# MASTER OF COMPUTER APPLICATIONS (M.C.A)
## COURSE STRUCTURE AND SCHEME OF VALUATION W.E.F. 2016-17

### V SEMESTER

| Code | Name of the subject | Periods/week | | Max. Marks | | Total | Credits |
|------|--------------------|--------|-----|------|------|-------|---------|
| | | Theory | Lab | Ext. | Int. | | |
| MCA 5.1 | Wireless Ad-hoc Networks | 4 | -- | 70 | 30 | 100 | 4 |
| MCA 5.2 | Big Data Analytics | 4 | -- | 70 | 30 | 100 | 4 |
| MCA 5.3 | Elective IV | 4 | -- | 70 | 30 | 100 | 4 |
| MCA 5.4 | Cyber Scurity and Digital Forensics | 4 | -- | 70 | 30 | 100 | 4 |
| MCA 5.5 | MOOCS-II | -- | -- | -- | -- | 100 | 4 |
| MCA 5.6 | Data Analytics Lab | -- | 3 | 50 | 50 | 100 | 2 |
| MCA 5.7 | Mini Project Using DBMS & OOSE Concepts | -- | 3 | 50 | 50 | 100 | 2 |
| | Total | 16 | 6 | 450 | 220 | 700 | 24 |

**Elective IV: Cloud Computing / Soft Computing/ Bio-Informatics/ E-Commerce**
**MOOCS-II :**

Each student should learn any one of the following topics by registering for courses through Online instruction from standard e-learning portals like nptel, coursera, etc. and write the examination conducted as per the university norms.

**List of topics for MOOCS-II:**

Python programming, Machine Learning, Agile Methods for Software Development, problem solving using Matlab, Programming in Rasberry Pi Platform, Mongo DB for Developers

| **MCA 5.1** | **WIRELESS AND AD-HOC NETWORKS** | |
|---|---|---|
| **Instruction: 3 Periods & 1 Tut/week** | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | **Total: 100 Marks** |

1. Introduction: Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks- Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-WiMax- Radio Propagation mechanism , Pathloss Modeling and Signal Coverage

2. WIRELESS LOCAL AREA NETWORKS: Introduction-WLAN topologies-IEEE 802.11 Standards , MAC Protocols,Comparision of 802.11 a,b,g and n Standards, HIPER LAN , ZigBee 802.15.4**,** Wireless Local Loop

3. Wireless Adhoc Networks: Basics of Wireless Networks, Infrastructured Versus Infrastructureless Networks – Properties of Wireless, AD hoc Networks, Types of Ad Hoc Networks, Challenges in AD Hoc Networks –Applications of Wireless AD Hoc Networks

4. Routing Protcols for Ad Hoc Networks:Introduction-Proactive Routing Protocols- Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues in Routing.

5. Mobile Ad Hoc Networks (MANETs): Overview, Properties of A MANET, Spectrum of MANET Applications, Routing and Various Routing Algorithms.

6. Other Wireless Technologies**:** Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physical layer.

7. Security in Ad Hoc Networks: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy( WEP) -A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.


**Text Books:**

1. Principles of Wireless Networks , Kaveth Pahlavan, K. Prasanth Krishnamurthy, Pearson Publications, Asia, 2002
2. Mobile Cellular Communications, G.Sasibhusan Rao, "", Pearson Publications.

**References**:

1. Guide to Wireless Ad Hoc Networks: Series: Computer Communications and Networks, Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, 2009, Springer

| **MCA 5.2** | **BIGDATA ANALYTICS** | |
|---|---|---|
| **Instruction: 3 Periods & 1 Tut/week** | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | **Total: 100 Marks** |

**Course Objectives:**

On completing this course student will be able to

1. Understand big data and Apache Hadoop Eco system
2. Understand distributed , parallel, cloud computing and SQL concepts
3. Apply Hadoop concepts
4. Understand concepts of map and reduce and functional programming

**Course Outcomes :**

1. Gain conceptual understanding of analytics concepts, algorithms and statistical tests

2. Students will be able to look at the core projects used for both batch and real time data processing such as Hadoop
3. Students will be able to look at wider range of problems and data science based solutions

**Syllabus:**

1. **Introduction to Big Data:** Big Data-definition, Characteristics of Big Data (Volume, Variety, Velocity, Veracity, Validity), Importance of Big Data , Patterns for Big Data Development, Data in the Warehouse and Data in Hadoop,

2. **Introduction to Hadoop:** Hadoop- definition, Understanding distributed systems and Hadoop, Comparing SQL databases and Hadoop, Understanding MapReduce, Counting words with Hadoop—running your first program, History of Hadoop, Starting Hadoop - The building blocks of Hadoop, NameNode, DataNode, Secondary NameNode, JobTracker and Task Tracker

3. **MapReduce** -A Weather Dataset, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Pipes, Developing a MapReduce Application - The Configuration API, Configuring the Development Environment, Running Locally on Test Data, Running on a Cluster, Tuning a Job, MapReduce Workflows

4. **HDFS:** Components of Hadoop -Working with files in HDFS, Anatomy of a MapReduce program, Reading and writing the Hadoop Distributed File system -The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystem, The Java Interface, Data Flow, Parallel Copying with distcp, Hadoop Archives

5. **MapReduce Programming:** Writing basic Map Reduce programs - Getting the patent data set, constructing the basic template of a Map Reduce program, Counting things, Adapting for Hadoop's API changes, Streaming in Hadoop, Improving performance with combiners.

6. **MapReduce Advanced Programming:** Advanced MapReduce - Chaining MapReduce jobs, joining data from different sources, creating a Bloom filter, Passing job-specific parameters to

your tasks, probing for task-specific information, Partitioning into multiple output files, Inputting from and outputting to a database, keeping all output in sorted order

7. **Graph Representation in MapReduce:** Modeling data and solving problems with graphs, Shortest Path Algorithm, Friends-of-Friends Algorithm, PageRank Algorithm, Bloom Filter, Parallelized Bloom filter creation in MapReduce, Map-Reduce semi-join with Bloom filters

**Textbooks**:

1. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch ,"Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.

2. Hadoop: The Definitive Guide by Tom White, 3$^{rd}$ Edition, O'reilly

**Reference Books:**

1. Hadoop in Action by Chuck Lam, MANNING Publ.

2. Hadoop in Practice by Alex Holmes, MANNING Publishers

3. Mining of massive datasets, Anand Rajaraman, Jeffrey D Ullman, Wiley Publications.

| MCA 5.3 | Elective-IV | **CLOUD COMPUTING** |
|---|---|---|

| Instruction: 3 Periods & 1 Tut/week | | Credits:4 |
|---|---|---|
| Internal: 30 Marks | University Exam: 70 Marks | Total: 100 Marks |

1. Cloud Computing Basics - Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.

2. Organization and Cloud Computing - When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues, Cloud Computing with the Titans - Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBMPartnerships.

3. Hardware and Infrastructure - Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIs,Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.

4. Software as a Service - Overview, Driving Forces, Company Offerings, Industries Software plus Services - Overview, Mobile Device Integration, Providers, Microsoft Online.

5. Developing Applications - Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

6. Local Clouds and Thin Clients - Virtualization in Your Organization, Server Solutions, Thin Clients, Case Study: McNeilus Steel.

7. Migrating to the Cloud - Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

**Text Books:**

1. Cloud Computing-A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGrawHill.

| MCA 5.3 | Elective-IV | **SOFT COMPUTING** | |
|---------|-------------|---------------------|--|
| **Instruction: 3 Periods & 1 Tut/week** | | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | | **Total: 100 Marks** |

1.  Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

2.  Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

3.  Interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

4.  Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory , Hebb's Learning, Adaline, Perceptron

5.  Multilayer Feed Forward Network, Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing,  Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

6.  Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

7.  Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications.

8.  Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

**Text Books:**

1.  Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications,
    S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.
2.  Rough Sets, Z.Pawlak, Kluwer Academic Publisher, 1991.
3.  Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997

**References:**
1.  Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2.  Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley
3.  Learning and Soft Computing, V. Kecman, MIT Press, 2001
4.  Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

| MCA 5.3 | Elective-IV | **BIOINFORMATICS** | |
|---|---|---|---|
| **Instruction: 3 Periods & 1 Tut/week** | | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | | **Total: 100 Marks** |

1. Introduction: Definitions, Sequencing, Biological Sequence/Structure, Genome Projects, Pattern Recognition a Prediction, Folding Problem, Sequence Analysis, Homology and Analogy.

2. Protein Information Resources: Biological Databases, Primary Sequence Databases, Protein Sequence Databases, Secondary Databases, Protein Pattern Databases, and Structure Classification Databases.

3. Genome Information Resources: DNA Sequence Databases, Specialized Genomic Resources

4. DNA Sequence Analysis: Importance Of DNA Analysis, Gene Structure And DNA Sequences, Features Of DNA Sequence Analysis, EST (Expressed Sequence Tag) Searches, Gene Hunting, Profile of A Cell, EST Analysis, Effects Of EST Data on DNA Databases.

5. Pair Wise Alignment Techniques :Database Searching, Alphabets and Complexity, Algorithm and Programs, Comparing Two Sequences, Sub-Sequences, Identity and Similarity, The Dotplot, Local and Global Similarity, Different Alignment Techniques, Dynamic Programming, Pair Wise Database Searching.

6. Multiple Sequence Alignment : Definition And Goal, The Consensus, Computational Complexity, Manual Methods, Simultaneous Methods, Progressive Methods, Databases of Multiple Alignments And Searching

7. Secondary Database Searching : Importance And Need of Secondary Database Searches, Secondary Database Structure and Building a Sequence Search Protocol .

8. Analysis Packages : Analysis Package Structure, Commercial Databases, Commercial Software, Comprehensive Packages, Packages Specializing in DNA Analysis, Intranet Packages, Internet Packages.

**Text Books:**
1. Introduction To Bioinformatics, By T K Attwood & D J Parry-Smith
   Addison Wesley Longman

2. Bioinformatics- A Beginner's Guide By Jean-Michel Claveriw, Cerdric Notredame, WILEY Dreamlech India Pvt. Ltd

**Reference Books:**

1. Introduction To Bioinformatics By M. Lesk OXFORD Publishers (Indian Edition)

| MCA 5.3 | Elective-IV | **E-COMMERCE** | |
|---|---|---|---|
| **Instruction: 3 Periods & 1 Tut/week** | | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | | **Total: 100 Marks** |

1. Introduction: Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile Process Models.

2. Electronic Payment Systems – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems

3. Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value Added Networks.

4. Intra Organizational Commerce, Macro Forces And Internal Commerce, Work Flow Automation and Coordination, Customization And Internal Commerce, Supply Chain Management.

5. Business Cases for Document Library, Digital Document Types, Corporate Data Ware-Houses.

6. Advertising And Marketing: Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, Information Filtering.

7. Multimedia-Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

**Text Books:**

   1. Frontiers of Electronic Commerce, Kalakata and Whinston, Pearson.

**References**

   1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
   2. E-Commerce, S.Jaiswal, Galgotia.
   3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
   4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol Guyerico Traver.

| MCA 5.4 | CYBER SECURITY AND DIGITAL FORENSICS | |
|---------|---|---|
| **Instruction: 3 Periods & 1 Tut/week** | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | **Total: 100 Marks** |

### Introduction to Information Security Fundamentals and Best Practices

- Protecting Your Computer and its Contents
- Securing Computer Networks--Basics of Networking
- Compromised Computers
- Secure Communications and Information Security Best Practices
- Privacy Guidelines
- Safe Internet Usage

### Ethics in Cyber Security & Cyber Law

- Privacy
- Intellectual Property
- Professional Ethics
- Freedom of Speech
- Fair User and Ethical Hacking
- Trademarks
- Internet Fraud
- Electronic Evidence
- Cybercrimes

### Penetration Testing

- Overview of the web from a penetration testers perspective
- Exploring the various servers and clients
- Discussion of the various web architectures
- Discussion of the different types of vulnerabilities
- Defining a web application test scope and process
- Defining types of penetration testing

### Web Application Security

- Common Issues in Web Apps
  What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues

### Forensics & Network Assurance

- Forensic Technologies
- Digital Evidence Collection
- Evidentiary Reporting
- Layered Defense
- Surveillance and Reconnaissance
- Outsider Thread Protection

### Information Risk Management

- Asset Evaluation and Business Impact Analysis
- Risk Identification
- Risk Quantification
- Risk Response Development and Control
- Security Policy, Compliance, and Business Continuity
- Forensic investigation using AccessData FTK, En-Case

## Cyber Incident Analysis and Response

- Incident Preparation
- Incident Detection and Analysis
- Containment, Eradication, and Recovery
- Proactive and Post-Incident Cyber Services
- CIA triangle

Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart
3. www.**nist**.gov/

| MCA 5.6 | DATA ANALYTICS LAB | |
|---------|---------------------|---|
| **Instruction: 3 Periods & 1 Tut/week** | | **Credits:4** |
| **Internal: 30 Marks** | **University Exam: 70 Marks** | **Total: 100 Marks** |

**Module-I on Data Mining**

1. Introduction to the WEKA machine learning toolkit or R programming

    Create an ARFF (Attribute-Relation File Format) file and read it in WEKA. Explore the purpose of each button under the preprocess panel after loading the ARFF file. Also, try to interpret using a different ARFF file, *weather.arff*, provided with WEKA**.**

2. Performing data preprocessing in Weka – Part1

    Study **Unsupervised Attribute Filters** such as *ReplaceMissingValues* to replace missing values in the given dataset, *Add* to add the new attribute *Average, Discretize* to discretize the attributes into bins. Explore *Normalize* and *Standardize* options on a dataset with numerical attributes.

3. Perform data preprocessing in WEKA – Part 2

    Study the **Unsupervised Instance Filters such as *Remove Range*** filter to remove the last two instances,

4. Classification using the WEKA toolkit – Part 1

    Explore classification process using ID3 algorithm on categorical dataset(weather).

    Explore classification process using naïve Bayes algorithm on categorical dataset ('vote').

    Explore classification process using Random Forest algorithm on datasets containing large number of attributes.

5. Classification using the WEKA toolkit – Part 2

    Explore classification process using J48 algorithm on mixed type of dataset after discretizing numeric attributes. Generate classification rules from a small dataset. Perform cross-validation strategy with various fold levels. Compare the accuracy of the results.

6. Performing clustering in WEKA

    a. Apply hierarchical clustering algorithm on numeric dataset and estimate cluster quality.
    b. Apply DBSCAN algorithm on numeric dataset and estimate cluster quality.
    c. Apply COBWEB clustering algorithm on categorical dataset and estimate cluster quality.

7. Association rule analysis in WEKA with different support and confidence thresholds

    Apply Association Rule Mining on supermarket dataset using Apriori Algorithm.

    Apply Association Rule Mining on supermarket dataset using FP-Growth Algorithm.

**Module-II on Bigdata Analytics**

1. (i)Perform setting up and Installing Hadoop in its three operating modes:

- Standalone,
- Pseudo distributed,
- Fully distributed.

(ii)Use web based tools to monitor your Hadoop setup.

Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files

- Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

4. Write a Map Reduce program that mines weather data.

Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

5. Implement Matrix Multiplication with Hadoop Map Reduce

6. Write a Map Reduce program to implement Join operations on RDBMS.

7. Write a Map Reduce program to determine statistical measures

a) Variance
b) Max
c) Min
d) Range of a large data collection.

| MCA 5.6 | **MINI PROJECT USING DBMS & OOSE CONCEPTS** | |
|---|---|---|
| **Instruction: 3 Periods/week** | | **Credits:2** |
| **Internal: 50 Marks** | **University Exam: 50 Marks** | **Total: 100 Marks** |

**Scope of the Mini Project:**

1. Object Oriented Concepts: Requirement Engineering,  Design Such as architecture, User Interface Design, Testing, Preparations User Manuals Etc and also

2. Design of DBMS Schema Including Normalization, Forms design, Report Generation,  Linking to Web Data Bases  Etc. Preferably on  Live Projects

3. Periodical Presentations and Discussions Among the Groups and their Outputs.

# MASTER OF COMPUTER APPLICATIONS (M.C.A)
## COURSE STRUCTURE AND SCHEME OF VALUATION W.E.F. 2016-17

### V SEMESTER

| Code | Name of the subject | Periods/week | | Max. Marks | | Total | Credits |
|------|---------------------|--------|-----|------|------|-------|---------|
| | | Theory | Lab | Ext. | Int. | | |
| MCA 6.1 | Project Work | -- | -- | 50 | 50 | 100 | 14 |
| | 1. Three Stages In Project adjudication:<br>    Stage I: Presentation of Concept Note & Problem Approval by Guide<br>    Stage II; Progress Approval by System Demonstration with results Internal -50 Marks<br>    Stage III: Final Presentation with Documentation & External Viva-Voce - 50 Marks<br>2. Candidates can do their thesis work within the department or in any industry/research organization for two semesters (4$^{th}$ semesters). In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor(CO-Guide) should be from the industry/research organization.<br>3. A publication of a paper on the thesis work in a National/International Conference proceedings with presentation certificate or a paper on the thesis work be communicated to a National/International Journal & accepted for publication for the submission of thesis at the end of 4$^{th}$ semester is desirable.<br>4. The external examiner shall be nominated by the Chairman, Board of Examiners in CSSE as per the norms of the University. | | | | | | | |

| Code | Name of the subject | | | Max. Marks | | Total | Credits |
|------|---------------------|--------|-----|------|------|-------|---------|
| | | Theory | Lab | Ext. | Int. | | |
| | | | | | | | |
| Total | (Complete Course) | 96 | 30 | 2230 | 1270 | 3600 | 132 |