Programme: Information Technology   Sixth Semester   With effect from June 2018

Course Code	Course Title	Teaching Hours				Credits	Examination Scheme					
							Theory					
		L	P	TU	Total		TH	TS	PR	OR	TW	Total
IT16501	Management Information System	4	---	---	4	4	70	30	---	---	---	100
IT16315	Cloud Computing	3	2	---	5	5	70	30	---	50*	50	150
IT16316	Software Testing and Quality Assurance	3	4	---	7	7	70	30	50*	---	50	200
IT16403 (O2)	Big Data	3	4	---	7	7	70#	30	---	50*	50	200
IT16404 (O2)	Internet of Things											
IT16405 (O2)	Geographical Information System (GIS)											
IT16317	Project and Seminar Stage II	---	4	---	4	4	---	---	---	50*	50	100
IT16318	Mobile Application Development	2	4	---	6	6	---	---	50*	---	50	100
IT16319	Industrial Training (During Summer Break after 5th Semester)	---	2	---	2	2	---	---	---	25*	25	50
	TOTAL	15	20	---	35	35	280	120	100	175	225	900

Abbreviations: 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 External Examiner   # Indicates Online Examination

Academic Coordinator
10-12-18

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Academic Co-ordinator
G. P. Mumbai

Head of Department
(Information Technology)
10-12-18

Principal
Government Polytechnic Mumbai

Programme : Diploma in Information Technology									
Course Code:IT16501				Course Title: **MANAGEMENT INFORMATION SYSTEM**					
Compulsory / Optional: Compulsory									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	-	--	4	70(3 Hrs)	30	--	--	---	100

Rationale: The modern business environment is characterized by intense competition, short product life cycles & technological development. Hence representing the information in a systematic manner becomes an integral part of the business. The need for the systematic Management Information.The system is essential for creating competitive firms, managing the global scenario of cut throat competition & no rover adding value.

Management Information System facilitates the decision makers to extend their planning horizons & introduce even greater levels of uncertainty in business plans & budgeted allocations. Management Information System facilitates a higher degree of accountability in business process.
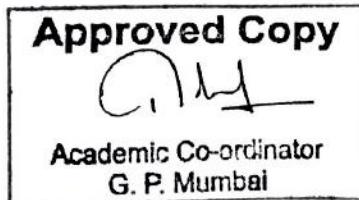
Course Outcomes:
Student should be able to:

| CO1	Define the important role of MIS in modern organizations.
CO2	Explain the function of Business Process Outsourcing, processes in Customer Relationship Management & types of E-commerce.
CO3	Apply the use of data warehouse, data mining for decision support system.
CO4	Identify different Expert systems.
CO5	Define the various tools of Security Management.

Course Content Details:

Unit No	Topics / Sub-topics
1	1. **Foundation of Information System** 1. Information Systems (Concept, Resources and Products, Activities) 2. Management Information System (Definition, Role, Features) 3. Importance of Management, Process of Management (Planning,Organizing, Staffing, Coordinating, Directing) 4. Organizational Structure – Basic model of organization structure, 5.Organizational Behavior, Management Information System Organization 7.Strategic Management of Business – Concept of corporate planning, 8.Essentiality of Strategic planning, Development of Business Strategy, Types of strategies, Tools of planning, MIS Business planning

IT16501

2	**2. Application of MIS**
	 1. Applications in manufacturing sector
	   1.1 Personal Management,
	   1.2 Financial Management,
	     1.3 Production Management, Materials
	 1.4 Management, and Marketing Management)
	 2. Applications in Service sector
	 (Airlines, Hotels, Hospitals, Banking, Insurance, Utilities, and Finance.)

3	**3. Decision Support System**
	 1. Characteristics of decision making process
	   1.1 Decision Support System
	 (Concept, Components, Development, Risk)
	   2. Management Information System and Decision Support System,
	 3. Data warehouse (Concept, Design, Organization and Management,
	 Architecture, Implementation),
	 4.Data in data warehouse
	 5.Data Mining

4	**4. Integration of Information**
	 1.Enterprise Resource Planning (ERP)-
	   1.1 ERP (Basic features, Benefits, selection, implementation)
	   1.2 Enterprise Management System (EMS) &
	   1.3 Management Information System (MIS)
	 2.Customer Relationship Management (CRM)
	 (Concept , Three Phasesof CRM, Benefits , Challenges & Trends)
	   3. Business Process Outsourcing (BPO) -BPO, Voice BPO i.e. Call
	   4. Center, Non-Voice BPO, Challenges in BPO Management.
	   5. Electronic Commerce Systems (E-Commerce) – Concept, Scope,
	 B2C, B2B, C2C, E-Commerce Applications

5	**5. Security & Ethical challenges**
	 1. Viewing Versus Security
	 Risks, Threats & Vulnerability, Assessing Risks.
	   2. Common Controls (Physical, Electronic, Software, ManagementControls)
	   3. Common Threats
	     3.1 Natural Disasters Employee Errors
	     3.2 Computer
	     3.30Crime, Fraud, Abuse, Program Bugs
	   4. Ethical & Contractual Behaviors, Privacy, Access & Accuracy Issues,
	 Property Issues.

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IT16501

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	R Level	U Level	A Level	Total Marks
1	Foundation of Information System	10	6	6	4	16
2	Application of MIS	10	2	4	6	12
3	Decision Support System	10	4	4	6	14
4	Integration of Information	9	2	8	6	16
5	Security & Ethical challenges	6	4	4	4	12
	Total	45	18	26	26	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

References/ Books:

Sr.no	Author	Title	Publisher
1.	Robert Schulthis&Mary Sumner	Management Information System	Tata Mcgraw Hill
2.	O'Brien	Management Information System	Tata Mcgraw Hill
3.	Jawadekar	Management Information System	Tata Mcgraw Hill

Websites:
- www.en.wikipedia.org
- www.dwinfocenter.org
- www.ousourceking.com/bpo

Course Curriculum Development Committee:
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IT16501

Management Information System

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Programme : **Diploma in Information Technology**									
Course Code: IT16315				Course Title: **CLOUD COMPUTING**					
Compulsory / Optional: Compulsory									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	2	5	70(3 Hrs)	30	--	50*	---	150

*Assessment by External Examiner

Rationale: This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, Software as a Service, and Physical Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc. solutions as well as theoretical solutions are introduced.
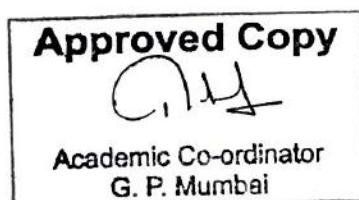
Course Outcomes:
Student should be able to:

CO1	List cloud computing techniques
CO2	design and implement cloud-based applications.
CO3	Find the best practices in cloud computing.
CO4	Explain the current challenges in cloud computing.
CO5	Demonstrate Virtualization in cloud computing
CO6	Make use of Cloud Resource Management

Course Content Details:

Unit No	Topics / Sub-topics

1	1. **Introduction To cloud computing**
	  1.1 Definition,
	  1.2 Characteristics,
	  1.3 Components,
	  1.4 Cloud provider
	    SAAS, PAAS, IAAS / HAAS. Comparison among SAAS, PAAS, IAAS
	  1.5 Organizational scenarios of clouds,
	  1.6 Administering & Monitoring cloud services,
	  1.7 Benefits and limitations.
	  1.8 Cloud Fundamentals
	    i. Cloud Building Blocks
	    ii. Understanding Public & Private cloud environments

2	2.**Cloud computing platforms:**
	  2.1 Infrastructure as service:
	    2.1.1 Amazon EC2,
	    2.1.2 Platform as Service: Google App Engine, Microsoft Azure,
	      Utility Computing, Elastic Computing.

|	

	2.2 Data in the cloud:
	    2.2.1 Relational databases,
	    2.2.2 Cloud file systems: GFS and HDFS, BigTable,
	       HBase and Dynamo.
	    2.2.3 Features and comparisons among GFS ,HDFS.

3	**3. Virtualization & Cloud**
	    3.1 Virtualization characteristics.
	    3.2 Types of Virtualization & its benefits
	    3.3 Introduction to Various Virtualization OS - Vmware , KVM etc
	    3.4 Managing virtualization, Virtualization in cloud
	    3.5 Virtualization desktop and managing desktops in the cloud ,security issues

4	**4. Cloud Storage**
	    4.1 Storage basics, providers, Security, reliability, advantages,
	       cautions, outages, theft, Cloud Storage Provider
	    4.2 Storage Security: Aspects of data security, data security mitigation,
	       provider data and it's security.

5	**5. Data Security**
	    5.1 Cloud computing security architecture:
	       5.1.1 Architectural Considerations-
	       5.1.2 General Issues,
	       5.1.3 Trusted Cloud computing,
	       5.1.4 Secure Execution Environments and Communications,
	       5.1.5 Micro-architectures; Identity Management and
	          Access control-Identity management, Access control,
	          Autonomic Security Cloud computing
	    5.2 security challenges: Virtualization security management-
	       5.2.1 virtual threats, VM Security Recommendations,
	          VMSpecific Security techniques,
	       5.2.2 Secure Execution Environments and Communications in cloud.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction To cloud computing**	10	4	6	4	14
2	**Cloud computing platforms**	10	4	4	6	14
3	**Virtualization & Cloud**	8	4	4	4	12
4	**Cloud Storage**	8	2	6	4	12
5	**Data Security**	9	4	8	6	18
	Total	45	18	28	24	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks

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weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments: (Minimum 10 experiments should be performed)

Sr. No.	Unit	List of Experiments	Approx. Hours	CO
1	1	Demonstrate services of Cloud (SAAS / PAAS)	2	1
2	1	Demonstrate services of Cloud (IAAS / HAAS)	2	1
3	1	Designing of sample cloud services	2	2
4	2	Prepare test case for working of Google App engine	2	3
5	2	Prepare test case for working of Amazon cloud	2	3
6	2	Prepare test case for working of Microsoft Azure	4	2
7	3	Configure VMware software for Virtualization OS.	2	5
8	3	Study Current techniques for large data processing (Google GFS, BigTable, and Map-Reduce)	2	4
9	3	Configure KVM, VirtualBox software for Virtualization OS.	2	5
10	4	Configuration of private cloud using open source technology	2	6
11	5	Discover various security techniques	2	4
12	6	Develop of a framework of e-exam	2	6
13	6	Mini Project	4	1,2,3,4,5,6
		Total	**30**	

References/ Books:

Sr. No.	Book Title	Author	Publication
1	Cloud Computing: A Practical Approach	J.Vette, Toby J. Vette, Robert Elsenpeter	Tata McGraw Hill
2	Enterprise Cloud Computing	GautamShroff	Cambridge University Press
3	Cloud Computing for Dummies	Judith Hurwitz, R.Bloor, Kanfman, F.Halper	Wiley India Edition
4	Cloud Security & Privacy	Tim Malhar, S.Kumaraswammy, S.Latif	O'REILLY

Course Curriculum Development Committee:
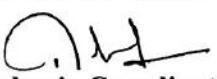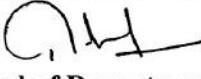
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Academic Coordinator	**Head of Department** (Information Technology)	**Principal** Govt. Polytechnic Mumbai

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Academic Co-ordinator
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Programme : **Diploma in Information Technology**									
Course Code:**IT16316**				Course Title: **Software Testing and Quality Assurance**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**-**	**4**	**7**	**70(3 Hrs)**	**30**	**50***		**50**	**200**

*Assessment by External Examiner

Rationale:

Software testing is a process, to evaluate the functionality of a software application with an intent to find whether the developed software met the specified requirements or not and to identify the defects to ensure that the product is defect free in order to produce the quality product. student will learn how to immediately find problems in any computer program, how toplan an effective test approach, how to clearly report your finding and how to tell when your software is ready for release.

Course Outcomes:

Student should be able to:

CO1	Define software testing concept and importance of Quality software
CO2	Learn the basic types of testing for software and Differentiate White box and Black box testing
CO3	Explain various types and levels of software testing.
CO4	Develop STLC, test planning, test case writing and test case execution.
CO5	Solve defectmanagement.
CO6	Demonstrate the various automated testing tools to improve testing efficiency and limitation of Manual testing.

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Course Content Details:

| Unit No	Topics / Sub-topics
1	**Basics of Software Testing** 1.1 Definition of Software Testing, what is Quality?, Software Quality, Role of Testing 1.2 Failure, Error, Fault, Defect, Bug Terminology 1.3 Objectives of Testing 1.4 Test Case 1.5 When to Start and Stop Testing of Software (Entry and Exit Criteria) 1.6 Skills for Software Tester ,SDLC 1.7 Quality Assurance, Quality Control, Verification and Validation Model, waterfall model, V model , spiral model

2	**Types of Testing**
	2.1 White Box Testing : Classification of White Box Testing
	   1. Static Testing- Inspections, Structured Walkthroughs, Technical Review
	   2. Structural Testing-Code Functional Testing, Code Coverage Testing, Code Complexity Testing
	2.1 Black Box Testing: Techniques for Black Box Testing Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Decision Tables, Equivalence Partitioning, User Documentation Testing, Sample Examples on White and Black Box Testing.

3	**Levels of Testing and Special Tests** 3.1 **Unit Testing:** Driver, Stub 3.2 **Integration Testing:** Decomposition Based Testing - Top-Down Integration, Bottom-Up Integration, Bi-Directional Integration, Incremental Integration, Non-Incremental Integration 3.3 **System Testing:** Recovery Testing, Security Testing, Performance Testing, Load Testing, Stress Testing, Usability Testing, Compatibility Testing 3.4 **Acceptance Testing:** Acceptance criteria, Alpha Testing an Beta Testing 3.5 **Special Tests:** Smoke Testing and Sanity Testing, Regression Testing, Usability Testing, GUI Testing, Object Oriented Application Testing: Client-Server Testing, Web based Testing
4	**Test Management** 4.1 **Test Planning :**STLC(software testing life cycle) Preparing a Test Plan, Scope Management, Deciding Test Approach, Setting Up Criteria for Testing, Identifying Responsibilities, Staffing, Training Needs, Resource Requirements, Test Deliverables, Testing Tasks 4.2 **Test Management:** Choice of Standards, Test Infrastructure Management, Test People Management, Integrating with Product Release 4.3 **Test Process:** Base Lining a Test Plan, Test Case Specification, Update of Traceability 4.4 **Test Reporting:** Recommending Product Release. Matrix, Executing

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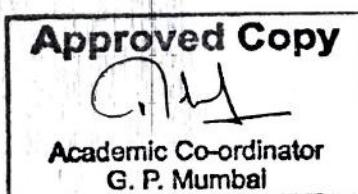
	Test Cases, Collecting and Analyzing Metrics, Preparing Test Summary Report.
5	**Defect Management** 5.1 Introduction, Defect Classification, Defect Management Process 5.2 Defect Life Cycle, Defect Template 5.3 Estimate Expected Impact of a Defect, Techniques for Finding Defects, Reporting a Defect
6	**Testing Tools and Measurements** 6.1 Limitations of Manual Testing and Need for Automated Testing tools, What is Automation Testing?, Manual Testing vs Automation Testing, Automation testing Tools 6.2 Features of Test Tool: Guideline for Static and Dynamic Testing Tool 6.3 Advantages and Disadvantages of Using Tools 6.4 Selecting a Testing Tool 6.5 When to Use Automated Test Tools, Testing Using Automated Tools 6.6 **What are Metrics and Measurement:** Types of Metrics, Project Metrics, Progress and Productivity Metrics

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	R Level	U Level	A Level	Total Marks
1	Basics of Software Testing	6	4	4	2	10
2	Types of Testing	7	4	6	-	10
3	Levels of Testing and Special Tests	8	4	6	4	14
4	Test Management	10	2	8	4	14
5	Defect Management	6	4	6	2	12
6	Testing Tools and Measurements	8	2	2	6	10
	Total	45	20	32	18	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

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List of experiments/Assignments: (Minimum 10 experiments should be performed)

Sr. No.	Unit	List of Experiments	Approx. Hours	Co
1.	1	Study of Software testing types & methods.	4	1
2.	2	Study system specification & designing test cases for Inventory & purchase order management. (Min 20 Test case)	4	2
3.	2	Design test cases for pen.(Positive and Negative Test case)	4	2
4.	2	Design and write test cases for simple calculator application.	4	2
5.	2	Design and write test cases for ATM. (Min 20 Test case).	4	2
6.	2	Design test write test cases for Notepad (MS Window based) Application.	4	2
7.	4	Design test cases for college Admission form. (Write test cases in test case format)	4	4
8.	4	Create a test plan document for Library Management System	4	5
9.	4	Create a test plan document for Online Shopping.	4	4
10.	5	Design test cases for Social site (Twitter, Facebook) login form. (Write test cases in test case format)and prepare a bug report document.	4	5,3
11.	5	Write the test cases for any known application and prepare bug report document. (eg. Banking Application)	4	5,3
12.	6	Study of Automated Testing Tools.(Bugzilla, Selenium, Mentis, QTP, or any freeware tool)	4	6
13.	6	Using an Automated/ computerised tool, Atomizing and running test cases for WordPad (MS Windows based).	4	6,3
14.	6	Using an Automated/ computerized tool, Atomizing and running test cases for MS-Paint application(MS Windows based).	2	6,3
15.	6	Implement test cases for MS Word application using an Automation Tool	2	6
16.		Mini project -Test Your Final Year Project using all types of testings.	4	1,2,3,4,5,6
		Total	**60**	

Software Testing and Quality Assurance IT16316

References/ Books:

Sr. No.	Book Title	Author	Publication
1	Software Testing	Ron Patton	
2	Software Testing: Principles and Practices	SrinivasanDesikanGopalaswamy Ramesh	PEARSON
3	Software Testing: Principles, Techniques and Tools	M. G. Limaye	Tata McGraw-Hill
4	Software Testing: Principles and Practices	Naresh Chauhan	Oxford
5	Software quality Assurance, testing and metrics	Anirban Basu	Phi Learning

Websites References :-

1. https://www.softwaretestingclass.com/wp-content/uploads/2016/06/Beginner-Guide-To-Software-Testing.pdf
2. https://books.google.co.in/books?id=Yt2yRW6du9wC&pg=PA45&source=gbs_toc_r&cad=4#v=onepage&q&f=true
3. http://en.wikipedia.org/wiki/Software_testing#Testing_tools
4. https://en.wikipedia.org/wiki/Test_automation

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Ms. Dipali B Gosavi (Lecturer in Information Technology, Govt. Polytechnic Mumbai)
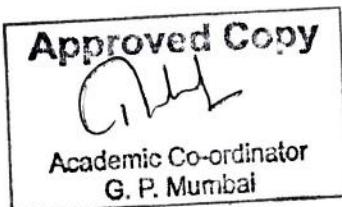
b. External Faculty

10-12-18	10-12-18	
Academic Coordinator	**Head of Department** (Information Technology)	**Principal** Govt. Polytechnic Mumbai

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Academic Co-ordinator
G. P. Mumbai

Programme : **Diploma in Information Technology**									
Course Code:**IT16403**				Course Title: **Introduction to Big Data and Hadoop**					
Compulsory / Optional: **Optional**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	4	7	70#	30	50*	--	50	**200**

*Assessment by External Examiner,　# On line examination

Rationale:

Big data analytics examines large amounts of data to uncover hidden patterns, correlations and other insights. With today's technology, it's possible to analyze your data and get answers from it almost immediately – an effort that's slower and less efficient with more traditional business intelligence solutions. Big data analytics helps organizations harness their data and use it to identify new opportunities.
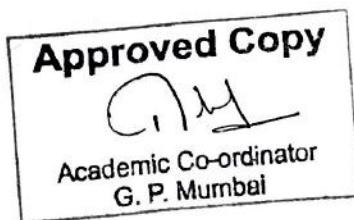
Course Outcomes:
Student should be able to:

CO1	Define Big data and Hadoop ecosystem
CO2	List the key issues in big data management and its associated applications
CO3	Analyse various forms of Big Data
CO4	Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
CO5	Solve Complex real world problems in various applications like recommender systems, social media applications, health and medical systems, etc.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Big Data** 1.1 Introduction to Big Data, Data Mining ,Data Warehousing 1.2 Big Data characteristics, types of Big Data, 1.3 Traditional vs. Big Data business approach, 1.4 Case Study of Big Data Solutions.
2	Introduction to Hadoop 2.1 Concept of Hadoop 2.2 Core Hadoop Components

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	2.3 Hadoop Ecosystem	
	2.4 Hadoop HDFS	
	2.5 Hadoop Limitations	
3	**MapReduce** 3.1 Distributed File Systems: Physical Organization of Compute Nodes, Large-Scale File-System Organization. 3.2 MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. 3.3 Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce	
4	**NoSQL** 4.1 Introduction to NoSQL, NoSQL Business Drivers, 4.2 NoSQL Data Architecture Patterns: Key-value stores, Graph stores, Column family (Bigtable)stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study 4.3 NoSQL solution for big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; NoSQL systems to handle big data problems.	
5	**Finding Similar Items and Clustering** 5.1 Distance Measures: Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance. 5.2 CURE Algorithm, Stream-Computing , A Stream-Clustering Algorithm, Initializing & Merging Buckets, Answering Queries	
6	**Real-Time Big Data Models** 6.1 PageRank Overview, Efficient computation of PageRank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector. 6.2 A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. 6.3 Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities in a social graph.	

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to Big Data	6	2	4	4	10
2	Introduction to Hadoop	5	2	2	4	8

IT16403

Big Data

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Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to Big Data	6	2	4	4	10
2	Introduction to Hadoop	5	2	2	4	8
3	MapReduce	7	4	2	6	12
4	NoSQL	7	2	4	6	12
5	Finding Similar Items and Clustering	10	4	4	6	14
6	Real-Time Big Data Models	10	4	4	6	14
	Total	45	18	20	32	70
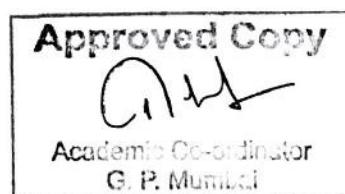
Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments

Sr. No.	Unit	List of Experiments	Approx. Hours
1	1,2	Hadoop HDFS Practical: -HDFS Basics, Hadoop Ecosystem Tools Overview. -Installing Hadoop.	4
2	1,2	Hadoop HDFS Practical: Copying File to Hadoop. -Copy from Hadoop File system and deleting file. -Moving and displaying files in HDFS.	4
3	1,2	Use of Sqoop tool to transfer data between Hadoop and relational database servers. a. Sqoop - Installation. b. To execute basic commands of Hadoop eco system component Sqoop	6
4	4	To install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands	6
5	3	-Implementing simple algorithms in Map-Reduce: Matrix multiplication, Aggregates, Joins, Sorting, Searching, etc	4
6	3	Create HIVE Database and Descriptive analytics-basic statistics, visualization using Hive/PIG/R	4

Big Data

IT16403

7	3	Write a program to implement word count program using MapReduce	4
8	3	Implementing DGIM algorithm using any Programming Language	4
9	3	Implement Bloom Filter using any programming language.	4
10	4	Implementing any one Clustering algorithm (K-Means/CURE) using Map-Reduce.	4
11	5,6	Implement PageRank using Map-Reduce	4
12	5,6	Implement predictive Analytics techniques (regression / time series, etc.) using R/ Scilab/ Tableau/ Rapid miner	4
14	1,2,3,4,5,6	Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web).	8
		Total	**60**

References/ Books:
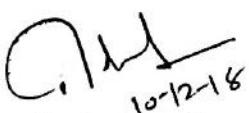
1. CreAnand Rajaraman and Jeff Ullman ―Mining of Massive Datasetsǁ, Cambridge University Press,
2. Alex Holmes ―Hadoop in Practiceǁ, Manning Press, Dreamtech Press.
3. Dan Mcary and Ann Kelly ―Making Sense of NoSQLǁ – A guide for managers and the rest of us, Manning Press.
1. Bill Franks , ―Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analyticsǁ, Wiley 2. Chuck Lam, ―Hadoop in Actionǁ, Dreamtech Press 3. Jared Dean, ―Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitionersǁ, Wiley India Private Limited, 2014

Course Curriculum Development Committee:
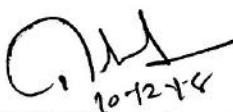
a. **Internal Faculty**
b. Ms. Namrata A Wankhade (Lecturer in Information Technology, Govt. Polytechnic Mumbai)
c. Ms. Dipali B Gosavi (Lecturer in Information Technology, Govt. Polytechnic Mumbai)

d. **External Faculty**
   Ms. Abhijit Wankhade (Principal Business solution Archtect Cleagoals company Montreal Canada)

Academic Coordinator   **Head of Department**   **Principal**
                                  (Information Technology)   **Govt. Polytechnic Mumbai**
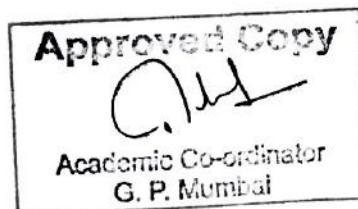
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G. P. Mumbai

Big Data   *IT16403*

Programme : **Diploma in IT**									
Course Code:**IT16404**				Course Title: **Internet of Things**					
Compulsory / Optional: **Optional 2**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	4	7	70 #	30	50*		50	200

 # indicates on line examination

***Indicates assessment by External examiner**

Rationale:

The Internet of Things (IoT) is one of the current emerging technologies that have no universal definition to date. The Internet of Things normally denotes the situations where the things or objects are connected through the Internet and can communicate with one another with minimum involvement from the users. IoT can be considered as the next industrial revolution. It is set to disrupt the way major industries operate and most likely, open more opportunities. We hear about the potentials applications of IoT in almost all industries. A lot of major companies involved in the information technology field are investing on further research and development. To name a few, these companies include the cloud service providers, the telecommunications providers and the device manufacturers. This subject gives focus on basics of IoT, parts of IoT and design of IoT.
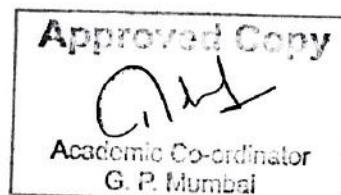
Course Outcomes:

After the completion of the course, student will be able to

CO1	Describe IoT and key technologies in IoT.
CO2	Explain Actuators and Sensors
CO3	Demonstrate interfacing of sensors and actuators
CO4	Design small IoT applications
CO5	Explain business models for the Internet of Things

Course Content Details:

Unit No	Topics / Subtopics
1	**INTRODUCTION** History of IoT, About IoT, Overview and Motivations, Applications and considerations, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, 3 views of IoT, IoT Frameworks, Basic Nodal Capabilities

2	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES** Identification of IoT Objects and Services, Structural Aspects of the IoT, M2M communications, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, SMAC (Social, Mobile, Analytics and Cloud).
3	**ACTUATORS AND SENSORS** Introduction to Embedded system What is actuator? Types of actuators, Stepper Motor, Servo Motor What is a sensor?, Types of sensors, Basic sensors like LM35, DHT11, Soil moisture, LDR, Push button, Environmental sensors like MQ2, Medical sensors like pulse sensor. Basic communication Protocols COAP, MQTT Sensor Technology: RFID, Introduction, Principle of RFID, Components of an RFID system
4	**MICROCONTROLLERS AND OS – ARDUINO, RASPBERRY PI** Understanding Arduino board Arduino Programming Understanding Raspberry PI Raspberry PI programming using Python Interfacing of sensors and actuators
5	**BUSINESS MODELS FOR THE INTERNET OF THINGS** Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things. Internet of Things Application : Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards,

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**INTRODUCTION**	6	6	4		10
2	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES**	8	6	6		12
3	**ACTUATORS AND SENSORS**	12		4	14	18
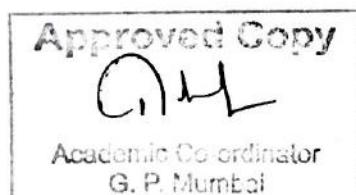
4	MICROCONTROLLERS AND OS – ARDUINO, RASPBERRY PI	14		4	16	20
5	BUSINESS MODELS FOR THE INTERNET OF THINGS	5		4	6	10
	Total	**45**	**12**	**22**	**36**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of Practicals :-Any Twelve

Sr. No.	Title of the Experiment	CO
1	Arduino Interfacing using LM35 Temperature sensor	CO3
2	Arduino Interfacing using LDR sensor	CO3
3	Interfacing Raspberry PI with LM 35	CO3
4	Interfacing Raspberry PI with LDR sensor	CO3
5	Interfacing BLE and Mobile Device	CO3
6	Uploading Raspberry PI LDR sensor data to Thingspeak server	CO4
7	Using GPRS for communication	CO4
8	Building REST Calls	CO5
9	Interfacing with 8266 and making REST Calls from device	CO3
10	Building MQTT Client with Raspberry PI	CO4
11	Sending data to own server and Plotting it	CO4, CO5
12	Controlling Servo motor through Internet	CO4
13	Home Automation: controlling LEDs through Internet	CO4, CO5
14	Vehicle Tracking	CO4, CO5
15	Interfacing with 8266 and Arduino	CO3

Reference Books:

Sr. No.	Book Title	Author	Publication
1	Internet of Things, A Hands-on Approach	Arshdeep Bahga, Vijay Madisetti	University Press
2	Architecting the Internet of Things	Bernd Scholz-Reiter, Florian Michahelles	Springer
3	The Internet of Things	Samuel Greengard	MIT Press
4	Arduino Home Automation Projects	Marco Schwartz	Packt Publishing Limited
5	Designing The Internet of Things	Adrian Mcewen, Hakin Cassimally	Willy Publications
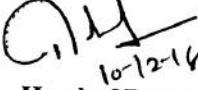
Course Curriculum Development Committee:

Internal Faculty:- Dr. R. A. Patil

External Faculty:- Mr. Rahul Kashyap, Analyst for National Advisory company: Ernst & Young LLP (EY)

Prof. Yogesh Pingle, Assistant Professor, Vidyavardhini College of Engineering and technology, Vasai

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Academic Coordinator

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(Information Technology)**

**Principal
Govt. Polytechnic Mumbai**

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Course Name:-Internet of Things   **Course Code:-IT16404**

CO Vs PO matrix

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

CO Vs PSO matrix

	CO/PSOs	PSO1	PSO2	PSO3
CO1	Describe IoT and key technologies in IoT.	2	3	
CO2	Explain Actuators and Sensors	2	3	1
CO3	Demonstrate interfacing of sensors and actuators	3	2	1
CO4	Design small IoT applications	3		3
CO5	Explain business models for the Internet of Things	3	3	3

Unit Number and COs

Sr. No.	Unit No.	Topics	COs
1	1	**INTRODUCTION**	CO1
2	2	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES**	CO1
3	3	**ACTUATORS AND SENSORS**	CO2, CO3
4	4	**MICROCONTROLLERS AND OS – ARDUINO, RASPBERRY PI**	CO3, CO4
5	5	**BUSINESS MODELS FOR THE INTERNET OF THINGS**	CO4, CO5

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Programme : **Diploma in Information Technology**								
Course Code:**IT16405**				Course Title: **Geographical Information System**				
Compulsory / Optional: **Optional**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	4	7	70#	30	50*	--	50	200

*Assessment by External Examiner   # On line examination

Rationale:

GIS (Geographic Information Systems) is a computer-based tool that uses spatial (geographic) data to analyze and solve real-world problems. This course is designed to introduce the student to the basic principles and techniques of GIS. Introduction to GIS is designed to provide the students with an understanding of the methods and theories of spatial analysis that will allow students to apply GIS knowledge and skills to everyday life and their chosen careers.
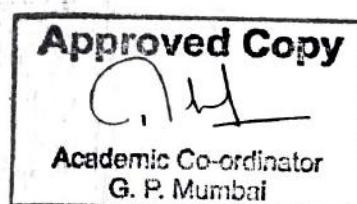
Course Outcomes:
Student should be able to:
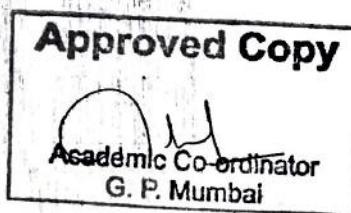
CO1	Understand GIS and Spatial data
CO2	Understand Spatial Referencing and Positioning
CO3	Understand vector and raster data structures and the appropriate use of each of these data structures
CO4	Learn the basics of data capture, storage, analysis, and output in a GIS
CO5	Know data visualization
CO6	Manage and processes different data

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to GIS** **1.1 The nature of GIS:** Some fundamental observations, Defining GIS, GISystems, GIScience and GIApplications, Spatial data and Geoinformation. **1.2 The real world and representations of it:** Models and modelling, Maps, Databases, Spatial databases and spatial analysis **1.3 Models and Representations of the real world** **1.3.1 Geographic Phenomena:** Defining geographic phenomena, types of geographic phenomena, Geographic fields, Geographic objects, Boundaries **1.3.2 Computer Representations of Geographic Information:** Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects

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	1.4 Organizing and Managing Spatial Data
	1.5 The Temporal Dimension
2	**Data Management and Processing System** **2.1 Hardware and Software Trends** **2.2 Geographic Information Systems:** GIS Software, GIS Architecture and functionality, Spatial Data Infrastructure (SDI) **2.3 Stages of Spatial Data handling:** Spatial data handling and preparation, Spatial Data Storage and maintenance, Spatial Query and Analysis, Spatial Data Presentation. **2.4 Database management Systems:** Reasons for using a DBMS, Alternatives for data management, The relational data model, Querying the relational database. **2.5 GIS and Spatial Databases:** Linking GIS and DBMS, Spatial database functionality.
3	**Spatial Referencing and Positioning** **3.1 Spatial Referencing:** Reference surfaces for mapping, Coordinate Systems, Map Projections, Coordinate Transformations **3.2 Satellite-based Positioning:** Absolute positioning, Errors in absolute positioning, Relative positioning, Network positioning, code versus phase measurements, Positioning technology
4	**Data Entry and Preparation** **4.1 Spatial Data Input:** Direct spatial data capture, Indirect spatial data capture, Obtaining spatial data elsewhere **4.2 Data Quality:** Accuracy and Positioning, Positional accuracy, Attribute accuracy, temporal accuracy, Lineage, Completeness, Logical consistency **4.3 Data Preparation:** Data checks and repairs, Combining data from multiple sources **4.4 Point Data Transformation:** Interpolating discrete data, Interpolating continuous data
5	**Spatial Data Analysis** **5.1 Classification of analytical GIS Capabilities** **5.2 Retrieval, classification and measurement:** Measurement, Spatial selection queries, Classification **5.3 Overlay functions:** Vector overlay operators, Raster overlay operators **5.4 Neighbourhood functions:** Proximity computations, Computation of diffusion, Flow computation, Raster based surface analysis **5.5 Analysis:** Network analysis, interpolation, terrain modelling **5.6 GIS and Application models:** GPS, Open GIS Standards, GIS Applications and Advances **5.7 Error Propagation in spatial data processing:** How Errors propagate, Quantifying error propagation

6	**Data Visualization**
	6.1 GIS and Maps, The Visualization Process
	6.2 Visualization Strategies: Present or explore?
	6.3 The cartographic toolbox: What kind of data do I have? How can I map my data?
	6.4 How to map? How to map qualitative data, How to map quantitative data, How to map the terrain elevation, How to map time series?
	6.5 Map Cosmetics, Map Dissemination

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction to GIS**	6	2	6	2	10
2	**Data Management and Processing System**	8	2	4	6	12
3	**Spatial Referencing and Positioning**	6	4	4	2	10
4	**Data Entry and Preparation**	7	2	2	6	10
5	**Spatial Data Analysis**	8	4	4	6	14
6	**Data Visualization**	10	4	4	6	14
	Total	45	18	24	28	70
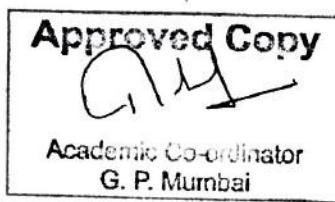
Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

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List of experiments/Assignments

Sr. No.	Unit	List of Experiments	Approx. Hours
1	1	Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.	4
2	2	Creating and Managing Vector Data: Adding vector layers, setting properties	4
3	2	Creating and Managing Vector Data: formatting, calculating line lengths and statistics	4
4	2	Exploring and Managing Raster data: Adding raster layers, raster styling and analysis.	4
5	2	Exploring and Managing Raster data: raster mosaicking and clipping	4
6	3	Making a Map, Working with Attributes, Importing Spreadsheets or CSV files Using Plugins, Searching and Downloading OpenStreetMap Data	4
7	3	Working with attributes, terrain Data	4
8	3	Working with Projections and WMS Data	4
9	4	Georeferencing Topo Sheets and Scanned Maps Georeferencing Aerial Imagery Digitizing Map Data	4
10	4	Managing Data Tables and Saptial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries	4
11	5,6	Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data	4
12	5,6	Advance GIS Operations 2: Batch Processing using Processing Framework Automating Complex Workflows using Processing Modeler Automating Map Creation with Print Composer Atlas	4
13	6	Validating Map data	4
14	4	Demonstrate the Use of GIS in mobile application	4
14	1,2,3,4,5,6	Mini project	8
		Total	**60**

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References/ Books:

| Sr. No	Title	Author	Publisher	Edition	Year
1.	Principles of Geographic Information Systems- An Introductory Text Book	Geographic Information Systems- An Introductory Text Book Editors: Otto Huisman and Rolf A.	Geographic Information Systems- An Introductory Text Book Editors: Otto Huisman and Rolf A. The International Institute of Geoinformation Science and Earth Observation	Fourth	2009
2	Principles of Geographic Information Systems	P.A Burrough and R.A.McDonnell	Oxford University Press	Third	1999
3	Fundamentals of Spatial Information Systems,	R.Laurini and D. Thompson,	Academic Press		1994
4	Fundamentals of Geographic Information Systems	Michael N.Demers	Wiley Publications	Fourth	2009
5	Introduction to Geographic Information Systems	Chang Kang-tsung (Karl),	McGrawHill	Any above 3rd edition	2013 7th edition

Course Curriculum Development Committee:

a. **Internal Faculty:-** Prof. N. A. Wankhade
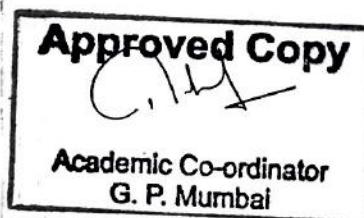
b. **External Faculty:-** Prof. Sadaf Shaikh, Lecturer in IT, Govt. Polytechnic Thane

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                     (Information Technology)   Govt. Polytechnic Mumbai

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Geographical Information system   IT16405

Programme Code: **Diploma in Information Technology**									
Course Code: **IT16317**				Course Title: **PROJECT AND SEMINAR STAGE - II #**					
Compulsory / Optional: **COMPULSORY**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	--	04	04	--	--	--	50*	50	**100**

Rationale:

In the field of Computer and Information Technology various technologies (hardware and Software) needs to be integrated and proper paradigms need to be implemented to develop any kind of computer applications . Hence it becomes essential to get hands on experience in developing industrial applications. This subject is essential to understand the implementation of the system development process i.e. analyze, design, coding, debugging and testing. This will help the students to acquire skills and attitudes to work as a programmer or Network administrator.

Furthermore the student will be able to find out various sources of technical information and develop self-study techniques to prepare a project and write a project report.

Objectives:

The students will be able to
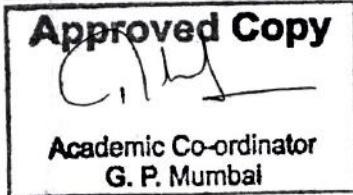
- Practically implement the acquired knowledge.
- Develop basic technical Skills by hands on experience.
- Write project report.
- Develop skills to use the latest technology in the Information Technology field.

Work to be done by the candidate / Group in VIth Semester
The candidate/ group is expected to complete detailed system design, analysis, data flow design, procurement of hardware and/or software, implementation of a module of the proposed work during the semester VI as a part of the term work submission in the form of a joint report.   The candidate / group will submit the completed project work to the department at the end of semester VI as mentioned below.   1. The workable project with code in compact disk.   2. The project reports in the bound journal complete in all respects with the following : -   i) Problem specifications.   ii) System definition – requirement analysis.   iii) System design – data flow diagrams, database design   iv) System implementation – algorithm, code documentation   v) Test results and test report.

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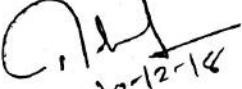
The project report should contain a full and coherent account of your work. Although there will be an opportunity to present the work verbally, and demonstrate the software,the major part of the assessment will be based on the written material in the project report.
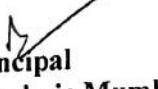
One can expect help and feedback from the project guide, but ultimately it's the candidate's own responsibility. The suggestive structure of a project report should be guided by your guide in selecting the most appropriate format for your project.
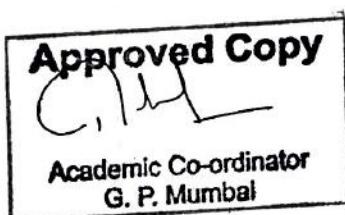
Academic Coordinator

**Head of Department
(Information Technology)**

**Principal
Govt. Polytechnic Mumbai**

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Academic Co-ordinator
G. P. Mumbai

Programme : **Diploma in Information Technology**	
Course Code:**IT16318**	Course Title: **Mobile Application Development**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
2	-	4	6	--	--	50*	--	50	100

*Assessment by External Examiner

Rationale:

Mobile Application development is becoming need of the day as webpage development was about ten years ago. Most companies are developing their mobile applications so that customers may interact with them on mobiles itself. Android is most popular mobile operating system of today. Android application development course is therefore designed to enable the diploma information technology students to build mobile applications on this platform. This course covers the basics of Android along with required programming codes for developing necessary programming skills for mobile applications. Thus this course is an important course for IT students with possibilities of self employment.
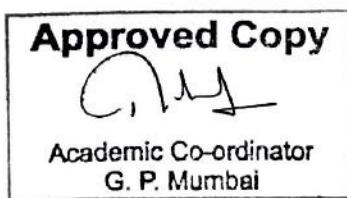
Course Outcomes:
Student should be able to:

CO1	Define the concept of open source mobile development and architecture
CO2	Build basic Android Application.
CO3	Design Android UI Layout
CO4	Develop event driven programs
CO5	Develop applications using menus and dialog boxes
CO6	Develop applications using SQLite database

Course Content Details:

| Unit No	Topics / Sub-topics
1	**Android Overview and Architecture** 1.1 Overview of Android - An Open Platform for Mobile development and other components 1.2 Open Handset Alliance 1.3 Use Android for mobile app development 1.4 Android Marketplaces 1.5 Dalvik Operating System 1.6 Libraries 1.7 Android Runtime 1.8 Application Framework
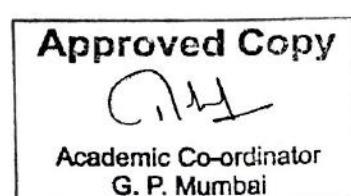
	1.9 Applications
	1.10 Android Debug bridge
	1.11 Android Permission model
	1.12 Android Manifest File
	1.13 React Native-a JavaScript framework
2	**Android Activities and UI Design**
	2.1 Android application components Intent, Activity, Activity Lifecycle, Broadcast receivers, Services and Manifest
	2.2 Create Application and new Activities
	2.3 Expressions and Flow control, Android Manifest
	2.4 Simple UI -Layouts and Layout properties
	• Fundamental Android UI Design
	• Introducing Layouts
	• Creating new Layouts
	• Drawable Resources
	• Resolution and density independence (px,dp,sp)
	2.5 XML Introduction to GUI objects (Push Button,Text / Labels,EditText, ToggleButton, WeightSum, Padding, Layout Weight
3	**Advanced UI Programming**
	3.1 Event driven Programming in Android (Text Edit, Button clicked etc.)
	3.2 Creating a splash screen
	3.3 Android Activity Lifecycle
	3.4 Introduction to threads in Android
4	**Toast, Menu, Dialog, List and Adapters**
	4.1 Menu: Custom Vs. System Menus
	4.2 Creating and Using Handset menu
	4.3 Button (Hardware)
	4.4 Android Themes, Dialog, create an Alter Dialog
	4.5 Toast in Android, List & Adapters
	4.6 Android Manifest.xmlFile
5	**SQLite Database Programming**
	5.1 SQLite: Open Helper and create database
	5.2 Open and close a database
	5.3 Different operations on database

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Android Overview and Architechture**	4				
2	**Android Activities and UI Design**	8		Not Applicable		
3	**Advanced UI Programming**	6				

IT16318

Mobile Application Development

|				
4	Toast, Menu, Dialog, List and Adapters	6		
5	SQLite Database Programming	6		
	Total	30		

Legends: *R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).*

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of experiments/Assignments: (Minimum 10 experiments should be performed)

Sr. No.	Unit	List of Experiments	Approx. Hours	Co
1	2	Create sample application with login module.(Check username and password), validate it for login screen or alert the user with a Toast.	4	2
2	2	Create and validate a login application using username as Email ID else login button must remain disabled.	2	2
3	2	Create and Login application and open a browser with any one search engine.	2	3
4	2	Create an application to display "Hello World" string the number of times user inputs a numeric value. (Example. If user enters 5, the next screen should print "Hello World" five times.)	4	3
5	2	Create spinner with strings from the resource folder (res >> value folder). On changing spinner value, change image	4	3
6	2	Create an application to change screen color as per the user choice from a menu.	4	3
7	3,4	Create an application that will display toast (Message) at some regular interval of time.	4	4
8	3	Create a background application that will open activity on specific time..	4	4
9	4	Create an application that will have spinner with list of animation names. On selecting animation name, that animation should affect on the images displayed below.	4	5
10	3	Create an UI listing the diploma engineering branches. If user selects a branch name, display the number of semesters and subjects in each semester.	4	5
11	4	Use content providers and permissions by implementing read phonebook contacts with content providers and display in the list.	4	5
12	4	Create an application to call a phone number entered by the user the Edit Text.	4	5

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13	5	Create an application that will create database to store username and password.	4	6
				6
14	5	Create an application to insert, update and delete a record from the database(using TinyDB database)	4	
15	1	Create an application using React Native.	4	1
15	3,4,5	Mini Project using database	4	4,5,6
		Total	60	

References/ Books:

Sr. No.	Book Title	Author	Publication
1	Beginning Android Programming with Android Studio	Jerome F. DiMarzio	Wrox(Wiley)
2	Android Studio Cookbook	Mike van Drongelen	PACKT Publishing
3	Beginning Android	Mark L Murphy	Wiley India Pvt Ltd

Websites References :-

1. https://developer.android.com/
2. http://www.vogella.com/tutorials/android.html
3. http://www.codeally.in/search/label/android

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