

**Semester III (Second Year) Curriculum**

<b>Code</b>	<b>Course Title</b>	<b>Max Marks</b>		<b>Total Marks</b>	<b>Hours Per Week</b>		<b>Cred its</b>
		External	Internal		Theory	Practical	
<b>MCA-20301</b>	Information Security and Cryptography	75	25	100	4	-	4
<b>MCA-20302</b>	Big Data Analytics	75	25	100	4	-	4
<b>MCA-20303</b>	Object Oriented Software Engineering	75	25	100	4	-	4
<b>MCA-20304</b>	Web Technologies	75	25	100	4	-	4
<b>MCA-20305</b>	Elective II 1. Blockchain Technology 2. Cloud Computing 3. Machine Learning and Deep Learning	75	25	100	4	-	4
<b>MCA-20306</b>	Elective-III 1.Business Intelligence and Visualization 2. Robotics 3.Foundations of Data Science	75	25	100	4	-	4
<b>MCA-20307</b>	Web Technologies and Object Oriented Software Engineering Lab	50	50	100	-	3	2
<b>MCA-20308</b>	Big Data Analytics lab	50	50	100	-	3	2
<b>MCA-20309</b>	Innovation, Entrepreneurship and Intellectual Property Rights	-	50	50	2	-	0
<b>MCA-20310</b>	Summer Internship	50	50	100	-	-	2
	Total Credits						30

Note: Summer Internship 2 Months (Mandatory) after First Year (to be evaluated during IIIsemester).

**Course Code & Title: MCA-20301 INFORMATION SECURITY AND CRYPTOGRAPHY**

**Semester: III**

**Course Index: C301**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about the security approaches and techniques, Introduction to number theory

To learn about Symmetric key and Asymmetric key cryptographic algorithms

To learn about User Authentication Mechanisms ,System security

To learn about Internet Security Protocols and Network Security

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C301.1	Able to understand the security approaches and techniques, Introduction to number theory
C301.2	Able to Symmetric key and Asymmetric key cryptographic algorithms
C301.3	Able to understand the User Authentication Mechanisms ,System security
C301.4	Able to understand the Internet Security Protocols and Network Security

## **MCA-20301 INFORMATION SECURITY AND CRYPTOGRAPHY**

**Instruction: 4 Periods/week**

**Time: 3 Hours**

**Credits:4**

**Internal: 25 Marks**

**External: 75 Marks**

**Total: 100 Marks**

### **UNIT I**

**Introduction:** The need for security-security approaches-principles of security-Plain Text and Cipher Text-substitution and Transposition Techniques-Encryption and Decryption-Symmetric and Asymmetric Cryptography-Stenography-key range and key size-types of attacks.

**Number Theory:** Introduction to number theory- Modular Arithmetic, Euclidean algorithm, Euler theorem, Fermat Theorem, Totient Function, Multiplicative and Additive Inverse.

### **UNIT II**

**Symmetric Key Cryptographic Algorithms:** Algorithm types and modes-overview of symmetric key cryptography – DES – IDEA – Blowfish – AES-Differential and Linear Cryptanalysis.

**Asymmetric Key Cryptographic Algorithms:** Overview of asymmetric key cryptography-RSA algorithm-symmetric and asymmetric key cryptography together-digital signatures.

### **UNIT III**

**User Authentication Mechanisms:** Introduction-Authentication basics – passwords-authentication tokens-certificate based authentication-biometrics Authentication-Hash functions-SHA1.

**System Security:** Intruders, Viruses, Related Threats, Trusted Systems.

### **UNIT IV**

**Internet Security Protocols:** Basic concepts-SSL-SHTTP-TSP-SET-SSL versus SET- 3D secure Protocol-Electronic Money-Email security-WAP security-security in GSM.

**Network Security:** Brief Introduction to TCP/IP -Firewalls -IP Security-Virtual Private Networks.

#### **Text Books:**

1. Cryptography and Network security, AtulKahate, Tata McGraw-Hill Pub company Ltd., NewDelhi
2. Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi

#### **Reference Books:**

1. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., NewDelhi
2. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes - Ousley, Keith Strass berg TataMcGraw-Hill.

**Course Code & Title: MCA-20302 BIG DATA ANALYTICS****Semester: III****Course Index: C302****Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about introduction to Big Data and Hadoop

To learn about Real Time Analytics, Map Reduce Programming

To learn about Streaming in Spark, Machine Learning, Map Reduce Advanced Programming

To learn about Graph Representation in Map Reduce, Graph Analytics in Spark, Programming with RDDs-Basics, Spark SQL overview

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C302.1	Understand about introduction to Big Data and Hadoop
C302.2	Understand about Real Time Analytics, Map Reduce Programming
C302.3	Understand about Streaming in Spark, Machine Learning, Map Reduce Advanced Programming
C302.4	Understand about Graph Representation in Map Reduce, Graph Analytics in Spark, Programming with RDDs-Basics, Spark SQL overview

## **MCA-20302 BIG DATA ANALYTICS**

**Instruction: 4 Periods/week**

**Time: 3 Hours**

**Credits: 4**

**Internal: 25 Marks**

**External: 75 Marks**

**Total: 100 Marks**

---

### **UNIT I**

**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.

**Introduction to Hadoop:** Hadoop- definition, understanding distributed systems and Hadoop, Comparing SQL databases and Hadoop, Starting Hadoop - The building blocks of Hadoop, NameNode, DataNode, Secondary NameNode, JobTracker and Task Tracker.

### **UNIT II**

**Real Time Analytics-** Examples, What is Apache Spark, Why Spark when Hadoop is there, Spark Features, Getting started with Spark, Spark Eco System, Architecture and its working, Data Structures of Spark, Spark components, Using Spark with Hadoop, Usecase.

**MapReduce Programming:** Writing basic Map Reduce programs - Getting the patent data set, constructing the basic template of a Map Reduce program, Counting things, Programming with RDDs-Basics.

### **UNIT III**

Streaming in Spark, Streaming features, Streaming Fundamentals. Usecase on streaming. Machine Learning, Spark MLlib Overview, Tools, Algorithms-Classification, Regression, Clustering, Dimensionality Reduction, Feature Extraction.

**MapReduce Advanced Programming-** Chaining Map Reduce jobs, joining data from different sources. Usecase.

### **UNIT IV**

**Graph Representation in MapReduce:** Modeling data and solving problems with graphs, Shortest Path Algorithm, Friends-of-Friends Algorithm, PageRank Algorithm, Bloom Filters. Graph Analytics in Spark, Spark GraphX, GraphX features, GraphX Examples, Usecase.

Creating RDDs, Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence, Adding Schemas to RDDs, RDDs as Relations, Creating Pairs in RDDs, Transformations and actions on RDDs.

Spark SQL, Overview, Libraries, Features, Querying using Spark SQL.

#### **TEXT BOOKS:**

1. Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data by Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, 1st Edition, TMH,2012.
2. Learning Spark: Learning Big Data Analysis: Karauec., O'reilly Publications. Hadoop in Action by Chuck Lam, MANNING Publishers.
3. Hadoop in Practice by Alex Holmes, MANNING Publishers

#### **REFERENCE BOOKS:**

1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
2. Big Java Fourth Edition Cay Horstmann Wiley, John Wiley & Sons
3. Mining of massive datasets, Anand Rajaraman, Jeffrey D Ullman, Wiley Publications.

**Course Code & Title: MCA-20303 OBJECT ORIENTED SOFTWARE ENGINEERING**

**Semester: III**

**Course Index: C303**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about Introduction to Object Oriented Software Engineering, Object Orientation, Requirements Engineering

To learn about the Unified Modeling Language & Use Case Modeling, Class Design and Class Diagrams

To learn about the Software Design , Architecture and Design Patterns

To learn about the Software Testing, Software Project Management, Software Process Models

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C303.1	Able to understand about the Introduction to Object Oriented Software Engineering, Object Orientation, Requirements Engineering
C303.2	Able to understand about the Unified Modeling Language & Use Case Modeling, Class Design and Class Diagrams
C303.3	Able to understand about the Software Design and Architecture, Design Patterns
C303.4	Able to understand about the Software Testing, Software Project Management, Software Process Models

## **MCA-20303 OBJECT ORIENTED SOFTWARE ENGINEERING**

**Instruction:4Periods/week**

**Time: 3Hours**

**Credits:4**

**Internal:25Marks**

**External:75Marks**

**Total: 100Marks**

---

### **UNIT I**

**Introduction to Object Oriented Software Engineering:** Nature of the Software, Types of Software, Software Engineering Activities, and Software Quality.

**Introduction to Object Orientation:** Data Abstraction, Inheritance & Polymorphism, Reusability in Software Engineering, Examples: Postal Codes, Geometric Points.

**Requirements Engineering:** Domain Analysis, Problem Definition and Scope, Types of Requirements, Techniques for Gathering and Analyzing Requirements, Requirement Documents, Reviewing Requirements, Case Studies: GPS based Automobile Navigation System, Simple Chat Instant Messaging System.

### **UNIT II**

**Unified Modeling Language & Use Case Modeling:** Introduction to UML, Modeling Concepts, Types of UML Diagrams with Examples; User-Centered Design, Characteristics of Users, Developing Use Case Models of Systems, Use Case Diagram, Use Case Descriptions, The Basics of User Interface Design, Usability Principles.

**Class Design and Class Diagrams:** Essentials of UML Class Diagrams, Associations and Multiplicity, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Process of Developing Class Diagrams, Interaction and Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

### **UNIT III**

**Software Design and Architecture:** Design Process, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document, Software Architecture, Architectural Patterns: The Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter And MVC Architectural Patterns.

**Design Patterns:** Abstraction-Occurrence, General Hierarchical, Play-Role, Singleton, Observer, Delegation, Adaptor, Façade, Immutable, Read-Only Interface and Proxy Patterns.

### **UNIT IV**

**Software Testing:** Effective and Efficient Testing, Defects in Ordinary Algorithms, Numerical Algorithms, Timing and Co-ordination, Stress and Unusual Situations, Testing Strategies for Large Systems.

**Software Project Management:** Introduction to Software Project Management, Activities of Software Project Management, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring.

**Software Process Models:** Waterfall Model, The Phased Released Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model, Rational Unified Process.

#### **Text Book:**

1. Object Oriented Software Engineering: Practical Software Development using UML and Java. Timothy C Lethbridge & Robert Langaneire, Mc Graw Hill

#### **Reference Books:**

1. The Unified Modeling Language User Guide. Grady Booch, James Rumbaugh and Ivar Jacobson. Addison-Wesley.
2. Software Engineering; A Practitioner's Approach. Roger SPressman.
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education.

**Course Code & Title: MCA-20304 WEB TECHNOLOGIES**

**Semester: III**

**Course Index: C304**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

Learn the concept of Networking Protocols and OSI Model, Internetworking Concepts, Devices, Basics, History and Architecture.

Learn about TCP/IP and Electronic commerce in detail.

Learn about the concept of Web Technology and types of Web Pages.

Learn the concept of Middleware and Component-based E-commerce Architectures, EDI, XML and WAP.

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C304.1	Understand the concept of Networking Protocols and OSI Model, Internetworking Concepts, Devices, Basics, History and Architecture.
C304.2	Understand about TCP/IP and Electronic commerce in detail.
C304.3	Understand about the concept of Web Technology and types of Web Pages.
C304.4	Understand the concept of Middleware and Component-based E-commerce Architectures, EDI, XML and WAP.

## **MCA-20304 WEB TECHNOLOGIES**

**Instruction: 4 Periods/week**

**Time: 3 Hours**

**Credits: 4**

**Internal: 25 Marks**

**External: 75 Marks**

**Total: 100 Marks**

### **UNIT I**

**Networking Protocols and OSI Model:** Protocols in Computer Communications, the OSI Model, OSI Layer Functions.

**Internetworking Concepts, Devices, Basics, History and Architecture:** Internetworking, Problems in Internetworking, Dealing with Incompatibility Issues, A Virtual Network, Internetworking Devices, Repeaters, Bridges, Routers, Gateways, A Brief History of the Internet, Growth of the Internet, Internet topology, Internal Architecture of an ISP

**TCP/IP Part I** (Introduction to TCP/IP, IP, ARP, RARP, ICMP):TCP/IP Basics, Why IP Addresses? Logical Addresses,TCP/IP Example, the Concept of IP Address, Address Resolution Protocol (ARP), Reverse ARP, Internet Control Message Protocol (ICMP), Datagram, Fragmentation and Reassembly.

### **UNIT II**

**TCP/IP Part II** (TCP, UDP):Basics of TCP, Features of TCP, Relationship between TCP and IP, Ports and Sockets, Connections-Passive Open and Active Open, TCP connections, What Makes TCP Reliable? TCP Packet Format, Persistent TCP Connections, User Datagram Protocol, UDP Packet, Difference between UDP and TCP

**TCP/IP Part III** (DNS, Email, FTP, TFTP): Domain Name System (DNS), Electronic Mail (Email), File Transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP)

**TCP/IP Part IV** (WWW, HTTP, TELNET): A Brief History of WWW, Basics of WWW and Browsing, Locating Information on the Internet, HTML, Web Browser Architecture, Web Pages and Multimedia, Remote Login (TELNET).

**An Introduction to Electronic Commerce:** Aspects of Electronic Commerce, Types of E Commerce, Approaches for Developing E Commerce Solutions, Electronic Procurement, Phases in a Procurement Process, E-Procurement Models, E-Procurement Solutions, Trading Models, Buyer Side Purchasing, Supply Chain Management (SCM) and Customer Relationship Management (CRM)

### **UNIT III**

**Introduction to Web Technology:** Features Required for Enabling e-commerce, Web pages-Types and Issues, Tiers, The Concept of a Tier, A Concept of Microsoft and Java Technologies, Web Pages, Static Web Pages, Plug-ins, Introduction to Frames and Forms.

**Dynamic Web Pages:** Need for Dynamic Web Pages, Magic of Dynamic Web Pages, Overview of Dynamic Web Page Technologies, Overview of Dynamic HTML (DHTML), Common Gateway Interface (CGI), Microsoft's Active Server Pages (ASP), Basics of ASP Technology, ASP Example, Modern Trends in ASP, Java and the Concept a Virtual Machine, Java Servlets and Java Sever Pages(JSP), Java Servlets, Java Sever pages (JSP).

**Active Web Pages:** Active Web pages is a Better Solution, Java Applets, Why are Active Web Pages Powerful? When not to use Active Web Pages, Lifecycle of Java Applets, Java Beans, Active X Controls.

### **UNIT IV**

**Middleware and Component-based E-commerce Architectures:** CORBA, Java Remote Method Invocation (RMI), Microsoft's Distributed Component Object Model

**Electronic Data Interchange (EDI):** An Overview of EDI, the Origins of EDI, Understanding EDI, Data Exchange Standards, EDI Architecture, The Significance of EDI in International Trade, Financial EDI, EDI and the Internet.

**Extensible Markup Language (XML):** Standard Generalized Markup Language (SGML), Basics of XML, XML parsers, The Need for a Standard.

**Wireless Application Protocol (WAP):** Limitations of Mobile Devices, The emergence of WAP, WAP Architecture, The WAP Stack, Concerns about WAP and its Future, Alternatives to WAP.

**Text Book:**

Web Technologies: TCP/IP to Internet Application Architectures-TATA McGraw Hill Publications - Achyut S Godbole, AtulKahate.

**Course Code & Title: MCA-20305 BLOCK CHAIN TECHNOLOGY(ELECTIVE II)**

**Semester: III**

**Course Index: C305**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about introduction to Block Chain, Basic Distributed System Concepts

To learn about Cryptography in Blockchain, Cryptography algorithms

To learn about Bitcoin-Cryptography, Hyperledger Fabric

To learn about Use cases of Blockchain, Financial Service, healthcare, energy markets, media, Cyber Crime, e-Governance, Tax payments, land registry records and blockchain in IoT

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C305.1	Understand about introduction to Block Chain, Basic Distributed System Concepts
C305.2	Understand about Cryptography in Blockchain, Cryptography algorithms
C305.3	Understand about Bitcoin-Cryptography, Hyperledger Fabric
C305.4	Understand about Use cases of Blockchain, Financial Service, healthcare, energy markets, media, Cyber Crime, e-Governance, Tax payments, land registry records and blockchain in IoT

**MCA-20305 BLOCKCHAIN TECHNOLOGY (ELECTIVE-II)****Instruction: 4 Periods/week****Time: 3 Hours****Credits: 4****Internal: 25 Marks****External: 75 Marks****Total: 100 Marks****UNIT – I**

**CRYPTOGRAPHY IN BLOCKCHAIN:** Blockchain Definitions – Blockchain versus Databases – History – Motivation – Characteristics – Types – Overview - Hashing in Blockchain – Linking blocks in blockchain – Linking blocks using SHA256 – Block structure – Blockchain functionality – Creating Blockchain – Byzantine failure problem in blockchain – Digital signatures in blockchain – Blockchain wallets

**UNIT – II**

**BLOCKCHAIN DESIGN PRINCIPLES:** Networked Integrity – Distributed Power- Value as Incentive – Security – Privacy – Rights Preserved – Inclusion – Centralized Registries versus Distributed Ledgers – Public versus Private Ledgers – Transparency as a Strategic Risk – Transparency as a Strategic Asset - Zero Knowledge Proofs

**UNIT – III**

**CONSENSUS ALGORITHMS:** Proof of Work – Pure Stake Based Consensus – Proof of Stake - Leased Proof of Stake – Delegated Proof of Stake – Hybrid Form of PoS and PoW – Practical Byzantine Fault Tolerance – Ripple –Tendermint – Proof of Elapsed Time – Proof of Activity – Proof of Burn – Hyperledger Fabric.

**UNIT – IV**

**BLOCKCHAIN OPTIMIZATIONS AND ENHANCEMENTS:** Blockchain Optimizations – Transaction Exchange – Off-chain Transactions – Block size improvements – Blockchain enhancements – Sharding – Evolution of consensus algorithm – Proof of Stake – Proof of Activity – Byzantine Fault Tolerance Consensus Models – Proof of Elapsed Time – Cross-chain Protocol – Privacy Enhancement – Blockchain Security – Transaction Security Model – Decentralized Security Model – Attacks on Blockchain

**Text Books:**

1. Koshik Raj, “Foundations of Blockchain”, Packt Publishers, 2019.
2. S. Shukla, M. Dhawan, S. Sharma and S. Venkatesan, “Blockchain Technology: Cryptocurrency and Applications”, Oxford University Press, 2019.

**Reference Books:**

1. Josh Thompson, “Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming”, Create Space Independent Publishing Platform, 2017.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, Orelly Media, 1st Edition, 2014.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. “Bitcoin and cryptocurrency technologies: a comprehensive introduction”, Princeton University Press, 2016.

**Course Code & Title: MCA- 20305 CLOUD COMPUTING (ELECTIVE-II)**

**Semester: III**

**Course Index: C305**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about the Cloud Computing basics, Intranet and Cloud, Services and Business Applications, Salesforce.com, Organization and Cloud Computing

To learn about the Hardware and Infrastructure , Overview of Software as a Service, Overview of Industries Software plus Services, Mobile device Integration

To learn about Developing the Applications like Google, Microsoft, Intuit QuickBase, Local Clients and thin clients

To learn about Migrating the Cloud, Cloud Services

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C305.1	Able to understand about the Cloud Computing basics, Intranet and Cloud, Services and Business Applications, Salesforce.com, Organization and Cloud Computing
C305.2	Able to understand about the Hardware and Infrastructure , Overview of Software as a Service, Overview of Industries Software plus Services, Mobile device Integration
C305.3	Able to understand about Developing the Applications like Google, Microsoft, Intuit QuickBase, Local Clients and thin clients
C305.4	Able to understand about the Migrating the Cloud, Cloud Services

## **MCA- 20305 CLOUD COMPUTING (ELECTIVE-II)**

**Instruction:4Periods/week**

**Time:3Hours**

**Credits: 4**

**Internal:25Marks**

**External:75Marks**

**Total: 100Marks**

---

### **UNIT I**

**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.

**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, IBM Partnerships.

### **UNIT II**

**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.

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

### **UNIT III**

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

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

### **UNIT IV**

**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.

#### **Reference Books:**

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MKElsevier.
2. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press

**Course Code & Title: MCA-20305 MACHINE LEARNING AND DEEP LEARNING**

**(ELECTIVE-II)**

**Semester: III**

**Course Index: C305**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To introduce students to the basic concepts and techniques of Machine Learning

To discuss Decision Tree learning, Artificial Neural Networks

To learn about Bayesian learning, Instance-Based Learning

To study various Genetic Algorithms, Learning Sets of Rules

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C305.1	Able to understand the basic concepts and techniques of Machine Learning
C305.2	Able to understand Decision Tree learning, Artificial Neural Networks
C305.3	Able to understand Bayesian learning, Instance-Based Learning
C305.4	Able to understand Genetic Algorithms, Learning Sets of Rules

**MCA-20305 MACHINE LEARNING AND DEEP LEARNING (ELECTIVE-II)****Instruction: 4 Periods/week****Time: 3 Hours****Credits: 4****Internal: 25 Marks****External: 75 Marks****Total: 100 Marks**

---

**UNIT – I**

The Machine Learning Landscape: What Is Machine Learning, Why Use Machine Learning, Types of Machine Learning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Main Challenges of Machine Learning, Insufficient Quantity of Training Data, Non representative Training Data, Poor-Quality Data, Irrelevant Features, Over fitting the Training Data, Under fitting the Training Data, Stepping Back, Testing and Validating.

**UNIT II**

Classification: Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label Classification, Multi output Classification.

Ensemble Learning and Random Forests: Voting Classifiers, Bagging and Pasting, Out-of-Bag Evaluation, Random Patches and Random Subspaces, Random Forests, Extra-Trees, Feature Importance, Boosting, AdaBoost, Gradient Boosting, Stacking, Exercises.

**UNIT III**

The Neural Network: Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers

Training Feed-Forward Neural Networks: The Fast-Food Problem , Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm, Stochastic and Minibatch Gradient Descent , Test Sets, Validation Sets, and Overfitting, Preventing Overfitting in Deep Neural Networks.

**UNIT IV**

Implementing Neural Networks in TensorFlow: What Is TensorFlow? How Does TensorFlow Compare to Alternatives Contents Installing TensorFlow Creating and Manipulating TensorFlow Variables, TensorFlow Operations, Placeholder Tensors, Sessions in TensorFlow , Navigating Variable Scopes and Sharing Variables, Managing Models over the CPU and GPU, Specifying the Logistic Regression Model in TensorFlow, Logging and Training the Logistic Regression Model, Leveraging TensorBoard to Visualize Computation Graphs and Learning, Case Study: Building a Multilayer Model for MNIST in TensorFlow.

**TEXTBOOKS:**

1. Hands on machine-learning with scikit-learn and tensorflow. Concepts, tools and techniques to build Intelligent System AurelienGeron, O'reillyPublicatons.
2. Fundamentals of Deep Learning. Designing Next Generation Machine Intelligence - Algorithms. Nikhil Buduma...O'reillyPublications.

**Course Code & Title:MCA-20306: BUSINESS INTELLIGENCE AND VISUALIZATION  
(ELECTIVE-III)**

**Semester:III**

**Course Index: C306**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about the Business intelligence, architecture, analysis, ethics

To learn about the Knowledge discovery, Geographic Visualization

To learn about the Efficiency measures, identification of good operating practices, Pattern matching

To learn about the Business intelligence applications, Future of business intelligence

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C306.1	Able to understand about the Business intelligence, architecture, analysis, ethics
C306.2	Able to understand about the Knowledge discovery, Geographic Visualization
C306.3	Able to understand about the Efficiency measures, identification of good operating practices, Pattern matching
C306.4	Able to understand about the Business intelligence applications, Future of business intelligence

<b>MCA-20306: BUSINESS INTELLIGENCE AND VISUALIZATION (ELECTIVE-III)</b>		
<b>Instruction:4Periods/week</b>	<b>Time:3Hours</b>	<b>Credits: 4</b>
<b>Internal:25Marks</b>	<b>External:75Marks</b>	<b>Total: 100Marks</b>

## **UNIT I**

**BUSINESS INTELLIGENCE:** Effective and timely decisions—Data, information and knowledge—Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

## **UNIT II**

**KNOWLEDGE DELIVERY:** The business intelligence user types, Standard reports, InteractiveAnalysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

## **UNIT III**

**EFFICIENCY:** Efficiency measures—The CCR model: Definition of target objectives- Peer groups—Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis

## **UNIT IV**

**BUSINESS INTELLIGENCE APPLICATIONS:** Marketing models—Logistic and Production models— Case studies.

**FUTURE OF BUSINESS INTELLIGENCE:** Future of business intelligence—Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

### **TEXT BOOK:**

1. Efraim Turban, Ramesh Sharda, DursunDelen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

### **REFERENCES:**

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley,2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’sGuide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a KillerApp”, McGraw-Hill,2007.
5. Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley PublicationInc.,2007.

**Course Code & Title: MCA-20306 ROBOTICS(ELECTIVE III)**

**Semester: III**

**Course Index: C306**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To study the basics of control systems and components

To discuss robot end effectors its Types, Tools as End Effectors, Gripper Selection and Design Forward and Inverse Kinematics.

To learn about machine vision, Sensor Characteristics, Image processing and Analysis, Robotic Applications

To study robot programming, Motion Commands, program Control and Subroutines.

Programming methods and Branching

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C306.1	Able to understand the basic of control systems and components
C306.2	Able to understand robot end effectors its Types, Tools as End Effectors, Gripper Selection and Design Forward and Inverse Kinematics
C306.3	Able to understand machine vision, Sensor Characteristics, Image processing and Analysis, Robotic Applications
C306.4	Able to understand robot programming, Motion Commands, program Control and Subroutines. Programming methods and Branching.

### **MCA-20306 ROBOTICS (ELECTIVE III)**

**Instruction: 4 Periods/week**

**Time: 3 Hours**

**Credits: 4**

**Internal: 25 Marks**

**External: 75 Marks**

**Total: 100 Marks**

---

#### **UNIT-I**

**CONTROL SYSTEMS AND COMPONENTS:** Basic Control Systems Concepts and Models, Controllers, Control System Analysis, Classification, Components, Characteristics, Applications Robot Activation and Feedback Components, Power Transmission Systems, Robot Joint Control Design.

#### **UNIT-II**

**ROBOT END EFFECTORS:** Types, Mechanical Grippers and Other types, Tools as End Effectors, The Robot/End Effector Interface, Considerations in Gripper Selection and Design. Position Analysis, Robots as Mechanisms, Matrix Representation, Transformation Matrices, Forward and Inverse Kinematics.

#### **UNIT-III**

**MACHINE VISION:** Introduction, Sensor Characteristics, Description of Different Sensors. The Sensing and Digitizing function, Image processing and Analysis, Training and Vision Systems, Robotic Applications Characteristics of Actuating Systems, Actuating Devices and Control.

#### **UNIT-IV**

**ROBOT PROGRAMMING:** The Textual Robot languages, Generations of Robot programming languages, Robot language Structures, Constants, Variables, and other data Objects, Motion Commands, program Control and Subroutines. Programming methods, Robot program as a path in space, Motion Interpolation, WAIT, SIGNAL, DELAY Commands, Branching.

#### **TEXT BOOK:**

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey Industrial Robotics: Technology, Programming, and Applications, 1st edition, McGraw-Hill International Edition, 1986.
2. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia, 2001.

#### **REFERENCE BOOK:**

1. K.S.Fu, R.C Gonzalez, C.S.G.Lee, ROBOTICS, Control, Sensing, Vision and Intelligence, 1st edition, McGraw-Hill International Edition, 1987.
2. R.K.Mittal and I J Nagrath, Robotics and Control, TMH, 2003.
3. Computational Intelligence, Davis Poole, Alan Mackwath, Randy Coehel, Oxford University Press 1998.

**Course Code & Title: MCA-20306 FOUNDATIONS OF DATA SCIENCE(ELECTIVE III)**

**Semester: III**

**Course Index: C306**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

To learn about Key concepts in data science, including tools, approaches, and application scenarios

To learn about Topics in data collection, sampling, quality assessment and repair

To learn about Topics in statistical analysis and machine learning

To learn about State-of-the-art tools to build data-science applications for different types of data, including text and CSV data

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C306.1	Understand about Key concepts in data science, including tools, approaches, and application scenarios
C306.2	Understand about Topics in data collection, sampling, quality assessment and repair
C306.3	Understand about Topics in statistical analysis and machine learning
C306.4	Understand about State-of-the-art tools to build data-science applications for different types of data, including text and CSV data

<b>MCA-20306 FOUNDATIONS OF DATA SCIENCE (ELECTIVE-III)</b>		
<b>Instruction: 4 Periods/week</b>	<b>Time: 3 Hours</b>	<b>Credits: 4</b>
<b>Internal: 25 Marks</b>	<b>External: 75 Marks</b>	<b>Total: 100 Marks</b>

## **UNIT I**

**INTRODUCTION TO DATA SCIENCE:** Data science process – roles, stages in data science project, setting expectations, loading data into R – working with data from files, working with relational databases. Exploring data – Using summary statistics to spot problems, spotting problems using graphics and visualization. Managing data – cleaning and sampling for modelling and validation.

## **UNIT II**

**MODELING METHODS:** Choosing and evaluating models – mapping problems to machine learning tasks, evaluating models, validating models – cluster analysis – Kmeans algorithm, Naïve Bayes, Memorization Methods – KDD and KDD Cup 2009, building single variable models, building models using multi variable, Linear and logistic regression, unsupervised methods – cluster analysis, association rules.

## **UNIT III**

**INTRODUCTION TO R Language:** Reading and getting data into R, viewing named objects, Types of Data items, the structure of data items, examining data structure, working with history commands, saving your work in R.

**PROBABILITY DISTRIBUTIONS in R** - Binomial, Poisson, Normal distributions. Manipulating objects - data distribution.

## **UNIT IV**

**DELIVERING RESULTS:** Documentation and deployment–producing effective presentations –Introduction to graphical analysis – plot()function – displaying multivariate data– matrix plots – multiple plots in one window - exporting graph – using graphics parameters in R Language.

### **Text Books**

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications,2014.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, “Mining of Massive Datasets”, Cambridge University Press,2014.
3. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc.,2012.

### **Reference Books**

1. W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”,2013.
2. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, AbhijitDasgupta, “PracticalData Science Cookbook”, Packet Publishing Ltd.,2014.
3. Nathan Yau, “Visualize This: The FlowingData Guide to Design, Visualization, andStatistics”, Wiley,2011.
4. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”,Wiley, ISBN: 9788126551071,2015.

**Course Code & Title: MCA-20307 WEB TECHNOLOGIES AND OBJECT**

**ORIENTED SOFTWARE ENGINEERINGLAB**

**Semester: III**

**Course Index: C307**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

Learn how to create Web pages using HTML/DHTML and using CSS in it.

Learn how to write Java Script Programs to demonstrate the working of conditional, looping statements, arrays, functions, event handling, validation controls.

Learn how to develop simple applications like client server programming using Java Script, Servlets, ASP, JSP and a web application with database connectivity.

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C307.1	Students can able to create Web pages using HTML/DHTML and using CSS in it.
C307.2	Students can able to write Java Script Programs to demonstrate the working of conditional, looping statements, arrays, functions, event handling, validation controls.
C307.3	Students can able to develop simple applications like client server programming using Java Script, Servlets, ASP, JSP and a web application with database connectivity.

**MCA-20307 WEB TECHNOLOGIES AND OBJECT ORIENTED SOFTWARE  
ENGINEERING LAB**

**Instruction: 3 Periods/week**

**Internal: 50 Marks**

**Time: 3 Hours**

**External: 50 Marks**

**Credits: 2**

**Total: 100 Marks**

---

**Web Technologies Lab**

1. Create web pages for an application demonstrating the working of different features of HTML and DHTML.

2. Demonstrate the use of CSS in organizing the layout of webpages

**Implement at least two Java Script programs to demonstrate the working of**

3. Conditional statements

6. Functions.

4. Looping statements.

7. Event handling

5. Arrays

8. Validation controls.

**Develop simple applications for the following**

9. Exercise client server programming using Java Script, Servlets, ASP, JSP.

10. Create a web application with database connectivity and work on different queries for data manipulation.

**REFERENCES:**

1. Web Technologies, Godbole, Kahate, 2<sup>nd</sup>Ed, TMH

2. Internet & World Wide Web How to program, Dietel&Deitel Fourth Edition, PHI

**Object Oriented Software Engineering Lab**

**Document the Software Project Management and Software Engineering activities for any two of the following projects. Any other project of interest also can be chosen.**

- 1. Student Result Management System
- 2. Library Management System
- 3. Payroll System
- 4. Bank Loan System

- 5. Railway Reservation System
- 6. Automatic Teller Machine
- 7. Hospital Management System
- 8. Online Shopping System

**Software Project Management and Software Engineering activities specified below can be customized according to the features of the project.**

- Problem Statement
- Feasibility Study
- Software Requirements Specification Document
- Estimation of Project Metrics
- Entity Relationship Diagram
- Use Case Diagrams
- Class Diagram
- Sequence Diagrams
- Activity Diagrams
- State Chart Diagrams
- Test coverage

**REFERENCES:**

- 1. The Unified Modeling Language User Guide. Grady Booch, James Rumbaugh and Ivar Jacobson. Addison-Wesley.
- 2. Object Oriented Software Engineering: Practical Software Development using UML and Java. Timothy C Lethbridge & Robert, Langaneire, Mc Graw Hill.

**Course Code & Title: MCA-20308 BIG DATA ANALYTICS LAB**

**Semester: III**

**Course Index: C308**

**Course Objectives:**

The learning objectives of this course are:

**Course Objectives**

Learn how to implement data structures, generic types

Learn how to setup and install Hadoop

Learn how to implement file management tasks and programs in Hadoop

**Course Outcomes:**

By the end of the course, the student will be

<b>Course Index</b>	<b>Course Outcomes</b>
C308.1	Able to implement data structures, generic types
C308.2	Able to setup and install Hadoop
C308.3	Able to implement file management tasks and programs in Hadoop