



# Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)  
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Programme : Computer Engineering

Fifth Semester

With effect from 2018-19

Course Code	Course Title	C/ O	Teaching Scheme				Credits	Examination Scheme					
			L	P	TU	Total		Theory		PR	OR	TW	
								TH	TS				
IT16308	Operating Systems	C	03	02	--	05	05	70	30	50*	--	--	
CO16403	Advanced Database Technology	C	03	02	--	05	05	70	30	50*	--	--	
CO16404	Web Application Development Using Advanced Java	C	02	04	--	06	06	70#	30	50*	--	--	
CO16405	Mobile Application Development	Elective I	03	02	--	05	05	70	30	50	--	--	
CO16406	Data Warehousing & Data Mining		03	02	--	05	05	70	30	50*	--	--	
IT16402	Microcontroller & Embedded Systems		03	02	--	05	05	70	30	50*	--	--	
CO16407	Open Source Technology	C					02						
CO16408	Functional Programming Using Python	C	01	02	--	03	03	--	--	50	--	--	
CO16409	Technical Writing		--	--	02	02	02	--	--	--	--	50	
CO16301	Project and Seminar Stage – I	C	--	04	--	04	04	--	--	--	50*	--	
CO16418	** Industrial Training-I	C	--	04	--	04	04	--	--	--	50*	50	
<b>Total</b>			<b>12</b>	<b>22</b>	<b>02</b>	<b>36</b>	<b>36</b>	<b>280</b>	<b>120</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>900</b>

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work \*Indicates assessment by Internal & External Examiners. # Indicates Online Examination. \*\*indicates course to be completed during Winter Vacation after Third Semester

Academic Coordinator

**Approved Copy**  
  
Academic Co-ordinator  
G. P. Mumbai

Head of Department

Principal

**Programme : Diploma in Computer Engineering****Course Code: CO16403****Course Title: Advanced Database Technology.****Compulsory / Optional: Compulsory**

Teaching Scheme and Credits				Duration of Examination			Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total
03	---	02	05	3Hrs	1Hr 15min	---	70	30	50*	---	---	150

(\*) indicates assessment by Internal and External examiners.

**Rationale:**

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

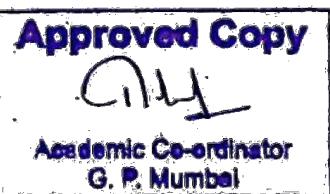
**Course Outcomes:**

The student will be able to:

CO1	Understand the concept of non-relational database system.
CO2	Understand the concept of data modeling in MongoDB.
CO3	Execute different MongoDB operations and methods.
CO4	Execute advanced database operations on collection.
CO5	Understand the concept of Distributed database system.
CO6	Understand the concept of Multimedia Databases.



Topic No	Contents
1	<p><b>Non-relational database system</b></p> <ul style="list-style-type: none"> <li>1.1 Relational (RDBMS) Vs. Non-relational database system (NoSQL).           <ul style="list-style-type: none"> <li>1.1.1 Structured vs. unstructured data.</li> </ul> </li> <li>1.2 Introduction to NoSQL.           <ul style="list-style-type: none"> <li>1.2.1 Types of NoSQL.               <ul style="list-style-type: none"> <li>1.2.1.1 Key Oriented.</li> <li>1.2.1.2 Column Oriented.</li> <li>1.2.1.3 Graph Oriented.</li> <li>1.2.1.4 Document Oriented.</li> </ul> </li> <li>1.2.2 Advantages of NoSQL.</li> </ul> </li> </ul>
2	<p><b>Introduction to MongoDB</b></p> <ul style="list-style-type: none"> <li>2.1 MongoDB overview.           <ul style="list-style-type: none"> <li>2.1.1 MongoShell</li> <li>2.1.1 Features</li> <li>2.1.2 MongoDB vs. SQL database.</li> <li>2.1.3 Advantages of MongoDB.</li> </ul> </li> <li>2.2 MongoDB schema design and Data Modeling           <ul style="list-style-type: none"> <li>2.2.1 Reference document.</li> <li>2.2.2 Embedded document.</li> </ul> </li> <li>2.3 MongoDB Datatypes</li> <li>2.4 Data Relationships           <ul style="list-style-type: none"> <li>2.4.1 One to One</li> <li>2.4.2 One to Many</li> <li>2.4.3 Many to Many</li> </ul> </li> </ul>
3	<p><b>MongoDB Operations</b></p> <ul style="list-style-type: none"> <li>3.1 Basic operations in MongoDB           <ul style="list-style-type: none"> <li>3.1.1 Create and Drop Database.</li> <li>3.1.2 Create and Drop Collection.</li> </ul> </li> <li>3.2 MongoDB Datatypes</li> <li>3.3 MongoDB CRUD Operations.           <ul style="list-style-type: none"> <li>3.3.1 Create.</li> <li>3.3.2 Read</li> <li>3.3.3 Update</li> <li>3.3.4 Delete</li> </ul> </li> <li>3.4 Methods in MongoDB           <ul style="list-style-type: none"> <li>3.4.1 Projection</li> <li>3.4.2 Limit</li> <li>3.4.3 Sort</li> <li>3.4.4 Save</li> <li>3.4.5 Gridfs</li> </ul> </li> </ul>



	<b>Advanced MongoDB</b>
4	4.1 Indexing 4.1.1 Types of index 4.2 Aggregation 4.3 Replication 4.4 Sharding 4.5 Database backup 4.6 Database restore
5	<b>Distributed databases</b> 5.1 Introduction 5.2 Distributed database system vs. Centralized database system. 5.3 Features 5.4 Classification 5.4.1 Homogeneous 5.4.2 Heterogeneous 5.5 Architecture 5.5.1 Client –Server 5.5.2 Peer to Peer 5.6 Distributed data storage 5.6.1 Fragmentation 5.6.1.1 Horizontal 5.6.1.2 Vertical 5.6.1.3 Hybrid 5.6.2 Replication 5.7 Advantages. 5.8 Disadvantages
6	<b>Multimedia databases.</b> 6.1 Introduction 6.2 Contents of MM database. 6.3 Types of data 6.4 Data types in MM database 6.5 Design Goals 6.6 MM database architecture 6.7 Applications

**SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Non relational database system	6	4	4		8
2.	Introduction to MongoDB	8	4	8		12
3.	MongoDB Operations	10	4	4	6	14
4.	Advanced MongoDB	8	2	4	6	12
5.	Distributed databases	10	4	4	6	14
6.	Multimedia databases	6	2	8		10
Total		48	20	32	18	70

Curriculum – 2016



Advanced Database Technology (CO16403)

Sr. No.	Unit	Experiment/Assignment	Approx . Hours
1	2	Installation of MongoDB.	2
2	3	Create and Delete database and collection in MongoDB.	2
3	3	Perform CRUD-Create, Read, Update and Delete operations on collections.	2
4	3	Implementation of different MongoDB methods on document.	4
5	4	Implementation of Aggregate operations on document.	2
7	4	Implementation of Indexing on a document.	4
8	4	Create a database backup in MongoDB.	2
9	4	Restore Backup data in MongoDB.	4
10	4	Implement Replication operation on document.	4
11	5	Perform Fragmentation operation on database.	4
12	6	Store multimedia data such as audio, images in database.	2

**Reference Books:**

Sr. No.	Book Title	Author	Publication
01	MongoDB- a Definitive Guide	Kristina Chodorow	O'REILLY
02	Data Modeling for MongoDB	Steve Hoberman	Technics Publications
03	Principals of distributed database systems.	M. Tamer Ozsu; Patrick Valduriez	Springer

**Course Curriculum Development Committee:**

a. Internal Faculty

Smt. Vrushali A. Patil (Lecturer in Computer Engineering, Govt. Polytechnic, Mumbai)

b. External Faculty

Smt. Megha G. Yawalkar (Lecturer in Computer Engineering, Govt. Polytechnic, Pune)



Academic Coordinator



Head of Department  
(Computer Engineering)



Principal  
Govt. Polytechnic Mumbai

Curriculum – 2016



Advanced Database Technology (CO16403)

**Course Name :- Advanced Database Technology**  
**Course Code :- CO16403**

**CO Vs PO matrix**

<b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>	<b>P06</b>	<b>P07</b>	<b>P08</b>	<b>P09</b>	<b>P010</b>
<b>CO 1</b>	3	1	2	2	1	2	2	2	2	3
<b>CO 2</b>	3	2	3	3	1	1	1	2	2	3
<b>CO 3</b>	3	3	3	3	1	1	1	3	1	3
<b>CO 4</b>	3	3	3	3	1	2	2	3	1	3
<b>CO 5</b>	3	3	3	3	1	2	2	3	1	3
<b>CO 6</b>	3	3	3	3	1	2	1	3	1	3

**CO Vs PSO matrix**

<b>Table CO/POs</b>		<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	Understand the concept of non-relational database system.	2	2	2
<b>CO2</b>	Understand the concept of data modeling in MongoDB.	3	3	3
<b>CO3</b>	Execute different MongoDB operations and methods.	3	3	3
<b>CO4</b>	Execute advanced database operations on collection.	3	3	3
<b>CO5</b>	Understand the concept of Distributed database system.	3	3	3
<b>CO6</b>	Understand the concept of Multimedia Databases.	3	3	3

**Unit Number and COs**

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Topic Title</b>	<b>COs</b>
1	1	Non relational database system	<b>CO 1:</b> Understand the concept of non-relational database system
2	2	Introduction to MongoDB	<b>CO 2:</b> Understand the concept of data modeling in MongoDB.
3	3	MongoDB Operations	<b>CO 3:</b> Execute different MongoDB operations and methods
4	4	Advanced MongoDB	<b>CO 4:</b> Execute advanced database operations on collection.
5	5	Distributed databases	<b>CO 5:</b> Understand the concept of Distributed database system.
6	6	Multimedia databases	<b>CO 6:</b> Understand the concept of Multimedia Databases.



<b>Programme Code: Diploma in Computer Engineering</b>													
<b>Course Code: CO16404</b>	<b>Course Title: Web Application Development using Advanced Java</b>												
<b>Compulsory / Optional: Compulsory</b>													
<b>Teaching Scheme and Credits</b>				<b>Duration of Examination</b>				<b>Examination Scheme</b>					
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total	
2	--	4	6	1Hr 15 Min	40 Min	2	70#	30	50*	--	--	150	

( #) indicates online examination  
(\*) indicates assessment by Internal and External examiners

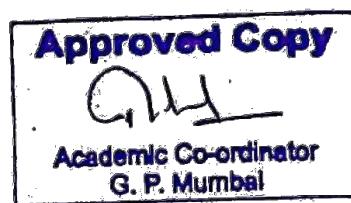
**Rationale:**

After having sufficient practice on programming in Java language, students of Computer Engineering can now focus on learning advanced features of Java language. Students should learn higher level application programming using Java and make the use of latest features in it for better quality of software and betterment of the society in turn. This course includes Network Programming, Design Patterns, Java Remote Method Invocation, web development in Java like Servlet and JSP, Advanced Web Development using Spring and Hibernate Frameworks.

**Course Outcomes:**

Students will be able to

CO 1	Use different networking concepts in Java Application Development.
CO 2	Use Design Patterns in Java.
CO 3	Develop a Client Server Application using Remote Method Invocation.
CO 4	Develop a Java Web Application using Servlet and JSP.
CO 5	Develop Web Application in Java using Spring Framework.
CO 6	Develop Web Application in Java using Hibernate Framework.



Curriculum – 2016 Web Application Development using Advanced Java (CO16404)

Topic No.	Contents
1.	<b>Java Network Programming</b> <ul style="list-style-type: none"> <li>1.1 Networking Basics</li> <li>1.2 The Networking Classes and Interfaces</li> <li>1.3 InetAddress: Inet4Address and Inet6Address</li> <li>1.4 TCP/IP Client Sockets</li> <li>1.5 URL and URLConnection</li> <li>1.6 HttpURLConnection</li> <li>1.7 The URI Class</li> <li>1.8 Cookies</li> <li>1.9 TCP/IP Server Sockets</li> </ul>
2.	<b>Design Patterns used in Java</b> <ul style="list-style-type: none"> <li>2.1 Factory</li> <li>2.2 Singleton</li> <li>2.3 Adaptor</li> <li>2.4 Strategy</li> <li>2.5 MVC</li> </ul>
3.	<b>Remote Method Invocation</b> <ul style="list-style-type: none"> <li>3.1 The RMI Architecture and Factory Design Pattern</li> <li>3.2 Stub and Skeleton</li> <li>3.3 The Remote Interface</li> <li>3.4 Naming Remote Objects,</li> <li>3.5 Implementation class</li> <li>3.6 RMIClient and RMIServer</li> <li>3.7 Client Server Application Development using RMI</li> </ul>
4.	<b>Developing Web Apps using Java Servlets</b> <ul style="list-style-type: none"> <li>4.1 Creating Java Web Application Project in IDE</li> <li>4.2 Structure of Java Web Application Project</li> <li>4.3 Web Servers, Application Servers, Database Servers</li> <li>4.4 Configuring a Java Web Application           <ul style="list-style-type: none"> <li>4.4.1 The configuration file: web.xml</li> <li>4.4.2 Tags in web.xml</li> </ul> </li> <li>4.5 Deploying a Java Web Application</li> <li>4.6 The Servlet API</li> <li>4.7 Configuring Servlets</li> <li>4.8 Setting Up a Default Servlet</li> <li>4.9 Servlet Initialization Attributes</li> <li>4.10 Writing a Simple HTTP Server</li> </ul>

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G. P. Mumbai

5.	<b>Java Server Pages</b> <ul style="list-style-type: none"> <li>5.1 Creating a Java Web Application Project for JSP</li> <li>5.2 Creating a simple JSP Page</li> <li>5.3 Using out and Page Directives</li> <li>5.4 JSP expressions, variables, and declarations</li> <li>5.5 JSP-generated servlet</li> <li>5.6 Implicit Objects</li> <li>5.7 The JSP Life Cycle</li> <li>5.8 A thought on Scriptlets</li> <li>5.9 useBean(), setProperty() and getProperty()</li> </ul>
6.	<b>Persistence using Hibernate Framework</b> <ul style="list-style-type: none"> <li>6.1 Creating the Database</li> <li>6.2 Creating the Web Application Project with Hibernate</li> <li>6.3 Modifying the Hibernate Configuration File</li> <li>6.4 Creating the HibernateUtil.java Helper File</li> <li>6.5 Generating Hibernate Mapping Files and Java Classes</li> <li>6.6 Creating the FilmHelper.java Helper Class</li> <li>6.7 Creating the JSF Managed Bean</li> <li>6.8 Creating the Web Pages</li> <li>6.9 Running the Project</li> <li>6.10 Downloading the Solution Project</li> <li>6.11 Troubleshooting</li> </ul>
7.	<b>Spring Web MVC</b> <ul style="list-style-type: none"> <li>7.1 Setting up a New Project with Spring Web MVC Support           <ul style="list-style-type: none"> <li>7.1.1 Creating a Spring Web MVC Skeleton Project</li> <li>7.1.2 Running the Skeleton Project</li> </ul> </li> <li>7.2 Overview of the Application</li> <li>7.3 Implementing a Service</li> <li>7.4 Implementing the Controller and Model</li> <li>7.5 Implementing the Views</li> </ul>

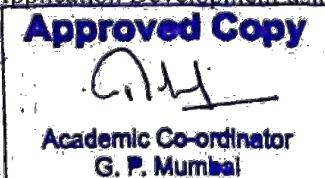


**Suggested Specifications Table with Hours and Marks (Theory):**

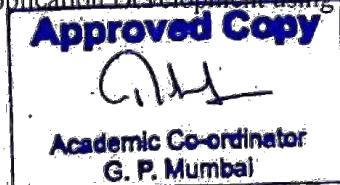
Unit No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Java Network Programming	5	4	4	4	12
2.	Design Patterns used in Java	3	2	4	--	6
3.	Remote Method Invocation	4	2	2	4	8
4.	Developing Web Apps using Java Servlets	5	2	4	6	12
5.	Java Server Pages	5	2	4	6	12
6.	Persistence using Hibernate Framework	5	2	4	4	10
7.	Spring Web MVC	5	2	4	4	10
<b>Total</b>		<b>32</b>	<b>16</b>	<b>26</b>	<b>28</b>	<b>70</b>

**List of Programming Experiments:**

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1.	1	<b>Client Server Programming in Java</b> 1.1 Develop a Java Application in which TCPClient will send a text message and TCPServer will receive it. 1.2 Add a functionality to the Java Application in 1.1 using which TCPServer will send a text message and TCPClient will receive it. 1.3 Add a functionality to the Java Application in 1.2 using which TCPServer will advertise the TCPCLients associated with it.	10
2.	2	<b>2.1 Factory Design Pattern</b> a. Create a Java Project in the IDE and in the project, create an interface PizzaTopping. The interface PizzaTopping will have two public methods viz., getPrice() and getCalories() with appropriate return types. Override the toString() method to invoke the above two methods. b. Create two subclasses of the interface defined in a. viz. ExtraCheeseTopping and BlackOlivesTopping with price and calories as private data members. Define parameterized constructors and implement the methods getPrice() and getCalories() in both the classes. c. Create a class PizzaToppingFactory with a static method getPizzaTopping() which takes type, price and calories as parameters and depending on values of type it will instantiate either of the two subclasses defined in 2.2. d. Create another Java Project for a simple test client that uses above Factory Design Pattern Implementation. <b>2.2 Singleton Design Pattern</b> a. Create a class named EasySingleton.	6



		b. Create a private static data member named instance in it. c. Create a private default constructor with empty body. d. Create a public static method named getInstance() which will return a instance of the same class. e. Create another class for main() method and instantiate the EasySingleton.	
3.	3	<b>Application Development using RMI</b> 3.1 Create a distributed application using RMI where the client will handshake with the server by invoking the remote method public void sayHello() where client and server are on different hosts in the same network. 3.2 Create a distributed application using RMI, where an RMI client can download a text file from the RMI server. Also identify the design pattern being used. 3.3 Create a distributed application using RMI, where a customer (RMI Client) wants connect to the online Pizza shop (RMI Server) and the shop will display the menu card (displayPizzaMenu()) to the customer remotely.	8
4.	4	<b>Web Application Development using Servlet</b> 4.1 Create a Java Web Application in an IDE. 4.2 Create a client side HTML web page to input your name from textbox and display "Hello <your name>" on the servlet after clicking on the "Login" button. 4.3 Display the server port and protocol number in the browser in scrolling from right to left format. 4.4 Create an HTML page login.html and create two textboxes on the HTML page named userName and password. After clicking on the 'Login' button the servlet will be displayed. It will show 'Login Successful' when userName and password are same else 'authentication failure' will be displayed. 4.5 Create two HTML pages userProfile.html and errorPage.html. Modify 4.4 as follows: In case of successful login redirect to the page userProfile.html and display the username passed from login.html page on it.. In case of Authentication Failure redirect to errorpage.html.	10
5.	5	<b>Web Application Development using JSP</b> 5.1 Create a Java Web Application in an IDE. 5.2 Create a JSP page registerEmployee.jsp for Employee Registration. The page will take inputs as First Name, Middle Name, Last Name, Email ID, Mobile No., Street, City, Pin code, Hire Date, Manager, Qualification, Designation and Experience. The page will also have a Submit button clicking on which all the inputs will be displayed on the userProfile.html page. 5.3 Modify registerEmployee.jsp in 5.2 to store the inputs in the 'employees' table you have created in the database. 5.4 Create a Java Bean EmployeeBean with the properties given in 5.2. 5.5 Modify registerEmployee.jsp to use theuseBean, getProperty and setPropety.	10
6.	6	<b>Using Hibernate in a Web Application</b> 6.1 Create a Database in any open source database like MySQL or Oracle. 6.2 Create a Web Application Project with Hibernate Framework.	10



		<p>6.3 Modify the Hibernate Configuration File      6.4 Create the HibernateUtil.java Helper File      6.5 Generate Hibernate Mapping Files and Java Classes      6.6 Create the FilmHelper.java Helper Class      6.7 Create the JSF Managed Bean      6.8 Create the Web Pages      6.9 Run the Project      6.10 Download the Solution Project      6.11 Troubleshooting</p>	
7.	7	<p>7.1 Setting up a New Project with Spring Web MVC Support          a. Create a Spring Web MVC Skeleton Project in IDE          b. Running the empty Skeleton Project and see the output.</p> <p>7.2 Implementing a Service          a. Create a Java class for implementing a service e.g. orderAPizza(), generaeBill(), etc.</p> <p>7.3 Implementing the Controller and Model          a. Use a SimpleFormController to handle user data and determine which view to return.</p> <p>7.4 Implementing the Views          a. Create two JSP pages. The first, which you will call nameView.jsp, serves as the welcome page and allows users to input a name. The other page, helloView.jsp, displays a greeting message that includes the input name. Begin by creating helloView.jsp</p>	10
8.	All	<p>2 online quizzes of at least 10 objective questions based on above contents shall be conducted with the help of any free open source learning management system.      Each quiz will be of duration 20 minutes duration and must contain the questions of the following category:</p> <ol style="list-style-type: none"> <li>1. General Concept (MCQs) (4 questions)</li> <li>2. What's wrong with the given code? (2 questions)</li> <li>3. Guess the output of the given code (3 questions)</li> <li>4. Write the code/ Fill in the missing code(1 question)</li> </ol>	
9.	All	<p><b>Assignment</b>      Solve total 100 Objective Questions based on the above contents.      Note: Questions should be categorized as said in 9.</p>	
10.	All	<p><b>Mini Project</b>      Students are required to make groups of two and develop a mini project which is using at least 2 of the given technology in the course contents.      For example,</p> <ol style="list-style-type: none"> <li>1. TCP Client Server Application</li> <li>2. RMI Client Server Application</li> <li>3. Web Application using Servlet and Hibernate</li> <li>4. Web Application using JSP and Hibernate</li> <li>5. Web Application using Spring Web MVC and Hibernate</li> </ol>	
<b>Total</b>			<b>64</b>



No.	Book Title	Author	Publication
1.	Java™ The Complete Reference Ninth Edition	Herbert Beilidt	McGraw Hill Education,
2.	Head First Servlets and JSP 2e	Bert Bates, Bryan Basham	O'Reilly publications
3.	Java 8 Programming Black Book	D. T. Additional Services	DreamTech Press

### Web Resources

1. [https://www.tutorialspoint.com/java/java\\_networking.htm](https://www.tutorialspoint.com/java/java_networking.htm)
2. <https://www.journaldev.com/1392/factory-design-pattern-in-jav>
3. <https://www.journaldev.com/1377/java-singleton-design-pattern-best-practices-examples>
4. <https://www.journaldev.com/1487/adapter-design-pattern-jav>
5. <https://www.journaldev.com/1751/strategy-design-pattern-in-java-example-tutorial>
6. <https://www.journaldev.com/16974/mvc-design-pattern>
7. <https://docs.oracle.com/javaee/7/api/javax/servlet/jsp/package-summary.html>
8. <https://www.youtube.com/watch?v=JUBOWVjnI88>
9. <https://netbeans.org/kb/docs/web/hibernate-webapp.html>
10. [https://www.tutorialspoint.com/hibernate/hibernate\\_examples.htm](https://www.tutorialspoint.com/hibernate/hibernate_examples.htm)
11. <https://netbeans.org/kb/docs/web/quickstart-webapps-spring.html>

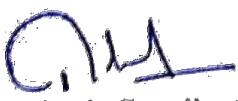
### Course Curriculum Development Committee:

#### a. Internal Faculty

Ms. Jijnasa S. Patil (Lecturer in Computer Engineering, Government Polytechnic, Mumbai)

#### b. External Faculty

Mr. Suraj S. Bhosale (Lecturer in IT, Government Polytechnic, Jalgaon)



Academic Coordinator



Head of Department  
Department of Computer Engineering



Principal  
Govt.Polytechnic Mumbai



Curriculum – 2016 Web Application Development using Advanced Java (CO16404)

**CO vs. PO matrix**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	1	2	1	2	1	3
CO2	1	3	3	2	3	2	2	2	1	3
CO3	1	3	3	3	2	1	1	1	1	3
CO4	1	3	3	3	2	1	1	1	1	3
CO5	1	3	3	3	2	1	1	1	1	3
CO6	1	3	2	3	2	1	1	1	1	3

**CO vs. PSO Matrix**

	Course Outcomes	PSO1	PSO2	PSO3
CO1	Use different networking concepts in Java Application Development.	3	2	3
CO2	Use Design Patterns in Java.	3	3	3
CO3	Develop a Client Server Application using Remote Method Invocation.	3	3	3
CO4	Develop a Java Web Application using Servlet and JSP.	3	3	3
CO5	Develop Web Application in Java using Spring Framework.	3	3	3
CO6	Develop Web Application in Java using Hibernate Framework.	3	3	3

**Unit Number and COs**

Sr. No.	Unit No.	Topic Title	COs
1.	1	Java Network Programming	CO 1
2.	2	Design Patterns used in Java	CO 2
3.	3	Remote Method Invocation	CO 3
4.	4	Developing Web Apps using Java Servlets	CO 4
5.	5	Java Server Pages	CO 4
6.	6	Persistence using Hibernate Framework	CO 5
7.	7	Spring Web MVC	CO6



Curriculum – 2016 Web Application Development using Advanced Java (CO16404)

<b>Programme Code: Diploma in Computer Engineering</b>												
<b>Course Code: CO16405</b>	<b>Course Title: Mobile Application Development</b>											
<b>Compulsory / Optional: Optional</b>												
<b>Teaching Scheme and Credits</b>				<b>Duration of Examination</b>			<b>Examination Scheme</b>					
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total
3	--	2	5	3	--	-	70	30	50*	--	--	150
( # ) indicates online examination												
( * ) indicates assessment by Internal and External examiners												

**Rationale:**

Android is the most widely used free, open source mobile operating system. It is very important for the students of Computer Engineering to be well versed with the application development using Android. As Android Developers are in high demand in industry, it is necessary to develop the Android Developers at the Diploma Level itself so as to ensure employability of the students. Student can develop Android Apps and deploy on Play Store and can earn own their own along with their studies.

**Course Outcomes:**

Students will be able to

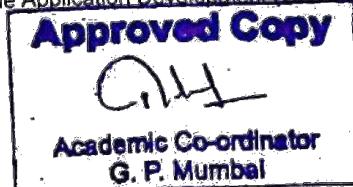
CO 1	Develop basic Android Application.
CO 2	Summarize Android App Development Approaches and Android Platform Architecture.
CO 3	Use UI Components and Event Listeners in Android.
CO 4	Develop Data Storage Management in Android.
CO 5	Design graphics and multimedia in Android.
CO 6	Interface with the hardware sensors.



Curriculum – 2016 Course: Mobile Application Development (CO16405)

Topic No	Contents
1.	<b>Introduction to Android Operating System</b> <ul style="list-style-type: none"> <li>1.1 What is Android?</li> <li>1.2 Installing Android Studio</li> <li>1.3 Android versions and Android SDK Manager.</li> <li>1.4 Multiple Entry Points for Android Apps</li> <li>1.5 Supporting different screen sizes</li> <li>1.6 Android Project Structure           <ul style="list-style-type: none"> <li>1.6.1 app &gt; java &gt; com.example.myfirstapp &gt; MainActivity</li> <li>1.6.2 app &gt; res &gt; layout &gt; activity_main.xml</li> <li>1.6.3 app &gt; manifests &gt; AndroidManifest.xml</li> <li>1.6.4 Gradle Scripts &gt; build.gradle</li> </ul> </li> <li>1.7 Create "Hello Android World" application</li> <li>1.8 Download the Android Studio Project</li> </ul>
2.	<b>Android Architecture</b> <ul style="list-style-type: none"> <li>2.1 Fundamentals of Java for Android Application Development,</li> <li>2.2 Introduction to Mobility, Mobile Platform</li> <li>2.3 App Development Approaches</li> <li>2.4 Android Platform Architecture</li> <li>2.5 Logical components of Android app</li> <li>2.6 Android Tool Repository</li> <li>2.7 Introduction of Apple and Window mobile OS Architecture</li> </ul>
3.	<b>UI Components and Event Listeners</b> <ul style="list-style-type: none"> <li>3.1 Activity life cycle</li> <li>3.2 UI resources</li> <li>3.3 String resources, Image resources</li> <li>3.4 Common attributes of View</li> <li>3.5 Event handling associated with Button, EditText, CheckBox, ListView, ImageView, AlertDialog, Navigation between Activities</li> <li>3.6 Fragments, Life cycle of Fragment, Interaction between Fragments</li> <li>3.7 ActionBar, Menu</li> <li>3.8 Introduction to Material Design Pattern, Layouts, Recycler View, Fragments, Intents</li> </ul>
4.	<b>Data Storage Management</b> <ul style="list-style-type: none"> <li>4.1 Internal and External File storage Operation</li> <li>4.2 Shared Preference</li> <li>4.3 SQLite database</li> <li>4.4 Remote database operations</li> <li>4.5 Notification</li> </ul>
5.	<b>Graphics Animations &amp; Multimedia</b> <ul style="list-style-type: none"> <li>5.1 Graphics and Animation</li> <li>5.2 Multimedia           <ul style="list-style-type: none"> <li>5.2.1 Audio</li> <li>5.2.2 Video</li> <li>5.2.3 Camera</li> </ul> </li> </ul>

Curriculum – 2016 Course: Mobile Application Development (CO16405)



6.	<b>Android Bluetooth Connection</b> <ul style="list-style-type: none"> <li>6.1 Create the layout of the BluetoothChat in an Android Studio Project</li> <li>6.2 Create the source code of the BluetoothChat</li> <li>6.3 Create the source code of the BluetoothChatService</li> <li>6.4 Create the layout of the DeviceListActivity</li> <li>6.5 Create the source code of the DeviceListActivity</li> <li>6.6 AndroidManifest.xml</li> <li>6.7 build.gradle .</li> <li>6.8 Build, Compile and Run</li> </ul>
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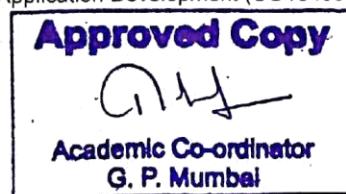
**Suggested Specifications Table with Hours and Marks (Theory):**

Unit No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Introduction to Android Operating System	4	2	4	--	6
2.	Android Architecture	8	4	4	4	12
3.	UI Components and Event Listeners	10	4	4	6	14
4.	Data Storage Management	10	4	6	6	16
5.	Graphics Animations & Multimedia	10	4	4	6	14
6.	Android Bluetooth Connection	6	--	4	4	8
<b>Total</b>		<b>48</b>	<b>18</b>	<b>26</b>	<b>26</b>	<b>70</b>

**List of Programming Experiments:**

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1.	1	Download Install and Configure Android Studio on Windows/ Linux environment.	2
2.	2	Building Simple User Interface using UI Widgets, Layouts and Adapters use Material Design Pattern.	4
3.	3	Design an android based application using content provider.	4
4.	3	Develop an application having animation on views.	4
5.	4	Design an android based application to demonstrate GPS services using Google map.	6
6.	5	Design an android based application to take a snapshot by using the Camera in your mobile.	4
7.	6	Develop an application to establish Bluetooth connectivity for deploying chatting service between two users.	4
8.	All	Develop an application to make and receive calls on mobile.	4
<b>Total</b>			<b>32</b>

Curriculum – 2016 Course: Mobile Application Development (CO16405)



**Reference Books:**

Sr. No.	Book Title	Author	Publication
1	Beginning Android™ Application Development	Wei-Meng Lee	Wiley Publishing, Inc.
2	The Busy Coder's Guide to Android Development Special Creative Commons BY-SA 3.0 License Edition	Mark L. Murphy	CommonsWare

**Web Resources**

1. <https://developer.android.com/guide/>
2. <http://www.vogella.com/tutorials/Android/article.html>

**Course Curriculum Development Committee:****a. Internal Faculty**

1. Ms. Jijnasa S. Patil (Lecturer in Computer Engineering, Government Polytechnic, Mumbai)
2. Mrs. Vrushali A. Patil (Lecturer in Computer Engineering, Government Polytechnic, Mumbai)

**b. External Faculty**

1. Mrs. AshaChaudhari, (Lecturer in Computer Engineering, Government Polytechnic, Jalgaon)



Academic Coordinator



Head of Department  
Department of Computer Engineering



Principal  
Govt.Polytechnic Mumbai



### CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	1	2	1	2	1	3
CO2	1	3	3	2	3	2	2	2	1	3
CO3	1	3	3	3	2	1	1	1	1	3
CO4	1	3	3	3	2	1	1	1	1	3
CO5	1	3	3	3	2	1	1	1	1	3
CO6	1	3	2	3	2	1	1	1	1	3

### CO vs. PSO Matrix

	CO/POs	PSO1	PSO2	PSO3
CO1	Develop basic Android Application.	3	2	3
CO2	Summarize Android App Development Approaches and Android Platform Architecture.	3	3	3
CO3	Use UI Components and Event Listeners in Android.	3	3	3
CO4	Develop Data Storage Management in Android.	3	3	3
CO5	Design graphics and multimedia in Android.	3	3	3
CO6	Interface with the hardware sensors.	3	3	3

### Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Introduction to Android Operating System	CO 1
2	2	Android Architecture	CO 2
3	3	UI Components and Event Listeners	CO 3
4	4	Data Storage Management	CO 4
5	5	Graphics Animations & Multimedia	CO 5
6	6	Android Bluetooth Connection	CO 5



<b>Programme : Diploma in Computer Engineering</b>																
<b>Course Code:CO16407</b>				<b>Course Title: Open Source Technology.</b>												
<b>Compulsory / Optional: Compulsory</b>																
<b>Teaching Scheme and Credits</b>				<b>Duration of Examination</b>			<b>Examination Scheme</b>									
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total				
---	---	02	02	---	---	02Hrs	---	---	50	---	---	50				
( * ) indicates assessment by Internal and External examiners.																

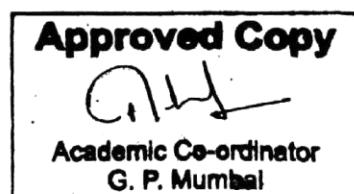
**Rationale :**

This course is aimed at providing the students with a fairly good knowledge and understanding of Open Source Software. After completion of this subject students will be able to use copyright free Open Source Software products in research and collaborate in enhancement of these OSS products.

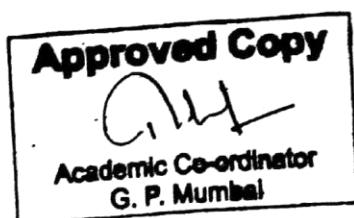
**Course Outcomes :**

The student will be able to:

CO1	Recognize the benefits and features of Open Source Technology.
CO2	Interpret, Contrast and Compare open source products among themselves
CO3	Write PHP code to produce outcomes & solve problems
CO4	Display and insert data using PHP and MySQL
CO5	Create, test & debug web pages containing PHP & MySQL



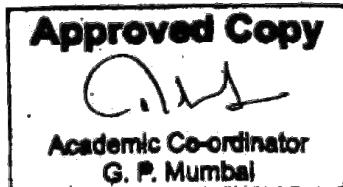
Topic No	Contents
1	<b>Introduction to Open Source Technology</b> <ul style="list-style-type: none"> <li>1.1 Open Source Origins,</li> <li>1.2 Differences among Open Source, freeware, proprietary and other software.</li> <li>1.3 Principle and Techniques of Open Source Development,</li> <li>1.4 Issues in Open Source Software Development.</li> </ul>
2	<b>Open Source Web Development Tools</b> <ul style="list-style-type: none"> <li>2.1 Introduction to is PHP           <ul style="list-style-type: none"> <li>2.1.1. Basic Syntax of PHP</li> <li>2.1.2. programming in web environment</li> <li>2.1.3. Common PHP Script Elements</li> <li>2.1.4. Using Variables, Constants, Data types , Operators ;</li> <li>2.1.5. Conditional Statements</li> <li>2.1.6. Loops(For, While, Do While, For each)</li> <li>2.1.7. Working With Arrays</li> <li>2.1.8. Using Functions</li> <li>2.1.9. OOP</li> <li>2.1.10. String Manipulation and Regular Expression</li> </ul> </li> <li>2.2 File and Directory Handling           <ul style="list-style-type: none"> <li>2.2.1 Including Files</li> <li>2.2.2 File Access</li> </ul> </li> <li>2.3 Working With Forms           <ul style="list-style-type: none"> <li>2.3.1 Processing Forms</li> <li>2.3.2 Form Validation</li> <li>2.3.3 Introduction to advanced PHP concepts</li> <li>2.3.4 Simple programs Using PHP</li> </ul> </li> </ul>
3	<b>Open Source Database</b> <ul style="list-style-type: none"> <li>3.1 Introduction to MySQL</li> <li>3.2 Setting up an account</li> <li>3.3 Starting, Terminating and writing your own MySQL Programs</li> <li>3.4 Record Selection Technology</li> <li>3.5 Working with Strings</li> <li>3.6 Date and Time</li> <li>3.7 Sorting Query Results module</li> <li>3.8 Generating Summary</li> <li>3.9 Working with Metadata</li> <li>3.10 Using Sequences</li> <li>3.11 MySQL and Web</li> </ul>



<b>4</b>	<b>PHP and SQL database:</b> 4.1 PHP and LDAP 4.2 PHP Connectivity 4.3 Sending and receiving emails 4.4 PHP Database Connectivity 4.5 Retrieving data from MySQL 4.6 Manipulating data in MySQL using PHP
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**List of Practicals :-**

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	Introduction to web programming using PHP & environment setup.	02
2	2	Write a PHP program to  a) display today's date in dd-mm-yyyy format b) check if number is prime or not c) print first 10 Fibonacci Numbers.	02
3	2	Write a PHP program to create Student registration form	02
4	2	Create HTML page that contain textbox, submit / reset button. Write PHP program to display this information and also store into text file.	02
5	2	Write a PHP script to read data from txt file and display it in html table (the file contains info in format Name: Password: Email: )	02
7	2	Write a PHP Script for login authentication. Design an html form which takes username and password from user and validate against stored username and password in file.	02
8	2	Write a PHP program to perform Form validation – Railway ticket reservation	02
9	3	Write PHP Script for storing and retrieving user information from MySQL table. 1. Design A HTML page which takes Name, Address, Email and Mobile No. From user ( register.php ) 2. Store this data in MySQL database / text file. 3. Next page display all user in html table using PHP ( display.php )	04
10	3	Demonstrate the Database using insert, delete& update operation	02



11	3	Demonstrate the Queries Record selection operation	02
12	3	Write the queries to demonstrate the working with date and time functions	02
13	3	Write the queries to demonstrate the working of Summaries operation	02
14	2&3	Write a PHP script for user authentication using PHP-MYSQL. Use session for storing username.	02
15	All	Mini Project	02

\*Mini Project should be assigned by subject teacher.

#### Reference Books:

Sr. No.	Book Title	Author	Publication
01	Open Source SOA	Jeff Davis	Wiley-India
02	Programming PHP	Rasmus Lerdorf and Levin Tatroe	O'Reilly Publications2002
03	Beginning PHP5, Apache, MySQL, Web Development	Elizabeth Naramore, Jason Gerner	Wiley Publishing Inc.
04	Web Programming	Chris Bates	Wiley India
05	MySQL	Bible Steve, Suchring John	Wiley sons

#### Reference Links:

1. [www.opensource.org](http://www.opensource.org)
2. [www.w3.org](http://www.w3.org)

#### Course Curriculum Development Committee:+

##### a. Internal Faculty

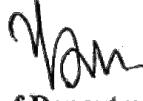
Mrs. R. V. Molawade (Lecturer in Computer Engineering, Govt. Polytechnic, Mumbai)

##### b. External Faculty

Mrs. Nisha Wartha (Lecturer in Information Technology, Govt. Polytechnic, Thane)



Academic Coordinator

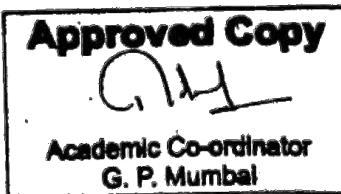


Head of Department  
(Computer Engineering)



Principal  
Govt. Polytechnic Mumbai

Curriculum – 2016



Open Source Technology (CO16407)

**Course Name :- Open Source Technology**  
**Course Code :- CO16407**

### CO Vs PO matrix

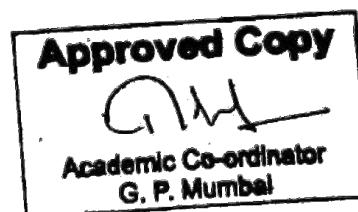
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	-	-	1	-	1	-	-	2
CO2	3	3	1	1	2	1	1	1	-	2
CO3	3	3	3	2	2	1	1	2	1	3
CO4	3	3	3	2	3	2	2	2	2	1
CO5	3	3	3	2	2	1	1	2	1	3

### CO Vs PSO matrix

CO/POs		PSO1	PSO2	PSO3
CO1	Recognize the benefits and features of Open Source Technology.	3	2	2
CO2	Interpret, Contrast and Compare open source products among themselves	3	2	3
CO3	Write PHP code to produce outcomes & solve problems	3	2	3
CO4	Display and insert data using PHP and MySQL	2	3	3
CO5	Create, test &debug web pages containing PHP & MySQL	3	2	3

### Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Introduction to Open Source Technology	<b>CO1:</b> Recognize the benefits and features of Open Source Technology <b>CO2:</b> Interpret, Contrast and Compare open source products among themselves
2	2	Open Source Web Development Tools	<b>CO3:</b> Write PHP code to produce outcomes & solve problems
3	3	Open Source Database	<b>CO4:</b> Display and insert data using PHP and MySQL
4	4	PHP and SQL database:	<b>CO5:</b> Create, test &debug web pages containing PHP & MySQL



<b>Programme Code: CO</b>												
<b>Course Code: CO16408</b>		<b>Course Title: Functional programming using Python</b>										
<b>Compulsory / Optional: Compulsory</b>												
<b>Teaching Scheme and Credits</b>		<b>Duration of Examination</b>		<b>Examination Scheme</b>								
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total
01	---	02	03	---	---	02Hrs	---	---	50	---	---	50

( \*) indicates assessment by Internal and External examiners.

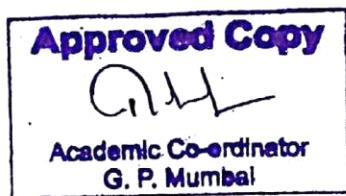
**Rationale:**

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to functional programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms. This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples.

**Course Outcomes:**

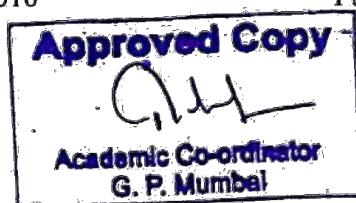
The students should be able to:

1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2	Express different Decision-Making statements and Functions
3	Interpret Object oriented programming in Python
4	Perform operations of File handling using Python
5	Demonstrate String handling and Exceptional handling in Python



**Course Content Details:**

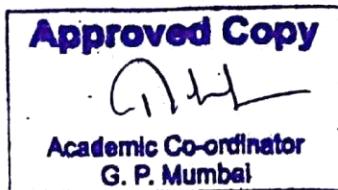
<b>Unit No</b>	<b>Topics / Sub-topics</b>
1	<b>Getting started with Python programming</b> <ul style="list-style-type: none"> <li>1.1 Introduction to Python           <ul style="list-style-type: none"> <li>1.1.1 Python features</li> <li>1.1.2 Scope of python</li> <li>1.1.3 Python products</li> <li>1.1.4 Python in today's context</li> </ul> </li> <li>1.2 Python Download, Installation and Environment Setup</li> <li>1.3 First python program execution "Hello World"</li> <li>1.4 Python programming syntax</li> </ul>
2	<b>Variables, keywords and Operators</b> <ul style="list-style-type: none"> <li>2.1 Variables           <ul style="list-style-type: none"> <li>2.1.1 Memory mapping of variables</li> <li>2.1.2 Application memory</li> <li>2.1.3 Variable nomenclature</li> <li>2.1.4 Properties and scope of variables</li> </ul> </li> <li>2.2 Keywords in Python</li> <li>2.3 Operators in Python</li> <li>2.4 Basics I/O and Type casting</li> <li>2.5 Built-in functions and getting help</li> </ul>
3	<b>Control flow statements</b> <ul style="list-style-type: none"> <li>3.1 Flow of program control</li> <li>3.2 Decision making statements: if-elseif-else</li> <li>3.3 for loop           <ul style="list-style-type: none"> <li>3.3.1 Making of 'for' loop</li> <li>3.3.2 Repetition using for loop: range() function</li> <li>3.3.3 Iteration using for loop</li> </ul> </li> <li>3.4 while loop           <ul style="list-style-type: none"> <li>3.4.1 Making of 'for' loop</li> <li>3.4.2 Infinite loop</li> </ul> </li> <li>3.5 Loop control keywords: break, continue, pass</li> </ul>
4	<b>Numbers, Functions, Classes</b> <ul style="list-style-type: none"> <li>4.1 Introduction to functions           <ul style="list-style-type: none"> <li>4.1.1 Function definition and return</li> <li>4.1.2 Function call and reuse</li> <li>4.1.3 Function parameters</li> </ul> </li> <li>4.2 Function recipe and doc string</li> <li>4.3 Programming with functions</li> <li>4.4 Namespaces and scope of variable</li> <li>4.5 Numbers – int, float, long, complex</li> <li>4.6. Classes</li> <li>4.7. Working with instances</li> <li>4.8. Designing classes</li> </ul>



5	<b>Strings and Exception Handling</b> 5.1 Introduction to Python 'string' data type 5.2 Properties of a string 5.3 String built-in functions 5.4 Programming with strings 5.5 String formatting 5.6 Exception handling 5.6.1 Basic input/output 5.6.2 Handling files 5.6.3 String processing
6	<b>Lists, Tuples, Dictionary and Sets</b> 6.1 Introduction to Python 'string' data type 6.2 Properties of a list 6.3 List built-in functions 6.4 Programming with lists 6.5 List comprehension 6.6 Tuples as Read only lists 6.7 Moving from list to dictionary 6.8 Dictionary built-in functions 6.9 Sets and sets properties

**List of Practicals:**

Sr. No	List of Practical	Hours
1.	Installation and configuration of python.	02
2.	Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.	04
3.	WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :  Grade A: Percentage $\geq 80$ Grade B: Percentage $\geq 70$ and $< 80$ Grade C: Percentage $\geq 60$ and $< 70$ Grade D :Percentage $\geq 40$ and $< 60$ Grade E : Percentage $< 40$	04
4.	Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user	04
5.	Write python programs to implement different decision making statements and Functions	02
6.	Write a Program to find factorial of the given number.	02
7.	Write a Program to find sum of the following series for n terms: $1 - \frac{2}{2!} + \frac{3}{3!} - \dots - \frac{n}{n!}$	02
8.	WAP to calculate the sum and product of two compatible matrices.	02



9.	Write python programs to implement different File handling operations	02
10.	Write python programs to implement classes in Python.	02
11.	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations,	02
12.	Write Python program to implement Basic String Operations & String Methods.	02
13.	Write Python to implement List, Tuples, Dictionaries, Arrays.	02

**References/ Books:**

Sr. No.	Author	Name of Book	Publisher
1.	Timothy A. Budd	Exploring Python	Tata McGraw Hill, New Delhi 2011
2.	Kenneth A. Lambert	The Fundamentals of Python: First Programs,	Cengage Learning, ISBN: 978-1111822705
3.	James Payne	Beginning Python: Using Python 2.6 and Python 3.1”,	Wrox Publication
4.	Dr. R. Nageswara Rao	Core Python Programming”	Dreamtech Press, Wiley Publication
5.	Magnus Lie Hetland	Beginning Python from Novice to Professional” Second Edition	Apress Publication.
6.	E. Balguruswamy	Introduction to Computing and Problem Solving using Python”,	McGraw Hill Publication

**Website:**

<https://pythonprogramming.net/>

[https://www.brianheinold.net/python/python\\_book.html](https://www.brianheinold.net/python/python_book.html)

**Course Curriculum Development Committee:****a. Internal Faculty :**

Mrs Anuradha Bhatt Oza,

**b. External Faculty:**

Mrs.Shipa Kabra, Lecturer Government College of Engineering,  
Aurangabad



Academic Coordinator



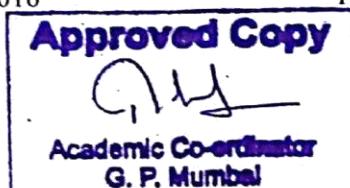
Head of Department  
(Computer Engineering)



Principal  
Govt. Polytechnic Mumbai

Curriculum-2016

Functional Programming Using Python (CO16408)



**Course Name:-Functional Programming using Python**  
**Course Code :- CO16411**

**CO Vs PO matrix**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	-	-	1	1	1	1	2	2
CO2	3	3	1	1	2	1	1	2	3	2
CO3	3	3	1	1	2	1	1	2	3	2
CO4	2	2	3	2	3	2	1	2	2	1
CO5	2	2	1	1	2	-	1	1	2	1

**CO Vs PSO matrix**

CO/POs		PSO1	PSO2	PSO3
CO1	Understand Basics of Python programming	3	2	2
CO2	Apply Decision Making and Functions in Python	3	2	3
CO3	Understand and summarize different File handling operations	3	2	3
CO4	Apply Functional Programming and mathematical operation using Python	2	3	3
CO5	String handling and Exceptional handling in Python	3	2	3

**Unit Number and COs**

Sr. No.	Unit No.	Topic Title	COs
1	1	Getting started with Python programming	CO1: Understand Basics of Python programming
2	2	Variables, keywords and Operators	CO1: Understand Basics of Python programming
3	3	Control flow statements	CO2: Apply Decision Making and Functions in Python CO3: Understand and summarize different File handling operations
4	4	Numbers, Functions, Classes	CO4: Apply Functional Programming and mathematical operation using Python
5	5	Strings and Exception Handling	CO5: String handling and Exceptional handling in Python
6	6	Lists, Tuples, Dictionary and Sets	CO5: String handling and Exceptional handling in Python CO4: Apply Functional Programming and mathematical operation using Python

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