VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)
MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Third year of
Three Year Postgraduate Program Leading to
Master of Computer Application (MCA)

Implemented from the batch admitted in Academic Year 2014-15

Master of Computer Application MCA

Program Educational Objectives (PEOs)

1. Transcend in professional career and / or pursue higher education and research utilizing the knowledge gained in computational domain, mathematics, and management.
2. Ability to analyze real world problems, develop feasible and environmentally acceptable solutions to achieve peer recognition as an individual or in a team.
3. Work in multidisciplinary environment with ethical and sustainable computing perspectives, adaptable to the changing trends in technology and society by engaging in lifelong learning.
4. Identify opportunity to evolve as an entrepreneur and pursue the same for the benefit of individual and society.

Program Outcomes (PO)

1. Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
2. Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
3. Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
6. Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
7. Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
8. Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
10. Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
11. Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
12. Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Third year of
Three Year Postgraduate Programme Leading to
Master of Computer Application (MCA)

SEMESTER V

S. No	Course code	Course Title	L-T-P (Hours / week)			Credits	TA	IST	ESE	ESE hours
1	MC7011T	Distributed System	3	-	-	3.0	20	20	60	3
	MC7011P	Distributed System Lab	-	-	2	1.0	100% CIE			
2	MC7012T	Business Analytics and Business Intelligence	3	-	-	3.0	20	20	60	3
	MC7012P	Business Analytics and Business Intelligence Lab	-	-	2	1.0	100% CIE			
3	MC7013S	Cloud Computing	3	1	-	4.0	20	20	60	3
4	MC7014S	Software Engineering and Testing	3	1	-	4.0	20	20	60	3
5	MC7015S	Project Management	3	1	-	4.0	20	20	60	3
6	MC7016L	Emerging Technologies Lab-II	-	-	2	1.0	100% CIE			
7	MC7818D	Technical Seminar	3	-	-	3.0	20	20	60	3
		Total	18	3	6	24				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment,**IST**: In Semester Tests (comprise of average of twoIn semester tests),**ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

SEMESTER VI

S. No	Course code	Course Title	Credits	Evaluation pattern	Semester
1.		Stage –I Presentation	4	Graded evaluation by a supervisor (guide)	VI
2.		Stage –II Presentation	4	Graded evaluation by a committee of atleast two examiners including supervisor (guide)	VI
3.		Final Presentation and Viva Voce	12	Graded evaluation by a committee of supervisor (guide) and an external examiner	VI

SEMESTER V

S. No	Course code	Course Title	L-T-P (Hours / week)			Credits	TA	IST	ESE	ESE hours
			Scheme of Instruction			Scheme of Evaluation				
1	MC7011T	Distributed System	3	-	-	3.0	20	20	60	3
1a	MC7011P	Distributed System Lab	-	-	3	1.5	100% CIE			
2	MC7012T	Business Analytics and Business Intelligence	3	-	-	3.0	20	20	60	3
2a	MC7012P	Business Analytics and Business Intelligence Lab	-	-	3	1.5	100% CIE			
3	MC7013S	Cloud Computing	3	1	-	4.0	20	20	60	3
4	MC7014S	Software Engineering and Testing	3	1	-	4.0	20	20	60	3
5	MC7015S	Project Management	3	1	-	4.0	20	20	60	3
6	MC7016L	Emerging Technologies Lab-II	-	-	3	1.5	100% CIE			
7	MC7818D	Technical Seminar	-	-	3	1.5	100% CIE			
		Total	15	3	12	24				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

Programme Name	M.C.A	SEMISTER-V
Course Code	MC7011T	
Course Title	Distributed System	

PREREQUISITES

Basic information about Processes and threads, Client-Server architecture and Cryptography

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Describe the basic principles of distributed system
2. Analyze different distributed file systems and differences between RPC and RMI.
3. Analyze the synchronization and shared memory problem in distributed system.
4. Analyze code migration and inter process communication at scheduler level.
5. Evaluate various security mechanisms for web application.

COURSE CONTENTS

Characterization of Distributed Systems and System Models
Introduction, Examples and distributed systems, Resource sharing and Web, Challenges, Architectural models, Fundamental models.

Processes and Interprocess Communication
Code Migration: Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems, The API for the Internet protocols, External data representation and Marshalling, Group communication.

Distributed Objects and Remote Invocation
Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI Case Study

Distributed File Systems
File Service Architecture, Sun Network File System, Andrew File System, Recent Advances.

Synchronization
Clock Synchronization, Physical and Logical Clocks, Global State, Election Algorithms, Mutual Exclusion

Distributed Transactions

Flat And Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Transactions, Distributed Deadlocks, Transaction Recovery.

Distributed Shared Memory

Design and Implementation Issues, Sequential Consistency and Ivy, Release Consistency, Other Consistency Models.

Current Trends in Distributed Computing

Introduction to Emerging Trend – Cluster Computing, Grid Computing, Cloud Computing. Service Oriented Architecture, Defining SOA, Business value of SOA, SOA characteristics, Concept of a service, SOA Architecture, Deploying SOA applications

Web Application Security

Sql Injection, CSRF -Cross-Site Request Forgery, XSS – Cross-Site Scripting, Remote Command Execution, Path Traversal.

Recommended Reading

1. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems, Concepts and Design, Pearson Education, Fourth Edition, 2009.
2. SunitaMahajan, Seema Shah, Distributed computing, Oxford Higher education, 2013
3. Pradeep K. Sinha, Distributed Operating Systems, Prentice Hall of India Private Limited, 2007.
4. SukumarGhosh, Distributed Systems: An Algorithmic Approach, Chapman & Hall / CRC, 2007.
5. Thomas Erl, Service Oriented Architecture: Concepts, Technology and Design, Prentice Hall, 2005.

Programme Name	M.C.A.	SEMESTER – V
Course Code	MC7011P	
Course Title	Distributed Systems Lab	

PREREQUISITES

1. Programming language (Java preferably)
2. Networking and Socket Programming

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Develop distributed applications using RMI, CORBA
2. Implement mutual exclusion, code migration in distributed system
3. Develop web service using SOA.

Title of the Experiment

1. Write a program of handling concurrent server using socket programming.
2. Write a program to demonstrate process/code migration
3. Write a program to demonstrate Election algorithm.
4. Write a program to demonstrate Distributed Mutual Exclusion algorithms.
5. Develop web service using SOA
6. Design a Distributed Application using Mobile agent that travels in the network and performs a given task on the targeted node. You may assign any task to the agent for example to carry out a file reading/processing at the remote machine and so on
7. Write a Java RMI program to maintain a Client Log script on Server.
8. Write a Java RMI program for a chat using callback Client where sever will store data in database.
9. Write a Java CORBA program for the summation of two 1-dimensional matrices.

Programme Name	M.C.A	SEMISTER-V
Course Code	MC7012T	
Course Title	Business Analytics and Business Intelligence	

PREREQUISITES

1. Introduction to statistics and probability
2. Knowledge about basic data mining techniques

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Identify the appropriate statistical analysis like formulae, charts and data mining techniques for a given managerial question.
2. Analyze text data using a variety of statistical and data mining methods to find sentiments and opinions from the text.
3. Translate statistical results/ visualization charts into dashboards and substantive managerial recommendations.
4. Apply various techniques for finding communities in social network graphs.
5. Discuss the Analytics required for various business verticals and the Business Intelligence that can be drawn from it.

COURSE CONTENTS

Introduction to Business Analytics and Business Intelligence

Business Analytics for competitive advantage, Foundation of Analytics, Information Management in Analytics.

Statistical Models in Business Analytics

Review of Statistical methods, Logistic Regression, Simulation Techniques, Sampling Techniques, Forecasting Techniques, Dynamic Programming, Inventory Models, Resampling Methods.

Business Intelligence Architecture and Capabilities:

Business Intelligence Architecture: Data - Model – Presentation, Business Intelligence capabilities - Reporting, Ad-Hoc Analysis, Dashboards, Scorecards, Event Management, Spreadsheet modeling, Overview of Data Visualization.

Mining Social Networks

Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, Finding Overlapping Communities.

Applied Text Analytics

Fundamentals, Dimension Reduction (PCA, SVD). Sentiment Analysis, Opinion Mining.

Application of Analytics

Business Verticals, Marketing, Financial and Operations Management.

Recommended Reading

1. R - Gareth James • Daniela Witten • Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer Publication, 2013.
2. Cathy O'Niel and Rachel Schutt, Doing Data Science, O'Rielly Publication, 2013.
3. Allen B. Downey, Think Bayes Bayesian Statistics Made Simple,Green Tea Press Needham, Massachusetts, 2013.
4. Bing Liu, Sentiment Analysis and Opinion Mining, Morgan and Claypool Publishers, 2012.
5. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
6. R N Prasad, SeemaAcharya: Fundamentals of Business Analytics, Wiley India Ltd, 1st Edition, 2011.

Programme Name	M.C.A	SEMISTER-V
Course Code	MC7012P	
Course Title	Business Analytics and Business Intelligence Lab	

PREREQUISITES

1. Familiarity with Microsoft excels.
2. Introduction to statistics and probability
3. Knowledge about basic data mining techniques

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Execute advanced Statistical / Financial functions using spreadsheet capability.
2. Perform sentiment and opinion mining on given datasets.
3. Create clusters of communities using social network graphs and finding communities.
4. Create Dashboards using Spreadsheet for decision making.
5. Create appropriate visualization diagrams for Analysis of business situation.

Title of the Experiment

1. Use Statistical functions in Spreadsheet to give simple predictions for given data sets.
2. Explore the various financial, mathematical functions and demonstrate their use for decision making.
3. Use given datasets to demonstrate the various charting options in Spreadsheets
4. Create dashboards using Spreadsheets.
5. Using R / Weka, perform Sentiment Analysis based on reviews on a dataset.
6. Using R / Weka, using opinion mining, determine the opinion of the consumer.
7. Perform dimensionality reduction using PCA and SVD techniques and compare their performances on given data sets.
8. Perform clustering to find communities in simple social graphs.
9. Study of any one Web Analytics tool.
10. Study of any two reporting tools.

Programme Name	*M.C.A*	*SEMISTER-V*
Course Code	**MC7013S**	
Course Title	**Cloud Computing**	

PREREQUISITES

1. Basic networking concepts
2. Knowledge of programming language
3. Basic knowledge of information security

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Distinguish between different types of architectures and services in the cloud computing.
2. Analyze different techniques of cloud security.
3. Explain high performance computing achievement by using cloud infrastructure.
4. Describe management in cloud computing.
5. Describe the characteristics and different components of different cloud implementations in the real world.

COURSE CONTENTS

Foundations:
Introduction to cloud computing; Migrating into a cloud; Enriching the integration as a service paradigm for the cloud Era; The Enterprise Cloud Computing Paradigm.

Infrastructure as a service (IAAS):
Virtual machines provisioning and migration services; On the Management of Virtual Machines for Cloud Infrastructures; Enhancing Cloud Computing Environments Using a Cluster as a Service; Secure Distributed Data Storage in Cloud Computing.

Platform and Software as a Service (PAAS / SAAS):
Aneka-integration of private and public clouds; Comet Cloud: An Automatic Cloud Engine; T-Systems' cloud-based solutions for business Applications; Workflow Engine for Clouds; Understanding Scientific Applications for Cloud Environments; the Map Reduce Programming Model and Implementations.

Open Stack Architecture:

Open Cloud Architecture & Openstack: OCA Overview, Openstack Overview, Concepts : Compute, Storage and Network Virtualization, Orchestration, Metering, Monitoring.

Monitoring and Management:

An Architecture for Federated Cloud Computing; SLA Management in Cloud Computing: A Service Provider's Perspective; Performance Prediction for HPC on Clouds.

Cloud Security:

Security issues associated with the cloud, Cloud security controls, Dimensions of cloud security, Security and privacy, Data security: Data Confidentiality, Data Access Controllability, Data Integrity: Effective encryption, Attribute-Based Encryption Algorithm, Ciphertext-policy ABE (CP-ABE), Key-policy ABE (KP-ABE), Fully homomorphic encryption (FHE) , Searchable Encryption (SE)

Applications:

Best Practices in Architecting Cloud Applications in the AWS Cloud; Massively Multiplayer Online Game Hosting on Cloud Resources; Building Content Delivery Networks Using Clouds; Resource Cloud Mashups.

Governance and Case Studies:

Organizational Readiness and Change Management in the Cloud Age; Data Security in the Cloud; Legal Issues in Cloud Computing; Achieving Production Readiness for Cloud Services: Case Studies (AWS, Bluemix, SalesforceCloud).

Recommended Reading

1. R. Buyya, Cloud Computing Principles and Paradigms, Wiley, 2014.
2. K. Hwang, G. Fox and J. Dongarra, Distributed and Cloud Computing, Morgan Kauffman, 2012.
3. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book, Dreamtech Publication, 2014.
4. Ronald L., Cloud Security, Wiley 2010.
5. Dr. Kumar Saurabh, Cloud Computing: Unleashing Next Gen Infrastructure to Application, 3rd ed, Wiley, 2014.
6. Charles Severance, Using Google Apps engine, O' Reilly,1st Edition 2009.
7. Jurg van Vliet, Flavia Paganelli, Programming Amazon EC2, O' Reilly, 1st Ed. 2011.
8. Velte, Anthony T., et al. Cloud computing: a practical approach. New York: McGraw-Hill, 2010.

Programme Name	*M.C.A*	*SEMISTER-V*
Course Code	**MC7014S**	
Course Title	**Software Engineering and Testing**	

PREREQUISITES

1. Should have sharp analytical, technical skills.
2. Should have Knowledge about Object oriented design model.
3. Should have Knowledge about Structured system analysis and design

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Design a software system for a real world problem.
2. Evaluate the cost of the software system.
3. Create audit process for the software system.
4. Evaluate existing open source testing tools.
5. Design various testing strategy for the software system.

COURSE CONTENTS

Introduction
Programs vs. Software Products, Software Characteristics, Emergence of Software of Software Engineering. Software life cycle/process models, Agile process, Agile process models.

Software Project Estimation
Project Planning - problem, process. Project Size Estimation Metrics: Measure, Metrics and Indicators, Lines of Code (LOC), Function Point Metric, Feature Point Metric Software Scope, Decomposition Techniques. Software Estimation Techniques - COCOMO Model, Heuristic Techniques, Analytical Estimation Techniques - Expert Judgment, make-buy decision.

Software Configuration Management
Necessity of Software Configuration Management baselines, SCM Process and SCL Configuration, Audit Version Control Source Code Control Systems (SCCS).

Fundamentals of Testing
Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics. Review of software development models, Agile Methodology and Its Impact on testing, Test Levels.

Test Approaches and Management

Static Testing, Structured Group Examinations, Dynamic Testing, Black Box Testing, Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques, White Box Testing, Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced Testing techniques, Instrumentation and Tool Support, Intuitive and Experience Based Testing. Test Organization, Test teams, tasks and Qualifications, Cost and economy Aspects, Test Strategies and comparison, Incident Management, Configuration Management, Specialized Testing: Performance, Load, Stress & Security Testing.

Testing Tools

Automation of Test Execution, Requirement tracker, High Level Review, Types of test Tools, Tools for test management and Control, Test Specification, Static Testing, Dynamic Testing, Non functional testing, Selection and Introduction of Test Tools, Tool Selection and Introduction, Cost Effectiveness of Tool Introduction.

Recommended Reading

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill, Seventh Edition, 2010.
2. Pankaj Jalote, An Integrated Approach to Software Engineering, Springer Science & Business Media, 2013.
3. Andreas Spillner, Tilo Linz, Hans Schaefer, Software Testing Foundations, Rocky Nook, Inc., 2014.
4. M.G.Limaye, Software Testing Principles, Techniques and Tools, McGraw-Hill, 2013.

Programme Name	*M.C.A*	*SEMISTER-V*
Course Code	**MC7015S**	
Course Title	**Project Management**	

PREREQUISITES

1. Basic knowledge of software engineering
2. Basic knowledge regarding business processes

COURSE OUTCOMES

After successful completion of this course the student should be able to:

1. Analyze the project for various compliances.
2. Evaluate the execution of project plan.
3. Calculate the roles and responsibility for resource requirements of project.
4. Evaluate the change management and risk management.
5. Justify the cost control measures of the project.

COURSE CONTENTS

Project Management

Introduction: Need, Goals, Evolution, Project environments, Systems, Organizations, and System methodologies.

Systems and Procedures

Planning fundamentals: Planning steps, Project master plan, Scope and work definition, Project organization structure and responsibilities, Project management system, Scheduling, Planning and scheduling charts.

Cost estimating and budgeting

Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts

Risk Management

Basic concepts, Risk Identification, Risk Assessment and Risk Projection, Risk Containment, Risk Mitigation, Monitoring and Management.

Project Scheduling and Tracking

Relationship between People and Effort: Staffing Level Estimation, Effect of schedule change on cost. Selecting Software Engineering Tasks: Degree of rigor, Task set selector, Task Network. Schedules, work break down structures, Task Network/Activity Networks, Gantt Charts, PERT charts, Organization and Team Structures.

Project Control

Control process, Control emphasis, Information monitoring, Internal and external project control, Traditional cost control, Cost accounting systems for project control, Performance analysis, Performance index monitoring, Variance limits, Controlling changes, Contract administration, Control problems

Project Management Information System

Functions of PMIS, Computer based tools, Computer –based PMIS, Representative Computer –based PMIS, Web based Project management, Applying computer based PMS, Project evaluation, Project reporting

Software Quality

Introduction, importance, software quality, ISO 9126, Software quality measures, External standards, Techniques to enhance software quality.

Termination

Terminating the project, termination responsibilities, Closing and contracts, Project extension

Recommended Reading

1. J.M.Nicholas, Project Management for Business and Technology 2nd Edition, PHI.
2. B.Hughes and Mike Cotterell, Software Project Management 4th Edition, Tata McGraw-Hill, 2003
3. R.K.Wysocki, R.Beck Jr., D. B. Crane, John Wiley, Effective Project Management, 1995.
4. J.Phillip, IT Project Management Tata McGraw-Hill, 2003.
5. Pankaj Jalote, Software Project Management in practice, Pearson Education, 2002.

Programme Name	T.Y.M.C.A
Course Code	MC7016L
Course Title	Emerging Technologies Lab-II

**This lab comprises of 3 sections: Raspberry PI, Cloud Computing, and NoSQL. Any two sections will be run in a semester with a maximum of 10 experiments

PREREQUISITES

1. Knowledge about object oriented programming languages.
2. Knowledge about hardware components.
3. Knowledge about Linux operating system.
4. Knowledge about Web Servers.
5. Basic understanding of database (RDBMS), text editor and execution of programs.

COURSE OUTCOME

After successful completion of this course the student should be able to:

1. Explore and use various components of a Raspberry Pi.
2. Analyze various cloud computing environments and manage data in cloud.
3. Implement virtualization in cloud.
4. Design, Implement complex query connectivity to NoSQL..

TITLE OF EXPERIMENT

List of Experiments based on Raspberry Pi

1. Adding a few sensor like time, temperature etc.
2. Converting of voice to text and text back to voice.
3. Adding external devices like camera / printer / radio.
4. Setting up a personnel basic web server.
5. Building a Raspberry Pi enabled computer.
6. Create a web app to establish a smart home.
7. Creating a small board game.

List of Experiments based on Cloud computing

1. Study of OpenStack architecture and networking requirements.
2. Working with the web based tools for managing the cloud and working with VMs.
3. Working with command line based tools for interacting with and managing the cloud.
4. Working with API based interfaces in cloud.
5. Creating and configuring new pre-configured images.
6. Import and export of VM images.
7. Study of cloud security.

List of Experiments based on NoSQL

1. Installation Configuration of Mongodb server
2. Creating a database to support various types searches using various attributes.
3. Performing CRUD operation on the database
4. Performing aggregation and indexing on a given database
5. Replication and sharding of the databases

SEMESTER VI

Course Code	Course Name	Hr / Week			Credits
	Scheme of Instruction				Scheme of Evaluation
		L	T	P	
MC7801D	Technical Seminar	-	-	-	4.0
MC7802D	Project stage 1:	-	-	-	4.0
MC7803D	Project stage 2:	-	-	-	12.0
	Total:	**-**	**-**	**-**	**20.0**