name & Signature:

Smt. A.D.Kshirsagar
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)

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CM/IT
PROGRAMME CODE	06/07
COURSE TITLE	JAVA PROGRAMMING
COURSE CODE	CM41205
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	
CM41205	JAVA PROGRAMMING	DSC	3	1	2	-	6	3	3 Hrs	70	30	100	40	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:

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:

Java is a widely used, platform-independent, and open-source object-oriented programming language. With strong industry support and a rich ecosystem of free libraries, it underpins technologies like Advanced Java, JSP, and Android development. This course equips Computer Engineering and IT students with essential and advanced Java skills through hands-on practice, preparing them for real-world software development and boosting their employability.

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 - Apply object-oriented programming concepts by developing Java programs using classes and objects.
CO2 – Apply inheritance and interfaces in java to achieve code reusability
CO3 - Develop Java program implementing multithreading and exception handling.
CO4 - Implement event-driven programming in Java using appropriate event handling mechanisms.
CO5 - Develop client-server applications using Java network programming concepts.
CO6 – Implement Java applications using JDBC for effective database connectivity and management.

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 BASICS OF JAVA (CL Hrs-6, Marks-11)		
1.	**TLO 1.1** Write programs to create classes and objects for the given problem. **TLO 1.2** Describe characteristics of the given java token. **TLO1.3** Write program to evaluate given expressions. **TLO 1.4** Write programs using relevant control structure to solve the given problem. **TLO 1.5** Develop programs using vectors and wrapper classes for the given problem. **TLO 1.6** Use constructors for the given programming problem	**1.1** Java features and the Java programming environment **1.2** Defining a class, creating object, accessing class members **1.3** Java tokens and data types, symbolic constant, scope of variable, typecasting, and different types of operators and expressions, decision making and looping statements **1.4** Arrays, strings, string buffer classes, vectors, wrapper classes **1.5** Constructors and methods, types of constructors, method and constructor overloading, nesting of methods, command line arguments, garbage collection, visibility control: public, private, protected, default, private protected.	Hands-on Demonstration Presentations	**CO1**
		UNIT-II INHERITANCE,INTERFACE AND PACKAGES (CL Hrs-6, Marks-12)		
2	**TLO 2.1** Apply identified type of inheritance for the given programming problem. **TLO 2.2** Differentiate between overloading and overriding with the help of examples. **TLO 2.3** Develop program using interface. **TLO 2.4** Create user defined package for the given problem.	**2.1** Inheritance: concept of inheritance, types of Inheritance: single inheritance, multilevel inheritance, hierarchical inheritance, method overriding, final variables, final methods, use of super, abstract methods and classes **2.2** Interfaces: Define interface, implementing interface, accessing interface variables and methods, extending interfaces **2.3** Package: Define package, types of package, naming and creating package, accessing package, import statement, static import, adding class and interfaces to a package	Hands-on Demonstration Presentations	**CO2**
		UNIT-III EXCEPTION HANDLING AND MULTITHREADING (CL Hrs-8, Marks-12)		
3	**TLO 3.1** Distinguish the errors and exceptions with example. **TLO 3.2** Develop program for handling the given exception. **TLO 3.3** Create threads to run multiple processes in a program. **TLO 3.4** Develop program using	**3.1** Errors and Exception: Types of errors and exceptions try and catch statement, throws and finally statement, built-in exceptions, throwing our own exception. **3.2** Multithreaded programming: creating a thread: By extending to thread class and	Hands-on Demonstration Presentations	**CO3**

	different thread life cycle methods.	by implementing runnable Interface, Life cycle of thread: Thread methods, thread exceptions, thread priority and methods, synchronization.		
		SECTION-II		
		UNIT- IV EVENT HANDLING USING AWT AND SWING COMPONENTS (CL Hrs-13, Marks-15)		
4	**TLO 4.1** Write steps to develop Graphical User Interface (GUI) using AWT components with frame for the given problem. **TLO4.2** Develop program using menu and dialog boxes for the given problem. **TLO 4.3** Write steps to develop Graphical user interface (GUI) using advanced swing components for the given problem. **TLO 4.4** Use delegation event model to develop event driven program for the given problem. **TLO 4.5** Use relevant AWT/ Swing component(s) to handle the given event.	**4.1** AWT:Component, Container, Window, Frame, Panel, Applet, use of AWT controls: Labels, Buttons, Checkbox, Checkboxgroup, Textfield, Textarea,List,Choice **4.2** Layout Managers: FlowLayout, BorderLayout,GridLayout,CardLayout, Menubars, Menus, Filedialog, Dialogbox **4.3** Swing: Swing features, AWT vs Swing, Swing components: Icons and Labels, TextField, ComboBox, Button, Checkbox, RadioButton , Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, Tooltip **4.4** Event Handling: Event delegation Model, MVC architecture **4.5** Event classes: ActionEvent, ItemEvent , KeyEvent, MouseEvent, TextEvent **4.6** Event Interfaces: ActionListener, ItemListener, KeyListener, MouseListener, MouseMotion, TextListener	Hands-on Demonstration Presentations	**CO4**
		UNIT –V BASICS OF NETWORK PROGRAMMING(CL Hrs-6, Marks-12)		
5	**TLO 5.1** Describe the concepts of sockets in java. **TLO 5.2** Use networking classes to retrieve host details. **TLO 5.3** Develop program for Client/Server communication through TCP/IP Server sockets for the given problem	**5.1** Networking Basics : Client/Server , reserved Sockets , proxy servers , Internet Addressing **5.2** InetAddress : Factory Methods , Instance Methods **5.3** TCP/IP :Socket and Server Socket class **5.4** UDP: DatagramSocket, DatagramPacket class **5.5** URL Class **5.6** URLConnection class	Hands-on Demonstration Presentations	**CO5**
		UNIT –VI INTERACTING WITH DATABASE (CL Hrs-6, Marks-8)		
6	**TLO 6.1** Choose relevant database connectivity methods. **TLO 6.2** Describe two tier and three tier architecture of JDBC. **TLO 6.3** Choose relevant type of JDBC driver for the specified environment. **TLO 6.4** Elaborate steps with	**6.1** Introduction to JDBC, ODBC **6.2** JDBC architecture: Two tier and three tier models **6.3** Types of JDBC drivers, Class Class , DriverManager class, Connection interface, Statement interface, PreparedStatement interface, ResultSet Interface	Hands-on Demonstration Presentations	**CO6**

	example to establish connectivity with the specified database.			

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** Implement conditional statements and control structures.	Demonstrate the use of conditional statements and control structures.	4	CO1
2.	**LLO 2.1** Implement the use of arrays and dynamic arrays using Vector to store and process data elements.	a) Write a program to demonstrate one-dimensional and two-dimensional array. b) Use Vector class to perform dynamic array operations.	2	CO1
3.	**LLO 3.1** Demonstrate the use of wrapper classes to convert primitive types to objects and vice versa for data encapsulation.	Convert primitive data types into objects and vice versa using wrapper classes like Integer, Double, etc.	2	CO1
4.	**LLO 4.1** Apply the concepts of single and multilevel inheritance to promote code reuse and logical hierarchy.	Implement single inheritance and multilevel inheritance with method overriding.	2	CO2
5.	**LLO 5.1** Implement interfaces to achieve abstraction and multiple inheritance in Java.	Write a program to implement interfaces and multiple inheritance using interfaces.	2	CO2
6.	**LLO 6.1** Use built-in and user-defined packages for modular, maintainable Java program development.	Demonstrate use of built-in packages (java.util, java.io, etc.) and create user-defined packages.	2	CO2
7.	**LLO 7.1** Implement robust exception handling using try, catch, finally, throw, and throws clauses to manage errors.	Implement try, catch, finally, throw, and throws for exception management.	2	CO3
8.	**LLO 8.1** Demonstrate multithreading using the Thread class and Runnable interface to achieve parallelism in Java applications.	Write a program to implement multithreading using Thread class and Runnable interface.	2	CO3
9.	**LLO 9.1** Design interactive graphical interfaces using AWT components to collect user input and display output.	a) Create a form using AWT components like TextField, Label, and Button. b) Write a program to implement Layout Manager.	2	CO4
10.	**LLO 10.1** Build advanced GUIs using Swing components. **LLO 10.2** Implement event-driven programming by handling user actions such as key presses, mouse	a) Implement swing component's JTree and JTable. b) Handle KeyEvent, MouseEvent, ActionEvent and TextEvent	4	CO4

	clicks, and button events in GUI applications.			
11.	**LLO 11.1** Implement Java networking using InetAddress, URL, Socket, and Datagram classes to facilitate client-server communication.	a)Retrieve hostname and IP using InetAddress. b)Demonstrate use of URL and URLConnection. c) Implement socket communication (TCP) and datagram (UDP).	2	CO5
12.	**LLO 12.1** Perform database operations including connection, insertion, update, deletion, and data retrieval using JDBC and ResultSet	a) Create a sample database and connect using JDBC. b) Perform Insert, Update, Delete operations. c) Retrieve data using ResultSet and demonstrate cursor navigation methods.	4	CO6
13.	ALL	Micro-project (Refer section V for micro project list)	-	ALL

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/CASE STUDIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT

Suggestive Micro Project Topics:

a) Develop Online Voting System: Role-based login (admin/voter), vote casting and result generation with GUI and JDBC. Use exception handling for security.
b) Develop Fitness Tracker Application: Input daily workouts, calories burned, and track progress over time. GUI input, JDBC storage, background threads for stats.
c) Develop Simple Blog Platform: Post, edit, delete blog posts. Login with roles (admin/user), GUI editor, and data stored via JDBC. Add timestamp via threads.
d) Develop IoT Device Monitor Simulator: Simulate multiple smart devices using multithreading. Display statuses in real-time via GUI, with data fetched/sent via sockets.
e) Develop Smart To-Do List: Add, update, delete tasks. Use OOP for task management, GUI for interaction, JDBC for persistence, and threading for reminders.
f) Any other micro project as suggested by course teacher.

Assignments

Solve assignment covering all COs given by course teacher.

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) Computer with JDK1.8 or above, any IDE for Java Programming such as Eclipse, Jcreator, NetBeans,VScode . c) Databases like MySQL, Oracle, MS-Access or any other.	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	Basics of JAVA	CO1	06	03	04	04	**11**
2	II	Inheritance, Interface and Packages	CO2	06	02	04	06	**12**
3	III	Exception Handling and Multithreading	CO3	08	02	04	06	**12**
SECTION II								
4	IV	Event Handling using AWT and Swing Components	CO4	13	05	04	06	**15**
5	V	Basics of Network Programming	CO5	06	02	04	06	**12**
6	VI	Interacting with database	CO6	06	02	02	04	**08**
Grand Total				**45**	**16**	**22**	**32**	**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	3	2	2	2	1	2	1	-	-	3
CO2	2	2	3	2	1	3	1	-	-	3
CO3	2	2	3	2	1	3	1	-	-	3
CO4	3	3	3	2	2	3	2	-	-	3
CO5	3	3	3	2	2	3	2	2	-	3
CO6	3	3	3	2	2	3	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	Schildt Herbert	Java Complete Reference	Mcgraw Hill Education, New Delhi . ISBN:9789339212094
2	E Balaguruswamy	Programming with JAVA	Mcgraw Hill Education (India) Private Limited, New Delhi . ISBN-13: 978-93-5134-320- 2
3	Holzner, Steven	Java 8 Programming Black Book	Dreamtech Press, New Delhi. ISBN: 978-93-5119-758-4

XII. LEARNING WEBSITES & PORTALS

1. https://www.javatpoint.com/java-tutorial
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29 959473947367270000_shared/overview
3. https://www.javatpoint.com/java-tutorial
4. https://www.w3schools.com/java/
5. https://www.tutorialspoint.com/java

Name & Signature: **Mrs. Swati S. Sant** Lecturer in Computer Engineering	**Mrs. Sonali B. Gosavi** Lecturer in Computer Engineering **(Course Experts)**	**Mrs.S.D.Raut** Lecturer in IT
Name & Signature: **Dr.D.N.Rewadakar** (Programme Head)		Name & Signature: **Shri. S.B. Kulkarni** (CDC In-charge)

GOVERNMENTPOLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN IT
PROGRAMME CODE	07
COURSE TITLE	CAPSTONE PROJECT
COURSE CODE	IT41207
PREREQUISITE COURSE CODE & TITLE	ACQUIRED 60 CREDITS. INCLUDING ALL FIRST YEAR COURSE CREDITS.
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	
IT41207	CAPSTONE PROJECT	INP	--	--	--	4	--	2	--	--	--	--	--	--	50	20	50#	20	--	100

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 the 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 the 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 the 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:

Project work at the institute level serves as a vital bridge between theoretical learning and practical application. It offers students a valuable platform to apply the concepts, knowledge, and technical skills acquired in classrooms and laboratories to address real-world problems—ranging from well-defined tasks to complex, open-ended challenges. This experiential learning approach fosters a deeper understanding of engineering and technological principles by encouraging students to design, develop, and implement solutions in realistic contexts.

The course is strategically designed to integrate interdisciplinary knowledge gained throughout the diploma program, thereby enhancing students' ability to approach problems holistically. Furthermore, it plays a crucial role in nurturing essential professional competencies such as critical thinking, problem-solving, creativity, teamwork, project planning, and innovation.

In alignment with industry and societal expectations, students are encouraged to undertake projects that go beyond conventional solutions and aim to provide impactful, sustainable outcomes. By engaging in

such projects, students not only reinforce their technical capabilities but also improve their employability by developing a mind-set geared towards innovation, collaboration, and continuous improvement.

III. INDUSTRY EXPECTED OUTCOME

This course is designed to enable students to develop the industry-relevant competency of:

Effectively executing innovative solutions to real-world problems through collaborative teamwork, adhering to defined timelines, and delivering a well-documented project report.

IV. 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 real-world field problems relevant to the project work conducted at the institute.
CO2: Analyse the feasibility and viability of the project by conducting data collection and experiments, as well as evaluating required resources, costs, and support.
CO3: Apply technical knowledge and engineering skills to develop effective solutions for real-life or industrial problems.
CO4: Evaluate the proposed project work's ethical considerations and societal impacts.
CO5: Create a comprehensive project report and present the methodology and results within the institute.
CO6: Demonstrate the project outcomes, findings, and achievements effectively through presentations and exhibits.

V. GENERAL GUIDELINES FOR PROJECT WORK

a) Project Selection and Scope

- The project must align with the field of engineering or technology. Interdisciplinary projects are permitted if expected to deliver outcomes aligned with industry relevance or societal needs.

Indicative Project Focus Areas:

i. Artificial Intelligence and Machine Learning Applications
ii. Web and Mobile Application Development
iii. Cyber security and Information Assurance
iv. Data Analytics and Business Intelligence
v. Cloud Computing and Virtualization Technologies
vi. Internet of Things (IoT), Robotics and Smart Systems
vii. Software Development and DevOps Practices
viii. Embedded Systems and Edge Computing
ix. AR/VR and Human-Computer Interaction (HCI)
x. Blockchain Technology
xi. e-Governance, E-commerce, Rural ICT, and Social Impact Solutions
xii. Smart Automation using Robotics and AI
xiii. Digital Image and Video Processing
xiv. Natural Language Processing (NLP) and Chatbot Development
xv. Smart Agriculture and Precision Farming Systems
xvi. Healthcare Informatics and Remote Patient Monitoring
xvii. Intelligent Transportation and Traffic Management Systems

xviii. Educational Technology Solutions
xix. Assistive Technologies for Special Needs
xx. Ethical Hacking and Penetration Testing
xxi. Smart Cities and Urban Computing Applications
xxii. Digital Forensics and Incident Response
xxiii. Game Development, Multimedia Applications and Interactive Media
xxiv. Speech and Emotion Recognition Systems
xxv. Big Data Platforms (Hadoop, Spark, etc.)
xxvi. Remote Sensing and GIS Applications
xxvii. Bioinformatics and Computational Biology

- Students should select projects that match their skills, knowledge and interests. Faculty should support students in identifying suitable topics.
- Study-based (theoretical-only) projects are **not encouraged**. Projects should involve practical implementation.
    - Project diary
    - Final demonstration
    - Assessment based on institutional RUBRICs

b) National Relevance

Projects should ideally address national thrust areas such as:

- Environmental Sustainability
- Digitization and Smart Technologies
- Industrial and Process Automation
- Renewable Energy Systems
- Socio-technical Solutions for Community Development

VI. COURSE IMPLEMENTATION STAGES

1. Orientation Session

A Project Orientation Session shall be conducted during the last week of the fourth term by the Portfolio In-charge faculty. This session will brief students on:

- Project objectives.
- Scope and expected deliverables
- Guidelines for execution and assessment
- Faculty and institutional support

2. Mapping of Students and Faculty Mentors

Students will be organized into teams and assigned faculty mentors based on the following criteria:

- Alignment of student interests
- Faculty expertise
- Team size and project scope.

3. Problem Identification and Finalisation

Students are required to:

- Conduct a field survey or exploratory study under faculty supervision
- Identify a real-world, relevant, and feasible problem
- present the idea to a group of faculty members for approval
- This activity should commence in the final week of the 4th semester and be completed by the first week of the 5th semester.

A dedicated week is allotted for collecting detailed project requirements, including:

- Estimation of human resources
- Identification of technical (hardware/software) needs
- Feasibility study and cost analysis

Outcome: Students must present their findings to the faculty mentor for approval.

4. Project Planning

Students must prepare a comprehensive project plan covering:

- Task allocation and resource planning
- Time frame and cost estimation
- Team member responsibilities
- Selection of an appropriate development model (e.g., Waterfall, Agile, Spiral)

Deliverables: A clear roadmap including timelines, milestones, and expected outcomes.

5. Project Proposal Submission

The finalized project proposal must be submitted in **soft copy format** and should include:

- Project title and objectives
- Detailed requirement analysis
- Project plan and execution strategy
- Expected deliverables and outcomes
- Development model and tools to be used

6. Project Development, Testing & Report Preparation

Under the continuous guidance of faculty mentors, students shall:

- Develop the project according to the approved plan
- Maintain project documentation throughout the development lifecycle
- Prepare a detailed final report that includes:
  - System design and architecture
  - Implementation details
  - Testing procedures and results
  - Challenges encountered and solutions adopted
  - Final outcomes and evaluation metrics.

7. Project Demonstration

Students must present their project in two stages:

- **Preliminary Demonstration:** A progress review shown to the faculty guide during the development phase.
- **Final Demonstration:** A complete presentation of the working model or application during the End Semester Examination (ESE).

VII. DETAILED WEEKWISE TIMELINE FOR THE COURSE IMPLEMENTATION STAGES:

Week	Activity	Responsibilities
Week 1	**Orientation Session** (Last week of 4th Term)	Portfolio In-charge Faculty: Brief students on project objectives, scope, deliverables, guidelines, execution, and assessment.
Week 2	**Mapping of Students and Faculty Mentors**	Portfolio In-charge Faculty: Organize students into teams based on interests, faculty expertise, team size, and project scope.
Week 3-4	**Problem Identification and Finalisation**	Students: Carry out a field survey or exploratory study under faculty supervision, identify a relevant real-world problem, finalise the issue, and submit a synopsis for faculty approval.
Week 5	**Requirement Gathering**	Students: Collect detailed project requirements (human resources, technical needs, feasibility study, and cost analysis).
Week 6	**Requirements Gathering Presentation**	Students: Present findings to the faculty mentor for approval.
Week 7	**Project Planning**	Students: Prepare a project plan including task allocation, resource planning, timeline, budget, development model, and deliverables. Faculty Mentor: Review plan.
Week 8	**Project Proposal Submission**	Students: Submit final project proposal (title, objectives, requirements, plan, tools, outcomes). Faculty Mentor: Review and approve.

Week	Activity	Responsibilities
Week 9-12	Project Development, Testing & Report Preparation	Students: Begin project development according to the plan. Maintain documentation. Test and iterate. Prepare final report (design, implementation, testing results).
Week 13	Preliminary Demonstration	Students: Present a progress review to the faculty mentor.
Week 14	Project Finalisation & Report Completion	Students: Finalise development. Prepare a detailed project report with system design, testing results, challenges, and outcomes.
According to the Examination Schedule	Final Demonstration (End Semester Examination)	Students: Conduct final demonstration of the working model/application during the ESE. Faculty: Evaluate the project based on the demonstration and report.

VIII. CRITERIA FOR ASSESSMENT/EVALUATION OF PROJECT WORK

A. Formative Assessment (FA) Criteria

The evaluation of students during the fifth semester for Progressive Assessment (PA), totalling **50 marks**, will be carried out based on the following criteria:

Category	Week(s)	Assessment Criteria	Max Marks	Performance Description (Rubric Scale: 1 to 5)	Group Enrollment Nos.	Group Marks
i) Team Assessment (30 Marks)	Week 3-4	Project Selection & Problem Definition	5	2 – Lacks clarity and relevance 3 – Relevant and defined 4 - Clearly defined and suitable 5 – Innovative and impactful		
	Week 5	Literature Review & Data Collection	5	1 – Insufficient or irrelevant sources 2 – Limited data with unclear relevance 3 – Adequate review with relevant data 4 – Structured, relevant data 5 – Comprehensive and critically evaluated sources		

	Week 6	Project Design / Concept & Execution	10	1–2 Design is poorly structured; minimal or no execution 3–4 Weak concept, unclear goals, and limited execution 5–6 Basic concept with moderate execution; design may lack innovation or clarity 7–8 Solid, functional design with good planning and consistent execution 9–10 Creative, technically sound design with excellent planning and thorough execution		
	Week 7	Progress as per Action Plan / Milestones	5	1 – No measurable progress 2 – Progress is significantly behind schedule 3 – Moderate progress; some tasks completed 4 – Mostly on schedule with minor delays 5 – Fully on schedule and meeting milestones		
	Week 8	Quality & Presentation of Project Report	5	1 – Poorly organized and unclear 2 – Disorganized with formatting issues 3 – Fair structure and readability 4 – Well-organized and readable 5 – Professionally formatted and well-written report		

Category	Week(s)	Assessment Criteria	Max Marks	Performance Description (Rubric Scale: 1 to 5)	Individual Enrollment Nos.	Individual Marks
ii) Individual Assessment (20 Marks)	Week 2–13 (Ongoing)	Individual Contribution to the Team	10	1 -2 Rarely involved or shows minimal effort 3 -4 Occasionally contributes with limited involvement 4 –5 Participates adequately 6 – 7 Active and dependable team member 8 –10 Consistently proactive, often leads initiatives		
	Week 2–13 (Ongoing)	Subject Knowledge & Understanding	10	1–2 Very limited understanding of subject concepts; unable to answer questions 3–4 Basic awareness but with significant gaps in understanding 5–6 Fair knowledge of concepts; can answer general questions correctly 7–8 Good understanding of a subject; explains concepts clearly and applies them logically 9–10 Excellent grasp; demonstrates deep insight, applies concepts to real-world/project scenarios		
Total			**50**			

i) **Total Formative Assessment (FA) Marks**

Sr. No.	Assessment Criteria	Marks
1	Team Assessment	30
2	Individual Assessment	20
Total		50

Note: The Total **Formative Assessment (FA) Marks** for the individual student.

B. Summative Assessment Criteria

*The summative assessment for students in the Fifth Semester **SA-PR** will carry a total of **50 marks** and shall be conducted by the faculty. Appropriate rubrics may be developed by the faculty for evaluation.*

Course Name :		**Course Code :**	
Student Name :		**Enrollment Number :**	
Project Batch Number:		**Division :**	
Faculty Guide Name:		**Term :**	

Sr. No.	Week	Assessment Criteria	Max Marks	Performance Description (Score Range)	Marks
1	According to the Examination Schedule	**Knowledge and Skill Set Developed**	10	**1–2**: Minimal knowledge gained	
				3–4: Basic understanding with limited skills	
				5–6: Moderate knowledge and practical exposure	
				7–8: Sound knowledge and good skill application	
				9–10: Excellent grasp and skill mastery with advanced application	
2	According to the Examination Schedule	**Quality and Potential of the Project**	10	**1–2**: Poor quality, unclear purpose	
				3–4: Basic functionality with low impact	
				5–6: Adequate quality with moderate potential	
				7–8: High-quality, practical utility	
				9–10: Exceptional quality and strong potential for real-world implementation	

3	According to the Examination Schedule	**Creativity, Innovation, and Teamwork**	10	**1–2**: Lacks originality, poor collaboration	
				3–4: Limited creativity and uneven teamwork	
				5–6: Shows creativity and fair teamwork	
				7–8: Innovative and well-coordinated efforts	
				9–10: Highly original ideas with exemplary team synergy	
4	According to the Examination Schedule	**Project Design, Development, Execution**	10	**1–2**: Poor design and implementation	
				3–4: Basic structure with several gaps	
				5–6: Functional design and moderate execution	
				7–8: Well-planned and executed efficiently	
				9–10: Robust, optimized design with flawless execution	
5	According to the Examination Schedule	**Project Presentation**	10	**1–2**: Disorganized and unclear	
				3–4: Lacks confidence and structure	
				5–6: Acceptable delivery with room for improvement	
				7–8: Clear, engaging, and well-structured	
				9–10: Highly professional, confident, and impactful presentation	

Note: The above rubric will be used as the summative assessment framework for evaluating individual student performance.

IX. SUGGESTED COS- POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes (PSOs)		
	PO1 -Basic and Discipline-Specific Knowledge	PO2- Problem analysis	PO3- Design/ Development of Solutions	PO-4 Engineering Tools, Experimentation and Testing	PO-5 Engineering Practices for Society, Sustainability, and Environment	PO-6 Project Management	PO-7 Lifelong Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	--	--	2	2	2	--	--	3
CO2	2	3	2	2	--	3	2	2	2	3
CO3	3	3	3	3	2	2	2	3	3	3
CO4	--	--	--	--	3	2	2	--	--	3
CO5	2	2	2	2	--	3	2	--	--	3
CO6	2	2	2	2	2	3	3	--	--	3

X. TYPOGRAPHICAL GUIDELINES FOR PROJECT REPORT WRITING:

After the completion of the project work, each student is required to submit a project report. The report should adhere to the following structure and formatting guidelines:

A. STRUCTURE OF THE REPORT

The project report must include the following sections in the given order:

1. **Cover Page** – As per *Annexure I.*
2. **Title Page** – As per *Annexure I.*
3. **Certificate** – As per *Annexure II.*
4. **Acknowledgment** – A brief section in which the student may express gratitude to individuals and organizations who supported the project. As per *Annexure III.*
5. **Abstract** – A one-page summary outlining the objective of the project and the methodology adopted. As per *Annexure IV.*
6. **Table of Contents** – Prepared as per general guidelines. As per *Annexure V.*
7. **List of Figures**-The **purpose of the List of Figures** in a project report is to provide a clear and organized index of all visual representations used throughout the document. As per *Annexure VI*
8. **List of Tables** -The **purpose of the List of Tables** in a project report is to provide a structured overview of all tabular data included in the document. As per *Annexure VI*
9. **Project Description** –
   - Divided into chapters or sections.
   - Each chapter should comprehensively describe a specific phase or component of the project.
   - Include properly labelled diagrams, tables, and flowcharts wherever applicable.
10. **Conclusion** – Summarizes findings and outcomes of the project work.
11. **References** –
    - Begin two spaces below the heading "**REFERENCES**", aligned to the left.
    - Use **single spacing** within entries and list in **alphabetical order**.

- References must be cited in the text using **square brackets [ ]**, numbered according to their first appearance.
- Include author name(s), publication year, and other relevant details.

B. REPORT SPECIFICATIONS

1. **Binding**: Hard-bound only
2. **Cover Color**: Black with gold-embossed text (as per *Annexure 1*)
3. **Number of Copies**: Five – One per student and one departmental copy

Paper Size: A4 (portrait orientation)

4. **Margins**:
   - Top: 1 inch
   - Bottom: 1 inch
   - Right: 1 inch
   - Left: 1.5 inches
5. **Font Style**: Times New Roman
6. **Font Sizes**:
   - **Chapter Titles:** 16-point, **Bold, Uppercase**
   - **Headings:** 14-point, **Bold**
   - **Body Text:** 12-point, **Regular**
7. **Line Spacing**: 1.5 throughout the report
8. **Page Numbering**: Bottom center in the format "Page X of N"

Annexure-I

GOVERNMENT POLYTECHNIC, PUNE

(An Autonomous Institute of the Government of Maharashtra)

DEPARTMENT OF INFORMATION TECHNOLOGY

PROJECT REPORT

ON

"[TITLE OF THE PROJECT IN CAPITAL LETTERS]"

Submitted By

Student name 1 (enrollment no.)
Student name 2 (enrollment no.)
Student name 3 (enrollment no.)
Student name 4 (enrollment no.)

UNDER THE GUIDANCE OF

[Guide's Full Name]

(Designation, e.g., Lecturer, Department of Information Technology)

Submitted in Partial Fulfilment

of

The Requirements for the Award of the Diploma in

INFORMATION TECHNOLOGY

ACADEMIC YEAR: 20__–20__

GOVERNMENT POLYTECHNIC, PUNE, Ganeshkhind Road, Shivajinagar, Pune – 411016

Annexure-II

GOVERNMENT POLYTECHNIC, PUNE

(An Autonomous Institute of the Government of Maharashtra)

DEPARTMENT OF INFORMATION TECHNOLOGY

CERTIFICATE

This is to certify that

1)Name of Student	Enrollment Number
2)Name of Student	Enrollment Number
3)Name of Student	Enrollment Number
4)Name of Student	Enrollment Number

has completed the necessary project work and prepared the bonafide report on

"PROJECT TITLE"

in a satisfactory manner as a partial fulfillment of the requirements for the

DIPLOMA IN

INFORMATION TECHNOLOGY

FOR THE ACADEMIC YEAR

20__- 20__

(Internal Guide) **(External Examiner)**

(H.O.D) **(Principal)**

Annexure-III

Acknowledgment

(Sample Format)

We would like to express our sincere gratitude to all those who supported and guided us throughout the successful completion of this project.

We are especially thankful to **[Guide's Name]**, our project guide, for their constant encouragement, valuable suggestions, and constructive feedback during the entire duration of this project work.

We would also like to thank **[Head of Department's Name]**, Head of the Department of **[Branch Name]**, Government Polytechnic, Pune, for providing us with the necessary infrastructure and support.

We are deeply grateful to **[Principal's Name]**, Principal, Government Polytechnic, Pune, for providing us with this valuable opportunity and for fostering an academic environment conducive to learning and innovation.

Our heartfelt thanks go to all the faculty members and technical staff of the **[Department Name]** for their help in various ways during this project.

We also wish to acknowledge the support of our classmates, friends, and family members who encouraged and motivated us throughout the journey.

Lastly, we are thankful to the **Government Polytechnic, Pune**, for allowing us to work on this project as a part of our academic curriculum.

Student name 1 (enrollment no.)
Student name 2 (enrollment no.)
Student name 3 (enrollment no.)
Student name 4 (enrollment no.)

Annexure-IV

Abstract

The abstract serves as a one-page comprehensive summary that encapsulates the core aspects of the project. It begins by clearly stating the primary objective or goal of the work, providing the reader with an understanding of the problem being addressed or the purpose behind the study. Following this, the abstract outlines the methodology employed, detailing the approach, techniques, tools, and processes used to achieve the project's objectives. This section may also briefly touch on the scope of the work, key findings, and any conclusions or implications derived from the results. The abstract offers a concise yet informative overview, enabling readers to quickly grasp the essence and significance of the project without delving into the full report.

Annexure-V

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PROJECT DAIRY

Course code :		**Course Name :**	
Student Name :		**Enrollment Number :**	
Project Batch Number:		**Division :**	
Faculty Guide Name:		**Term :**	

Date	Enrollment Numbers of Present Students	Work Assigned/Corrections Suggested	Faculty Remarks	Faculty Signature

Signature of Faculty **Signature of HOD**

Name & Signature:		
Shri. O. R. Varma Lecturer in Information Technology	**Shri. S.B. Kulkarni** Lecturer in Mechanical Engineering (Course Expert)	**Dr. N. G. Kulkarni** HoD in Mechanical Engineering
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 COMPUTER ENGG AND INFORMATION TECHNOLOGY
PROGRAMME CODE	06/07
COURSE TITLE	IoT and ROBOTICS
COURSE CODE	CM51202
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	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	
CM51202	IoT and ROBOTICS	SEC	1	--	2	1	4	2	--	--	--	--	--	50	20	25@	10	25	10	100

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:

This course is responsible for the super-fast evolution of industry 4.0, where the operations are mostly automated thus eliminating the need for much human intervention. The course describes the network of physical objects-"things" that are embedded with sensors , softwares and other technologies. IoT devices gather information and send it along to a data server where the information is collected, processed and used to make host of tasks easier to perform. IoT and robotics enable the creation of innovative solutions to real world challenges.

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 Integrate hardware and software for IoT Applications.
- CO2 Create IoT applications by interfacing various sensors, actuators and embedded boards.
- CO3 Develop IoT applications using IoT networking devices.
- CO4 Create Robotic application using various commands.
- CO5 Install Industrial Robot.

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: BASICS OF INTERNET OF THINGS (CL Hrs. -03, Marks- Nil)			
1	**TLO 1.1** Describe IoT building blocks with their relationship. **TLO 1.2** State the features of various Embedded boards. **TLO 1.3** Execute a simple Arduino program.	1.1 Introduction of IoT, Things, framework, Emerging Trends, Economic Significance, Technical Building Blocks 1.2 Physical design of IoT, Logical design of IoT, Sensors and Actuators, 1.3 IoT Issues and Challenges, IoT Security and Privacy 1.4 IoT Applications.	Hands-on Demonstration Presentations	**CO1**
	UNIT 2 : SENSORS AND ACTUATORS (CL Hrs. - 04, Marks-Nil)			
2	**TLO 2.1** Select various sensors for IoT applications. **TLO 2.2** Interface sensors with Arduino **TLO 2.3** Identify the working techniques of the Sensor. **TLO 2.4** Identify various Actuators available. **TLO 2.5** Explain the process of interfacing the appropriate actuator with Embedded boards. **TLO 2.6** Write the steps for displaying output on various display devices.	2.1 IoT sensor types: Active and Passive Sensors, Analog sensors Digital Sensors 2.2 Programming with Arduino Sensors: sensor, Humidity Sensor, Temperature Sensor, Water Sensor, Motion Sensor, Fire Detection Sensors, Smoke Detection Sensors, Gas Detection Sensors, Soil moisture sensors 2.3 Basic Working Technique of Sensor 2.4 Programming and Interfacing actuators: displaying on LED/LCD with ATMEGA328. 2.5 Displays: LCD, I2C LCD, 7-segment display 2.6 Actuators: Relay, stepper motor, Buzzer, Potentiometer etc.	Hands-on Demonstration Presentations	CO2

UNIT 3: COMMUNICATION IN IOT DEVICES (CL Hrs-03, Marks-Nil)				
3	**TLO 3.1** Explain IoT Protocols. **TLO 3.2** Write the process to use IoT Wireless networking devices in developing IoT applications. **TLO 3.3** Explain the method of performing Wi-Fi connectivity to WEB.	3.1 Introduction to IoT networking - IoT Protocols- HTTP, MQTT, CoAP etc. 3.2 IoT Wireless devices and uses in IoT : LPWAN(Low Power Wide Area Networks),Cellular(3G/G4/5G), Bluetooth, Zigbee, Wi-fi, RFID 3.3 Wi-Fi connectivity to WEB using ESP826 3.4 Raspberry Pi Architecture, Features, Raspberry Pi Vs Arduino, Raspbian OS	Hands-on Demonstration Presentations	CO3
UNIT4:INTRODUCTION TO INDUSTRIAL ROBOTS AND SAFETY(CLHrs-03 ,Marks-Nil)				
	TLO 4.1 Explain the types of industrial robot. **TLO 4.2.** Identidy various elements of the robot system. **TLO4.3** Perform the safety practices while using robot.	4.1 Introduction, Types of robots, Laws of robots. 4.2 Safe practices while handling the robots, applicable safety standard, general safety information 4.3 Basic elements of robot system (Robot Anatomy)-Base, manipulation arm, end effectors, sensors and transducers, actuators and drives, control system	Hands-on Demonstration Presentations	CO4
UNIT5:PROGRAMMING OF INDUSTRIAL ROBOT (CLHrs-02,Marks-Nil)				
5	**TLO 5.1** Perform installation of industrial robot. **TLO 5.2** Use teach pendant for industrial robot teaching **TLO 5.3** Operate the industrial robot for given condition **TLO 5.4** Perform maintenance of industrial robot.	5.1 Industrial robot installation lifting and mounting of robotic arm and controller. 5.2 Connecting power cable ,encoder cable and teach pendant . 5.3 Robot operation, switching mode jogging, homing the robot. 5.4 Managing robot errors and false logging in and configuration I/O . 5.5 Robot programming: brief introduction to teach pendant, robot programming instruction (MOVE, POINT , WAIT , SET , IF , ELSE, LOOP , HALT, JUMP).	Hands-on Demonstration Presentations	CO5

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 any embedded system. LLO1.2 Write a simple Arduino program to interface LED using Arduino Uno IDE.	*a) Install any one embedded system and interface the embedded board with it. (ex- Arduino IDE and Arduino UNO) b) Interface LED with Arduino and write a program to turn it ON/OFF using delay.	2	CO1
2	LLO 2.1 Interface LDR sensor with Arduino LLO 2.2 Write a program for the detection of Light.	* Interface the LDR sensor with Arduino and write a program for the detection of Light.	2	CO1
3	LLO 3.1 Interface Analog Temperature Sensor (e.g. LM35) with Arduino LLO 3.2 Write a program to sense the Temperature of an Object.	* Interface Analog Temperature Sensor (e.g. LM35) with Arduino and write a program to sense the Temperature of an Object.	2	CO2
4	LLO 4.1 Interface DHT11 sensor and with Arduino LLO 4.2 Write a program to display Humidity and Temperature.	* Interface Humidity and Temperature sensor (e.g. DHT11) with Arduino and write a program to display Temperature and Humidity on a serial monitor.	2	CO2
5	LLO 5.1 Interface Relay and temperature sensor with Arduino LLO 5.2 Write a program to control relay state based on input from IR sensor	Control action using Relay with Arduino and write a program to turn it ON/OFF when Temperature increases or decreases.	2	CO2
6	LLO 6.1 Interface PIR/IR/ Ultrasonic Sensor with Arduino/ Raspberry Pi LLO 6.2 Write program to Detect the motion of object/ Detect the obstacle/ Measure the Distance between sensor and object.	*Interface PIR Sensor with Arduino/ Raspberry Pi to Detect Motion of object and write a program to display motion detected or not. OR Interface IR sensor with Arduino/ Raspberry Pi and write a program to detect obstacle. OR Interface Ultrasonic Sensor with Arduino/Raspberry Pi write a program to measure the Distance between sensor and	2	CO2

		object.		
7	LLO 7.1 Bluetooth module and LED with Arduino LLO 7.2 Create Android Application using MIT App Inventor to control LED /Relay	Interfacing Bluetooth Module with Arduino & Creating Android Application using MIT App Inventor to control LED /Relay.	2	CO3
8	LLO 8.1 Install the appropriate OS for the embedded board. LLO 8.2 Connect various accessories to Rasberry Pi	* Setup Raspberry Pi as an interactive computer by installing the appropriate OS with the following accessories: i) display ii) cable to connect Raspberry Pi to display iii) keyboard iv) mouse v) SD card	4	CO3
9	LLO 9.1 study various components and anatomy of industrial robot. LLO 9.2 study basic robot motions for given application	*Perform installation of industrial robot: START, STOP, HOMMING, JOGGING (LINEAR AND JOINT MODE)	4	CO4
10	LLO 10.1Make a use of basic commands in robotics	*Basic robot program instructions-MOVE,POINT,WAIT,SET,IF,ELSE,HALT,JUMP	2	CO5
11	LLO 11.1Make a use of Merged movement commands for robotics applications LLO 11.2 Program robot to Pick and place operation using suction gripper.	*a) Industrial robot program for Merged movement, circular and arc movement. b) Setup and programming for suction based pick and place.	4	CO4,CO5
12	LLO 12.1 Program robot for spray painting.	*Perform spray painting of a given part using Robotic arm.	2	CO4, CO5

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

Self-Learning:

Automatic Street Light- The Street Light should be automatically ON in the evening and automatically OFF in the morning. LCDand Serial Monitor show the Light Intensity value on the First Line and the Status of the Street Light on the Second Line. USE RGB LED for street Light and use orange colour.
Home Automation through PC- Design and develop a project to control 8 home devices through a PC serial monitor, LCD connected to the project will show the Status of Devices is on or off. Also, show the status of all devices on the serial monitor.

Motion-enabled Room Light- The light present in the Room should automatically ON when human motion is detected and automatically OFF in the absence of human motion. LCD and Serial monitor shows the appropriate message as "Motion detected! Light ON" and "No Motion! Light OFF" when a particular condition is fulfilled.

Electronic Smart Blind Stick- If someone is in front of a blind person, the LED and Buzzer should be on and the LCD willshow the message" Obstacle. Be Alert" Otherwise LED and Buzzer will remain off and the LCD show the message "Safe.. Keep Walking".

Electronic Notice Board- Any Message sent from the Serial Monitor should be displayed on LCD.

Robotic Sorting System -Setup and programming for Logistic sorting robotics system.

Robotic MIG welding -Setup and programming for robotic MIG welding.

Case study on future robot technology.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications/Instrument Required	Relevant LLO
1	Sensors-LDR, IR, PIR, Ultrasonic Sensor, DHT11, LM35, Gas and smoke sensor	2,3,4,5,6,7
2	Bluetooth, Wi-Fi, and Ethernet modules	All
3	Arduino/NodeMCU/Raspberry Pi-controllers	All
4	Actuators- LED, Buzzer, Switches, Relay, Sprinkler,I2C LCD, 7-segment display, potentiometer, Servo motor, Stepper motor, DC motor, Camera module	All
5	Accessories - Resistors, Jumper wires, Bread Board	All
6	Software tools-Arduino UNO IDE, Tinkercad, Linux	All
7	Machine tending compatible with industrial Robot-dummy parts ,application pannel,safety fence,operating pannel and HMI,Cell peripheral items,Robot with control pannel ,teach pendant,power cables	9,10,11,12
8	Python lab-Raspberry Pi microcontroller,Arduino microcontroller,I/O box	9,10,11,12

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 INTERNET OF THINGS	CO1	03	--	--	--	--
2	SENSORS A ND ACTUATORS IN IOT	CO2	04	--	--	--	--
3	COMMUNICATION IN IOT DEVICES	CO3	03	--	--	--	--
4	INTRODUCTION TO INDUSTRIAL ROBOT AND SAFETY	CO4	03	--	--	--	--

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment forLearning)	Summative Assessment (Assessment ofLearning)
Each Practical will be assessed considering 60% weightage to the process, and 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	1	2	1	3	1	2	3	3	1	2
CO2	3	3	3	3	3	2	3	3	-	3
CO3	2	3	3	3	3	2	3	3	1	2
CO4	3	3	2	3	3	2	3	3	1	2
CO5	2	3	3	3	2	3	3	3	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	Cornel M Amariei	Arduino Development Cookbook	PACKT publishing Ltd. ISBN 978-1-78398-294-3
2	Arshdeep Bahga, Vijay Madisetti	Internet of Things: A Hands-On Approach	Orient Blackswan New Delhi ,ISBN: 978- 0996025515 628/- 2
3	David Hanes, Gonzalo Salgueiro, Patrick Grossetti Cisco Press –	IoT Fundamentals: Networking Technologies, Protocols, and Use Casesfor the Internet of Things	Cisco Press ISBN: 978-1- 58714-456- 1 599
4	Simen Monk	Raspberry Pi Cookbook	Publisher(s): O'Reilly Media, Inc. ISBN: 9781098130923
5	Mikell P.Groover,Micheil Weiss,Roger N.Nagel,Nicholas G.Ordrey and Ashish Dutta	Industraial Robotics	McGraw Hill education(India) Pvt. Ltd,Chennai 2012, ISBN:9781-1-25-900621-0

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://github.com/microsoft/IoT-For-Beginners	All practicals
2	https://www.javatpoint.com/difference-between-sensors-and-ac tutors	Sensors and Actuators
3	https://www.geeksforgeeks.org/introduction-to-internet-of-th ings-iot-set-1/	Online content of Internet ofThings
4	https://hands-on-books-series.com/iot.html	Introduction to IoT
5	https://hands-on-books-series.com/iot.html	Hands-on approach to IoT
6	https://www.raspberrypi.org/	Raspberry Pi Hands-on tutorial

Name & Signature:		
Smt. J. P.Dandale Lecturer in Computer Engineering	**Smt. Priya K.Zade** Lecturer in Computer Engineering **(Course Experts)**	**Smt. S.P.Dudhe** Lecturer in Information Technology
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
COURSETITLE	SERVER SIDE SCRIPTING USING PHP
COURSECODE	IT51206
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	
	SERVER SIDE SCRIPTING USING PHP	DSC	3	1	2	2	8	4	3 Hrs	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs forTerm: 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:

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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. **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:

PHP programming is a valuable skill for web development due to its simplicity, versatility, and wide community support. It's a free and open-source language, making it accessible and cost-effective. PHP is also known for its easy-to-understand syntax, facilitating rapid development and learning. Its compatibility with various operating systems and web servers further enhances its utility. In the growing field of Web technology it is essential for every Diploma Engineers to learn PHP Language to help them build large and complex web applications.

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 program in PHP using control statements.
CO2 – Perform operations using arrays and strings.
CO3 – Handle form data and user inputs.
CO4 - Apply object-oriented concepts in PHP.
CO5 – Manage sessions and cookie.
CO6 – Perform database operations in PHP.

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 PHP (CLHrs-06,Marks-10)		
1	**TLO1.1** Write simple PHP program to solve the given expression. **TLO1.2** Use relevant decision making control statement to solve given problem. **TLO1.3** Solve the given iterative problem using loop statements.	1.1 History and features of PHP 1.2 PHP vs. other scripting languages 1.3 Installation and configuration (XAMPP/WAMP) 1.4 PHP syntax, variables, data types, constants 1.5 Operators and control structures- if, if-else, nested if-else, switch, loops-for, do-while, while	Hands-on Demonstration Presentations	**CO1**
		UNIT-II Functions and Arrays (CLHrs-08,Marks-12)		
2	**TLO2.1** Manipulate the given type of array to get desired results. **TLO2.2** Apply implode, explode functions on the given array. **TLO2.3** Use string methods in program.	2.1 Function and its types, Built-in and user-defined functions 2.2 Parameter passing and return values 2.3 Arrays: Indexed, Associative, Multidimensional 2.4 Array functions -sort, explode, implode etc. 2.5 Operations on string and string functions:str_word_count(), strlen(), strrev(), strops, str_replace(), strtoupper(), strtolower(), strcmp()	Hands-on Demonstration Presentations	**CO2**

UNIT-III Form Handling (CLHrs-08,Marks-13)				
3	**TLO3.1** Use the relevant form controls to get users input. **TLO3.2** Design web pages using multiple Forms for the given problems. **TLO3.3** Apply the given validation rules on forms.	3.1 Working with HTML forms: $_GET and $_POST methods, Server role 3.2 Form controls: text box, text area, radio button, check box, list, buttons 3.3 Working with multiple forms: a web page having many forms, a form having multiple submit buttons 3.4 Web page validation.	Hands-on Demonstration Presentations	**CO3**
SECTION-II				
UNIT-IV Object Oriented Concepts (CLHrs-08, Marks-13)				
4	**TLO4.1** Apply object-oriented concepts in programming: Inheritance, Cloning **TLO4.2** Write programs using Introspection, Serialization.	4.1 Declaring a class & object, Accessing Properties and Methods, Static Class, Abstract Class, Interfaces 4.2 Inheritance, Overloading and Overriding, Cloning Object. 4.3 Introspection, Serialization	Hands-on Demonstration Presentations	**CO4**
UNIT–V Session Management and File Handling (CLHrs-08,Marks-12)				
5	**TLO5.1** Set/modify/delete cookies using cookies attributes. **TLO5.2** Manage the given session using session variables.	5.1 Introduction to Cookies and Sessions, $_SESSION and $_COOKIE usage. 5.2 File operations: create, read, write, delete 5.3 Uploading files securely 5.4 Use of sessions, start sessions , get session variables, destroy session 5.5 sending mails	Hands-on Demonstration Presentations	**CO5**
UNIT–VI Working with Databases (MySQL) (CLHrs-07,Marks-10)				
6	**TLO6.1:** Create database for the given problem using PHP scripts. **TLO6.2** Insert data in the given database using PHP scripts. **TLO6. 3** Apply searching and filtering operations on given data.	6.1 Introduction to MySQL- Create a Database, PHP-MySQL connectivity- MySQLi and PDO 6.2 Performing CRUD operations 6.3 Displaying data in tabular format 6.4 Searching and filtering data	Hands-on Demonstration Presentations	**CO6**

LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laborator Learning Outcome (LLO)	Laboratory Experiment/Practical Titles/ Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 Setup PHP environment LLO1.2 Write a simple program	*Write a PHP program to display 'Hello, World!'.	02	CO1
2	LLO2.1 Write a simple PHP program using expressions and operators	*Create a PHP script using variables and operators to perform arithmetic operations.	02	CO1
3	LLO3.1 Develop a program using control statements.	*Write a program to check whether a number is even or odd using conditional statements. Write a PHP script to display a multiplication table using loops	02	CO1
4	LLO4.1 Develop a program to using given type of array.	*Create an indexed array, associative array, and multidimensional array with examples.	02	CO2
5	LLO5.1 Develop a program to using different array functions.	Demonstrate use of array functions like sort(), array_merge(), explode(), and implode().	02	CO2
6	LLO6.1 Develop a program to using different string functions.	*Demonstrate use of string functions like strlen(), str_replace(), substr(), strpos()..	02	CO2
7	LLO7.1 Create a form using POST method.	*Create a registration form and display submitted data using $_POST.	02	CO3
8	LLO8.1 Create a form and apply validation.	Write a PHP script to validate email and mobile number using regex.	02	CO3
9	LLO9.1 Develop a PHP program to apply OOP concepts.	*Create an Object, Accessing Properties and Methods, Declaring a class in PHP program.	02	CO4
10	LLO10.1 Create an Overloading and Overriding class using Inheritance.	*Create an Overloading and Overriding class using Inheritance.	02	CO4
11	LLO11.1 Develop a form using session.	*Create a simple login form using sessions.	02	CO5
12	LLO 12.1 Develop a PHP program to create, read, write and delete a text file.	*Create, read, write, and delete a text file using PHP.	02	CO5
13	LLO13.1 Develop a PHP script using MySQL database.	*Create a PHP script to connect to a MySQL database.	02	CO6
14	LLO 14.1 Develop a MySQL table by inserting data .	Insert form data into a MySQL table using PHP	02	CO6
15	LLO 15.1 Retrieve data and display all record from MySQL table.	*Retrieve and display records from a MySQL table in HTML table format.	02	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.

V. SUGGESTED MICROPROJECT / ASSIGNMENT / ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF-LEARNING)

Micro-Project:

Suggestive list of micro-project:

1. Student Record Management System
2. Online Feedback System
3. Simple Blog or News Portal
4. Event Registration System
5. To-do list application
6. Basic calculator
7. Contact form and email validation
8. Simple blog system(no database)
9. Unit converter for measurements like temperature, length or weight
10. Simple user registration and login system
11. Simple poll/survey system
12. Simple E-commerce cart

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.

VI. 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 any Operating system Software c) Any compatible open source tools (Any compatible web server, Any compatible database tool e.g. MySQL or any equivalent tool)	ALL

VII. 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 PHP	CO1	06	04	04	02	10
2	II	Function and Arrays	CO2	08	04	04	04	12
3	III	Form handling	CO3	08	02	05	06	13
SECTION-II								
4	IV	Object Oriented Concepts	CO4	08	02	05	06	13
5	V	Session management and file handling	CO5	08	02	04	06	12
6	VI	Working with database (SQL)	CO6	07	02	02	06	10
Grand Total				45	16	24	30	70

VIII. ASSESSMENTMETHODOLOGIES/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. For formative assessment of laboratory learning 25 marks.	Two offline unit tests of 30 marks and average of two unit test marks will be considered for out of 30 marks.End semester assessment is of 70 marks. End semester summative assessment of 25 marks for laboratory learning.

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	1	1	1	1	1	1	2	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1
CO3	2	2	2	2	1	2	2	1	1	1
CO4	2	2	2	2	1	2	3	1	1	1
CO5	2	3	2	2	1	2	3	1	2	2
CO6	2	3	2	3	1	3	3	1	3	2

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

X. SUGGESTEDLEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Alan Forbes.	The Joy of PHP Programming: A Beginner's Guide	TataMcGrawHillEducation
2	Kevin Yank.	PHP & MySQL Novice to Ninja	TataMcGrawHillEducation,2015, ISBN: 97800705911343
3	Lynn Beighley & Michael Morrison	Head First PHP & MySQL	McGraw-Hill Education;ISBN:9780074635797
4	Vikram Vaswani.	PHP: A Beginner's Guide	McGraw Hill Education **ISBN-10:**0074632728 **ISBN-13:**978-0074632727

XI. LEARNING WEBSITES & PORTALS

1.https://www.w3schools.com/php/
2.https://www.codecademy.com/catalog/language/php
3.https://www.php.net/manual/en/index.php

Name & Signature: **Mr.Y.U.Bodhe** Lecturer in Information technology	**Smt.Sneha D.Raut** 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	01/02/03/04/05/06/07/08
COURSE TITLE	CLOUD TECHNOLOGIES
COURSE CODE	IT51207
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	
	CLOUD TECHNOLOGIES	DSE	3	1	2	2	8	4	3	30	70	100	40	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:

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:

Cloud computing has evolved as a very important computing model, which enables information, software, and other shared resources to be provisioned over the network as services in an on-demand manner. There are many aspects of cloud computing viz cloud types, storage in cloud, and security in cloud, cloud monitoring and management. Having specific skills in these areas is necessary for diploma pass-outs to create and maintain cloud based services. After learning this course student will be able to implement virtualization, create cloud based storage, Implement security, and manage cloud services.

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 - Understand the basic concepts of Cloud Computing.
CO2 - Elaborate Virtualization in Cloud Computing.
CO3 - Maintain storage system and services in Cloud.
CO4 - Demonstrate Cloud Security Measures.
CO5 - Use various Cloud Platforms.
CO6 - Compare and utilize various Open Source and Commercial Cloud.

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
	SECTION-I			
	UNIT 1 – Unit - I Fundamentals of Cloud Computing (CL Hrs-06, Marks-10)			
1	TLO 1.1 Explain characteristics of Cloud computing. TLO 1.2 Compare Cloud deployment models on the given services. TLO 1.3 Explain the given service offered by identified Cloud service model. TLO 1.4 Explain components of Cloud computing architecture.	1.1 Definition of Cloud Computing, Characteristics of Cloud computing 1.2 Cloud Deployment Models(Introduction, advantages and disadvantages) : Public Cloud, Private Cloud, Community Cloud, Hybrid Cloud 1.3 Cloud Service Models (Function, advantages, disadvantages) : IaaS, PaaS, SaaS 1.4 Cloud cost benefits 1.5 Architectural and Infrastructural components of Cloud Computing	Hands-on Demonstration Presentations	CO1

Unit 2: Unit - II Virtualization (CL Hrs. -08, Marks-14)				
2	TLO 2.1 Explain features of Virtualization. TLO 2.2 Compare characteristics of Virtualization types. TLO 2.3 Write the steps to build a virtual machine using VMWare on the given Operating System. TLO 2.4 Differentiate Virtual Machine Migration, Consolidation and Management. TLO 2.5 Explain advantages and disadvantages of Virtualization	2.1 Introduction, Virtualization Reference Model, Characteristics of virtualized environment 2.2 Differentiate various types of Virtualization : Storage, Network , Desktop , Application server 2.3 Technology Examples 2.3.1 VMWare: Full Virtualization Reference Model 2.3.2 Xen: Architecture and Guest Operating System Management 2.4 Definition and Life Cycle of Virtual Machine(VM), VM Migration: Concept and Techniques, VM Consolidation: Concepts, VM Management: Concepts 2.5 Advantages and Disadvantages of Virtualization	Hands-on Demonstration Presentations Flipped Classroom	CO2
Unit 3: Cloud Storage, Monitoring and Management (CL Hrs-10, Marks-11)				
3	TLO 3.1 Explain Cloud storage system architecture. TLO 3.2 Write steps to design storage system for the given Cloud set-up. TLO 3.3 Compare GFS and HDFS. TLO 3.4 Describe the components of federated Cloud computing. TLO 3.5 Compare different types of Service Level Agreement (SLA). TLO 3.6 Describe the Cloud service life cycle.	3.1 Cloud Storage System Architecture 3.2 Virtualize Data Centre (VDC) Architecture, VDC Environment, Server, Storage, Networking, Desktop and Application Virtualization techniques and benefits 3.3 Cloud File Systems: Google File System (GFS) : Components, Features, Advantages and Disadvantages and Hadoop Distributed File System (HDFS) :Terminologies like Heartbeat, Balancing and Replication, Features and Limitations 3.4 Service Provider and users, An architecture of federated Cloud computing : Model and It's Explanation 3.5 Service Level Agreement (SLA) 3.5.1 SLA management: 5 Phases of SLA management like Feasibility, On-Boarding, Pre-production, Production and Termination 3.5.2 Types of SLA: Infrastructure SLA and Application SLA	Hands-on Demonstration Presentations Flipped Classroom	CO3

		3.5.3 Life cycle of SLA: 5 Phases like Contract Definition, Publishing and Discovery , Negotiation, Operationalization and De-commissioning 3.6 Cloud Service life cycle phases: Service planning, service creation, service operation and service termination		
SECTION-II				
Unit 4: Security in Cloud Computing (CL Hrs-08, Marks-13)				
4	TLO 4.1 Explain security and related risks in Cloud Computing. TLO 4.2 Explain key features of Data Security. TLO 4.3 Write steps to implement Cloud Data Security. TLO 4.4 Explain identity management and access facility of given Cloud set up. TLO 4.5 Explain the features of Security-As-A- Cloud Service.	4.1 Cloud Security Concepts: Multi-tenancy, Virtualization, Data Outsourcing and Trust Management, Metadata security 4.2 Cloud Risk: Concept, Types of Cloud Risks 4.2.1 Policy and Organizational Risks 4.2.2 Technical Risks 4.2.3 Legal Risks 4.3 Data security technologies, Data Security risks 4.4 Digital Identity and Access Management 4.5 Content level security: Pros and Cons, Features of Security-As-A-Cloud Service	Hands-on Demonstration Presentations Flipped Classroom	CO4
Unit 5: Trends in Cloud (CL Hrs-08, Marks-12)				
5	TLO 5.1 Explain the characteristics of the enabling technology with the IoT. TLO 5.2 Select relevant Cloud platform or application for development. TLO 5.3 Describe the features of Cloud-based smart device. TLO 5.4 Compare features of various Cloud platforms.	5.1 Cloud trends in supporting Ubiquitous Computing 5.2 Enabling Technology in the Internet of Things(RFID, Sensor Networks and ZigBee Technologies, GPS) 5.3 Innovative Applications with the Internet of Things (Ex: Health care: ECG Analysis in Cloud and it's access, CRM and ERP: Business and Consumer Application) 5.4 Benefits of Cloud Platforms : Amazon EC2 and S3, CloudStack, Intercloud, Google App Engine, Open stack, Open Nebulla	Hands-on Demonstration Presentations Flipped Classroom	CO5

Unit 6: Open Source and Commercial Clouds (CL Hrs-05, Marks-10)				
6	TLO 6.1 Compare Open source and Commercial Cloud platforms TLO 6.2 Demonstrate various Open Source Cloud Platforms TLO 6.3 Outline existing commercial cloud platforms. TLO 6.4 Illustrate Cloud Service Providers in Market	6.1 Open source Vs Paid/ Commercial Cloud platforms 6.2 Introduction to Open Source Clouds Platform: Characteristics, Existing Open source cloud platforms 6.3 Introduction to Commercial Clouds Platforms: Characteristics, Existing commercial cloud platforms 6.4 Major Cloud Service Providers in Market: Google Cloud Platform (GCP), Amazon AWS, Microsoft Azure	Hands-on Demonstration Presentations Flipped Classroom	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 Configure Cloud storage.	* Configure Cloud using JustCloud	02	CO1
2.	LLO 2.1 Create document for given application	Use Goggle Doc to make spreadsheet and notes	02	CO1
3.	LLO 3.1 Create virtual environment	* Create Virtual Machines using VMware (Private Cloud) and delete the created VM after completion	02	CO2
4.	LLO 4.1 Implement storage service on Cloud.	* Implement Storage Service on Cloud using OpenStack	02	CO3
5.	LLO 5.1 Create and Host Web Application.	* Create and Host Simple Web Application on Google cloud/Any cloud platform	02	CO3
6.	LLO 6.1 Create a File system on Cloud.	Create a File System using HDFS	02	CO3
7.	LLO 7.1 Create a workspace platform for development.	Work in Codenvy to show Provisioning and Scaling of a website	02	CO3

8.	LLO 8.1 Implement Identity Management and Access Management using Cloud computing infrastructure	* Implement Identity Management and Access Management using OpenStack	02	CO4
9.	LLO 9.1 Configure server for security.	Configure Server using CFEngine or any other open source tool	02	CO4
10.	LLO 10.1 Design IoT based application.	* Case Study on: Cloud-based Smart Devices.	02	CO5
11.	LLO 11.1 Demonstrate various Open Source Cloud Platforms	Case Study on: Open Source Cloud Platforms	02	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:

a) Prepare the report on case study of Amazon Cloud Services.
b) Prepare the report on case study of Google App Engine.
c) Create infrastructure as service using OpenStack.

Assignments:

Prepare a journal of practicals performed in the laboratory.

Note :

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

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system - Hardware: Min 8GB RAM, 512 GB HDD, Gigabit Ethernet network equipment,	ALL
2	Software Requirement: Apache Tomcat, Java, Python, Virtualization Software, Academic version of any public cloud service(Google/AWS)	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
	SECTION-I						
01	Fundamentals of Cloud Computing	CO1	6	04	04	02	10
02	Virtualization	CO2	8	04	04	06	14
03	Cloud Storage, Monitoring and Management	CO3	10	04	03	04	11
	SECTION-II						
04	Security in Cloud Computing	CO4	8	04	03	06	13
05	Trends in Cloud	CO5	8	04	04	04	12
06	Open Source and Commercial Clouds	CO6	5	04	02	04	10
	Grand Total		45	24	20	26	70

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. For formative assessment of laboratory learning 25 marks.	Two offline unit tests of 30 marks and average of two unit test marks will be considered for out of 30 marks. End semester assessment is of 70 marks. End semester summative assessment of 25 marks for laboratory learning.

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	1	1	1	1	1	1
CO2	2	3	3	3	1	2	1	2	2	2
CO3	2	3	3	3	1	2	1	2	2	2
CO4	2	3	3	3	1	2	1	2	2	2
CO5	1	2	1	2	2	2	2	2	2	2
CO6	1	2	1	2	2	2	2	2	2	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.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Rajkumar Buyya, James Broberg,Andrzej Goscinski	Cloud Computing,Principals and Paradigms A John Wilwy & Sons, Inc.,Publication,	ISBN: 978-0-470-88799-8
2	Sharma Rishabh	Cloud Computing Wiley Publication	ISBN: 978-81-265-5306-8
3	Christian Vecchiola, RajkumarBuyya, and S.Thamarai Selvi	Mastering Cloud Computing McGraw Hill Publication	ISBN 978-1-25-902995-0
4	Singh Shailendra	Cloud Computing Oxford University Press	ISBN: 978-0199477388
5	Arshdeep Bahga, Vijay Madisetti	Cloud Computing: AHands-On Approach Self published	ISBN 1494435144,9781494435141

XII. LEARNING WEBSITES & PORTAL

Sr. No.	Links/Portal
1	https://www.techopedia.com/definition/2/cloud-computing
2	https://nptel.ac.in/courses/106105167
3	https://www.javatpoint.com/virtualization-in-cloud-computing
4	https://www.coursera.org/learn/cloud-security-on-aws/supplement/AcCam/course-overview

Name & Signature: **Smt.AD.Kshirsagar** Lecturer in Information Technology	**Mr.Y.U Bodhe** Lecturer in Information Technology
(Course Experts)	
Name & Signature: **Dr.D N Rewadkar** (Programme Head)	Name & Signature: S.B.Kulkarni **(CDC In-charge)** G P Pune

GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN IT
PROGRAMME CODE	07
COURSETITLE	NETWORK MANAGEMENT AND ADMINISTRATION
COURSECODE	IT51208
PREREQUISITE COURSECODE & 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	
IT51208	NETWORK MANAGEMENT AND ADMINISTRATION	DSE	3	1	2		6	3	3	30	70	100	40	25	10	25#	10	0	0	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:

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:

In today's digital age, network management and administration form the backbone of all computing and communication technologies. The ability to configure, monitor, and maintain reliable and secure network infrastructure is a critical skill demanded across industries. This course is designed to provide students with practical and in-depth knowledge of system and network administration, with a focus on Linux-based environments, using Linux Server. Students will gain hands-on experience in setting up, configuring, and managing server systems tailored for real-world network environments.

III. COMPETENCY

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

- **Effectively manage and administer computer systems and network infrastructure using the Linux server operating system.**

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

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

CO1 Install and manage software on Linux server operating system.
CO2 Create users, groups and configure their properties.
CO3 Configure file system and core system services.
CO4 Configure TCP/IP network and use network security tools.
CO5 Configure DNS and FTP server.
CO6 Configure DHCP server and implementation of virtualization technologies.

V. 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 1		
		UNIT 1 –Linux Server Installation and Software Management (CL Hrs. -07, Marks- 12)		
1	**TLO 1.1** Install and configure Linux server operating system. **TLO 1.2** Install software using RPM. **TLO 1.3** Explain steps to Install and Remove Software in Ubuntu **TLO 1.4** Explain Unpacking Packages. **TLO 1.5** Explain Configuring the Packages. **TLO 1.6** Describe testing the software.	1.1 Installing Linux in a Server Configuration: Hardware and Environmental Considerations, Server Design, Uptime, Dual- Booting Issues, Methods of Installation, Installing Fedora, Installing Ubuntu Server. 1.2 Managing Software: The RPM Package Manager, Managing Software Using RPM, Querying for Information the RPM Way, Installing with RPM, Uninstalling Software with RPM, Software Management in Ubuntu, Querying for Information, Installing Software in Ubuntu, Removing Software in Ubuntu, GUI RPM Package Managers. 1.3 Compile and Install GNU Software: Getting and Unpacking the Package, Looking for Documentation, Configuring the Package, Compiling the Package, Installing the Package, Testing the Software, Cleanup.	Hands-on Demonstration Presentations	CO1

UNIT 2- Managing Users and Groups (CL Hrs. -06, Marks- 09)				
2	TLO 2.1 Create Users and Groups. TLO 2.2 Configure properties of users and groups. TLO 2.3 Use Pluggable Authentication Modules.	2.1 Managing Users: Introduction to User account, User account Information, The /etc/passwd File, The /etc/shadow File. The /etc/group File. 2.2 User Management Tools, Command-Line User Management, GUI User Managers, Users and Access Permissions, Understanding SetUID and SetGID. 2.3 Pluggable Authentication Modules (PAM), working of PAM, PAM's Files and their Locations, Configuring PAM, Debugging PAM.	Hands-on Demonstration Presentations	CO2
UNIT 3- File System and Core System Services (CL Hrs. -09, Marks- 14)				
3	TLO 3.1 Configure File System. TLO 3.2 Manage Core system services. TLO 3.3 Edit crontab File.	3.1 File Systems: Structure of File System, i-Nodes, Superblocks, ext3 and ReiserFS, Managing File Systems, Mounting and Unmounting Local Disks, Using fsck, Adding a New Disk, Overview of Partitions, Traditional Disk and Partition Naming Conventions, Volume Management, Creating Partitions and Logical Volumes, Creating File Systems. 3.2 Core System Services: The init Daemon, upstart, The /etc/inittab File, xinetd and inetd, the /etc/xinetd.conf File, The Logging Daemon, Invoking rsyslogd, Configuring the Logging Daemon, Log Message Classifications, Format of /etc/rsyslog.conf. 3.3 The cron Program- The crontab File, Editing the crontab File.	Hands-on Demonstration Presentations	CO3

		SECTION II		
		UNIT 4- TCP/IP Networking and System Administration (CL Hrs. -12, Marks- 14)		
	TLO 4.1 Describe how TCP/IP relates to the ISO OSI seven-layer model. **TLO 4.2** Explain the working of ARP. **TLO 4.3** Explain static routing and dynamic routing. **TLO 4.4** Explain network device configuration utilities. **TLO 4.5** Explain network security tools. **TLO 4.6** Explain TCP/IP firewall	4.1 TCP/IP for System Administrators: The Layers, TCP/IP Model and the OSI Model, Headers, Ethernet, IP (IPv4), TCP, UDP, A Complete TCP Connection, Opening a Connection, Transferring Data, Closing the Connection, How ARP Works, The ARP Header: ARP Works with Other Protocols 4.2 Bringing IP Networks Together, Hosts and Networks, Subnetting, Netmasks, Static Routing, Dynamic Routing with RIP, Digging into tcpdump, IPv6, IPv6 Address Format, IPv6 Address Types, IPv6 Backward Compatibility 4.3 Network Configuration: Modules and Network Interfaces, Network Device Configuration Utilities (ip and ifconfig), IP Aliasing,, Setting Up NICs at Boot Time, Managing Routes, Simple Usage, Displaying Routes, A Simple Linux Router, Routing with Static Routes 4.4 TCP/IP and Network Security, The Importance of Port Numbers, Tracking Services, Using the netstat Command, Security Implications of netstat's output, Network Security Tools, Nmap, Wireshark/tcpdump 4.5 TCP/IP Firewall: Methods of Attack, What is Firewall?, What is IP filtering, Setting Up Linux for Firewalling	Hands-on Demonstration Presentations	CO4
		UNIT 5- DNS and FTP (CL Hrs. -07, Marks- 12)		
5	**TLO 5.1** Describe working of DNS. **TLO 5.2** Write steps for configuration of DNS Server. **TLO 5.3** Describe the use of DNS Toolbox. **TLO 5.4** Write the stepsfor installation of FTP Server. **TLO 5.5** Write the procedure to transfer file using FTP Server. **TLO 5.6** Write the steps for setting up FTP with virtual users.	5.1 DNS: The Hosts File ,Working of DNS, Domain and Host Naming Conventions, Subdomains, The in-addr.arpa Domain ,Types of Servers, Installing a DNS Server, The BIND Configuration File, Configuring a DNS Server, Defining a Primary Zone in the named.conf File, Defining a Secondary Zone in the named.conf File, Defining a Caching Zone in the named.conf File, DNS Records Types, SOA: Start of Authority, NS: Name Server, A: Address Record , PTR: Pointer Record , MX: Mail Exchanger, CNAME: Canonical Name , RP and TXT: The Documentation Entries, Setting Up BIND Database Files, Breaking Out the Individual Steps, 5.2 The DNS Toolbox:host ,dig, nslookup,	Hands-on Demonstration Presentations	CO5

		whois, nsupdate, The rndc Tool, Configuring DNS Clients, The Resolver ,Configuring the Client 5.3 FTP: The Mechanics of FTP, Client/Server, Obtaining and Installing vsftpd , Configuring vsftpd ,Starting and Testing the FTP Server, Customizing the FTP Server ,Setting Up an Anonymous-Only FTP Server, Setting Up an FTP Server with Virtual Users.		
UNIT 6- DHCP and Virtualization (CL Hrs. -04, Marks- 09)				
6	**TLO 6.1** Write the steps for configuration of DHCP Server and client. **TLO 6.2** Explain virtualization. **TLO 6.3** Explain Kernel- based Virtual Machines.	6.1 DHCP: The Mechanics of DHCP, The DHCP Server, Installing DHCP Software via RPM, Installing DHCP Software via APT in Ubuntu, Configuring the DHCP Server, The DHCP Client Daemon Configuring the DHCP Client. 6.2 Virtualization: WhyVirtualize?, Virtualization Concepts, Virtualization Implementations, QEMU, Xen, User-Mode Linux (UML), Kernel-based Virtual Machines (KVM), VMware, Virtualbox, Hyper-V	Hands-on Demonstration Presentations	CO6

VI. 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** Installation of Linux operating system.	Install and Configure Linux operating system.	2	CO1
2	**LLO 2.1** Installation of software using RPM.	Install and Uninstall any software using RPM.	2	CO1
3	**LLO 3.1** Installation of GNU software.	Compile and Install GNU software.	2	CO1
4	**LLO 4.1**Creation of user account.	Create User Account through command-line and GUI	2	CO2
5	**LLO 5.1.** Creation of group.	Create Group Account through command-line and GUI.	2	CO2
6	**LLO 6.1** Mount and Unmount Local Disks. **LLO 6.2** Create Partition and Logical Volume.	i. Mount and Unmount Local Disks. ii. Create Partition and Logical Volume.	2	CO3
7	**LLO 7.1** Configuration of the crontab file.	Configure the crontab file.	2	CO3

8	**LLO 8.1** Configure TCP/IP properties. **LLO8.2** Configure serial hardware using utilities.	i. Configure TCP/IP properties. ii. Configure serial hardware using utilities.	2	CO4
9	**LLO 9.1** Configuration a Firewall for a Private Network	Configure a Firewall for a Private Network.	2	CO4
10	**LLO 10.1** Installation and configuration of DNS server	Install and Configure DNS server.	2	CO5
11	**LLO 11.1** Installation and configuration of FTP server	Install and Configure FTP server.	2	CO5
12	**LLO 12.1** Installation and configuration DHCP server.	Install and Configure DHCP server.	2	CO6
13	**LLO 13.1** Advanced Nmap Scanning Techniques	Use Nmap for OS detection, service version detection, and stealth scans.	2	CO6
14	**LLO 14.1** Use Wireshark to analyze live traffic **LLO 14.2** Capture live packet data using tcpdump	i. Use Wireshark to analyze .pcap files or live traffic. Capture live packet data ii. Capture live packet data from a network interface using `tcpdump`	2	CO6
15	**LLO 15.1** Installation of KVM on Linux distribution	To install KVM on the Fedora/Ubuntu Linux distribution and create a virtual machine.	2	CO6

Note: Out of the above suggestive LLOs–

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

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

Self Learning: Yes

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. Configure a system as per the given requirement:
i. Create a user
ii. Configure the FTP server on Linux server operating system.
iii. Transfer file from server to user.
b. Configuring the Serial Hardware Communications Software for Modem Links, access devices through it.
c. Configure Primary and Secondary DNS server.
d. Configure DHCP server and DHCP client assign IP addresses to machines through it.

e. Configure a File System, Mount and Unmount the Local Disks, add new disk, create partitions and logical volumes.
f. Configure following services on Linux server: i) Managing User accounts and device configuration
g. Setting up and Configuring Local Print Device and Network Print Device

VI. 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	Wireshark, tcpdump, and nmap Tools preferably Open source as mentioned in practical's	

VII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Unit No	Unit Title	Aligned Cos	Learning Hours	R Level	U Level	A Level	Total marks
1	**Linux Server Installation and Software Management**	CO1	7	04	04	04	12
2	**Managing Users and Groups**	CO2	6	03	06	-	09
3	**File System and Core System Services**	CO3	9	04	06	04	14
4	**TCP/IP Networking and System Administration**	CO4	12	04	06	04	14
5	**DNS and FTP**	CO5	7	02	04	06	12
6	**DHCP and Virtualization**	CO6	4	03	03	03	09

VIII. ASSESSMENT METHODOLOGIES/TOOLS

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

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	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

X. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Wale Soyinka	Linux Administration A Beginners Guide	McGraw Hill Education, Obsorne DOI: 10.1036/0071545883
2	Tonny Bautts, Terry Dawson & Gregor N. Purdy	Linux Network Administrator's Guide	O'Reilly ISBN -10:0-596-00548-2 ISBN-13:978-0-59600541
3	James Turnbull, Peter Lieverdink, Dennis Matotek	Pro Linux System Administration	Apress ISBN-13 (pbk): 978-1-4302-1912-5 ISBN-13 (electronic): 978-1-4302-1913-2

XI. LEARNING WEBSITES & PORTALS

1. https://www.tutorialspoint.com/linux_admin/index.htm
2. https://www.geeksforgeeks.org/beginners-guide-to-linux-system-administration/?ref=leftbar- rightbar
3. http://www.tldp.org/LDP/nag2/index.html
4. https://www.tecmint.com/linux-networking-commands/
5. https://spoken-tutorial.org/tutorial-search/?search_foss=Linux+for+Sys-Ads&search_language=English
6. https://script.spoken-tutorial.org/index.php/Linux_for_Sys-Ads

Name & Signature: **Mr. O. R. Varma** Lecturer in Information Technology	Name & Signature: **Ms. P. C. Fafat** Lecturer in Information Technology
(Course Experts)	
Name & Signature: **Dr. D. N. Rewadkar** (Programme Head)	Name & Signature: **Mr. S. B. Kulkarni** (CDC In-charge)