

- ❖ Basic Computer Programming skills is required for all open electives. Additionally knowledge on the specified area mentioned in prerequisites is required for opting the open elective
- ❖ Note: A student can register for any open elective subject provided that he has not already registered for the same subject.

<b>S.No.</b>	<b>Open Electives</b>	<b>Prerequisites</b>
1.	"R" Programming	Maths, Statistics
2.	Algorithmics	-----
3.	Big Data Analytics	Data Bases , Maths
4.	Bioinformatics	Data Structures
5.	Biometrics	----
6.	Computer Forensics	Maths, Data Structures
7.	Cyber Security	Internet Technologies
8.	Distributed Systems Security	Information Security
9.	E-Commerce	Internet Technologies
10.	Embedded Systems	Digital logic
11.	Intellectual Property Rights	---
12.	Internet of Things	Java
13.	Internet Technologies and Services	Java
14.	Mobile Computing	Java
15.	Mobile Application Security	Mobile Application Development
16.	Open Stack Cloud Computing	Linux Programming
17.	Principles of Information Security	---
18.	Social Media Intelligence	---
19.	Storage Area Networks	Computer Networks
20.	Web Usability	-----

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**MCA**

### **R-PROGRAMMING (Open Elective)**

#### **Objectives:**

- To Learn the fundamentals of R
- To Understand performing operations on complex data types
- To understanding how to use the four object systems in R
- To Enable the students to use existing functional programming tools
- Explains how to create functions that use non-standard evaluation in a principled way
- Shows how to use profiling to pinpoint performance bottlenecks and how to convert slow R functions to fast C++ equivalents.

#### **UNIT - I**

Introduction to R programming, Introduction to Functions, Preview of Important R Data Structures, Vectors, Recycling, Common Vector Operations, Vectorized Operations, Filtering Matrices and Arrays

#### **UNIT – II**

Lists, Creating Lists, General List Operations Accessing List Components and Values, Applying Functions to Lists, Recursive Lists, Data Frames, Creating Data Frames, Other Matrix-Like Operations, Merging Data Frames, Applying Functions to Data Frames, Factors and Tables, Factors and Levels, Common Functions Used with Factors, Working with Table, Table-Related Functions

#### **UNIT - III**

R Programming Structures, Control Statements, Arithmetic and Boolean Operators and Values, Default Values for Arguments, Environment and Scope Issues, Recursion Replacement Functions, Anonymous Functions Data Frames, Creating Data Frames, Other Matrix-Like Operations, Merging Data Frames, Applying Functions to Data Frames, Factors and Tables Factors and Levels, Common Functions Used with Factors, Working with Table, Table-Related Functions, R Programming Structures, Control Statements Arithmetic and Boolean Operators and Values, Default Values for Arguments, Environment and Scope Issues, Recursion Replacement Functions, Anonymous Functions Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses.

#### **UNIT- IV**

Math and Simulations in R, Math Functions, Functions for Statistical Distributions, Sorting, Linear Algebra Operations on Vectors and Matrices, Set Operations, Simulation Programming in R, Object-Oriented Programming, S3 Classes, S4 Classes, S3 Versus S4, Managing Your Objects

#### **UNIT - V**

Input/Output, Accessing the Keyboard and Monitor, Reading and Writing Files, Accessing the Internet, String Manipulation, String-Manipulation Functions, Regular Expressions, Use of String Utilities in the edtdbg Debugging Tool, Creating Graphs, Customizing Graphs, Saving Graphs to Files Creating Three-Dimensional Plots

#### **TEXT BOOK:**

1. Art of R programming by Norman Matloff ,safari books online Publisher: No Starch Press

#### **REFERENCE BOOKS:**

1. Beginning R: The Statistical Programming Language by mark gardener wrox publication
2. Beginning R by lary pace Publishers appress publishing
3. R Programming for Dummies by Andrie De Vries and Joris Meys ,Wiley India Private Limited; 1st edition

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**ALGORITHMICS  
(Open Elective)**

**UNIT – I**

Relevant Mathematics: Existential and Universal Quantifiers, Logarithms and Exponentials, The Time (and Space) Complexity of an Algorithm, Asymptotic Notations and Their Properties, Adding Mode easy Approximations, Recurrence Relations, Abstractions: Different representations of Algorithms, Abstract Data Types (ADTs),

**UNIT – II**

Iterative Algorithms and Loop Invariants: Iterative algorithms: Measures of Progress and Loop Invariants, Examples Using More –Of- the – Input Loop Invariants,

**UNIT – III**

Narrowing the Search Space: Binary Search, Iterative Searching Algorithm Euclid's GCD Algorithm, The Loop Invariant for Lower Bound,

**UNIT – IV**

Recursion: Abstractions, Techniques and theory, Some Sample Algorithms of Recursive Algorithms, Recursion on trees, Recursive Images, Parsing with Context-free Grammars.

**UNIT – V**

Optimization Problems: Definition, Graph Search Algorithms, Network Flow and Linear programming, Greedy Algorithms, Recursive backtracking, Dynamic Programming Algorithms, Examples of Dynamic Programs, Reduction and NP-Completeness, Randomized Algorithms.

**TEXT BOOKS:**

1. How to think about Algorithms by Jeff Edmonds Cambridge 2003 and 2008.

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### BIG DATA ANALYTICS (Open Elective)

#### Objectives:

- To understand about big data
- To learn the analytics of Big Data
- To Understand the MapReduce fundamentals

#### Unit I

Big Data Analytics: What is big data, History of Data Management; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data;

Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools;

#### Unit- II

**Understanding Analytics and Big Data:** Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

#### Unit III

**Understanding MapReduce Fundamentals and HBase :** The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS;

#### Unit IV

**Big Data Technology Landscape and Hadoop :** NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFS (Hadoop Distributed File System), HDFS Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

#### Unit V

**Social Media Analytics and Text Mining:** Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

**Mobile Analytics:** Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

#### TEXT BOOKS:

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black Book™, DreamTech Press, 2015 Edition.

#### REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez, " Business Intelligence –Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, ShakuAtre, " Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, " Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**BIOINFORMATICS  
(Open Elective)**

**UNIT-I**

Introduction to Bioinformatics and Biological Databases, Sequence alignment, Pairwise Sequence alignment, multiple sequence alignment, database Similarities.

**UNIT-II**

Molecular phylogenetics: Basics, gene phylogene Vs Systems Phylogene, Tree construction methods and programs, advanced Statistical approaches, profiles and Hidden markow models.

**UNIT-III**

Gene and promoter prediction: Gene Prediction, promoter and regulatory element pridiction, RNA structure prediction, protine motives and domain prediction

**UNIT-IV**

Structural Bioinformatics: Basics, Protine structure Visualization, comparision, classofication, protein secondary structure prediction, protein tertiary structure prediction.

**UNIT-V**

Genomics and Proteomics: Genome Mapping, Assembly, comparison, functional genomics, proteomics.

**Text Books:**

1. Essential Bioinformatics: Jin Xiong 2006, Cambridge University Press.

## JAWAHARLAL NEHRUTECHNOLOGICAL UNIVERSITY

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### BIOMETRICS (Open Elective)

#### Objectives

To learn the biometric technologies

To learn the computational methods involved in the biometric systems.

To learn methods for evaluation of the reliability and quality of the biometric systems.

#### Unit – I

##### INTRODUCTION & HANDWRITTEN CHARACTER RECOGNITION

Introduction – history – type of Biometrics – General Architecture of Biometric Systems – Basic Working of biometric Matching – Biometric System Error and performance Measures – Design of Biometric Systems – Applications of Biometrics – Benefits of Biometrics Versus Traditional Authentication Methods – character Recognition – System Overview – Geature Extraction for character Recognition – Neura; Network for handwritten Charater Recognition – Multilayer Neural Network for Handwritten Character Recognition – Devanagari Numeral Recognition – Isolated Handwritten Devanagari Charater Recognition suing Fourier Descriptor and Hidden markov Model.

#### Unit –II.

##### FACE BIOMETRICS & RETINA AND IRIS BIOMETRICS

Introduction –Background of Face Recognition – Design of Face Recognition System – Neural Network for Face Recognition – Face Detection in Video Sequences – Challenges in Face Biometrics – Face Recognition Methods – Advantages and Disadvantages – Performance of Biometrics – Design of Retina Biometrics – Iris Segmentation Method – Determination of Iris Region – Experimental Results of Iris Localization – Applications of Iris Biometrics – Advantages and Disadvantages. VEIN AND FINGERPRINT BIOMETRICS & BIOMETRIC HAND GESTURE RECOGNITION FOR INDIAN SIGN LANGUAGE. Biometrics Using Vein Pattern of Palm – Fingerprint Biometrics – Fingerprint Recognition System – Minutiae Extraction – Fingerprint Indexing – Experimental Results – Advantages and Disadvantages – Basics of Hand Geometry – Sign Language – Indian Sign Language – SIFT Algorithms-Practical Approach Advantages and Disadvantages.

#### Unit –III.

##### PRIVACY ENHANCEMENT USING BIOMETRICS & BIOMETRIC CRYPTOGRAPHY AND MULTIMODAL BIOMETRICS

Introduction – Privacy Concerns Associated with Biometric Developments – Identity and Privacy – Privacy Concerns – Biometrics with Privacy Enhancement – Comparison of Various Biometrics in Terms of Privacy – Soft Biometrics - Introduction to Biometric Cryptography – General Purpose Cryptosystem – Modern Cryptography and Attacks – Symmetric Key Ciphers – Cryptographic Algorithms – Introduction to Multimodal Biometrics – Basic Architecture of Multimodal Biometrics – Multimodal Biometrics Using Face and Ear – Characteristics and Advantages of Multimodal Biometrics Characters – AADHAAR : An Application of Multimodal Biometrics.

#### Unit –IV

##### WATERMARKING TECHNIQUES & BIOMETRICS : SCOPE AND FUTURE

Introduction – Data Hiding Methods – Basic Framework of Watermarking – Classification of Watermarking – Applications of Watermarking – Attacks on Watermarks – Performance Evaluation – Characteristics of Watermarks – General Watermarking Process – Image Watermarking Techniques – Watermarking Algorithm – Experimental Results – Effect of Attacks on Watermarking Techniques – Scope and Future Market of Biometrics – Biometric Technologies – Applications of Biometrics -Biometrics – and Information Technology Infrastructure – Role of Biometrics in Enterprise Security – Role of Biometrics in Border Security – Smart Card Technology and Biometric – Radio Frequency Identification Biometrics – DNA Biometrics – Comparative Study of Various Biometrics Techniques.

#### Unit –V

##### IMAGE ENHANCEMENT TECHNIQUES & BIOMETRICS STANDS

Introduction – current Research in image Enhancement Techniques – Image Enhancement – Frequency Domain Filters – Databases and Implementation – Standard Development Organizations – Application

Programming Interface – Information Security and Biometric Standards – Biometric Template Interoperability.

**Text Book:**

1. BIOMETRICS: CONCEPTS AND APPLICATIONS by G R SINHA and SANDEEP B. PATIL, Wiley, 2013.
2. Biometrics for Network Security – Paul Reid, Pearson Education.

Reference Books:

1. Biometrics – Identity verification in a networked world – Samir Nanavathi, Micheal Thieme, Raj Nanavathi, Wiley – dream Tech.
2. Biometrics – The Ultimate Reference – John D. Woodward, Jr. Wiley Dreamtech.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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COMPUTER FORENSICS  
(Open Elective)

**Objectives:**

- To understand the cyberspace
- To understand the forensics fundamentals
- To understand the evidence capturing process.
- To understand the preservation of digital evidence.

**UNIT I :**

**Computer Forensics Fundamentals:** Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence?.**Types of Computer Forensics Technology :** Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensics Technology.

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**UNIT II :**

**Computer Forensics Evidence and Capture: Data Recovery:** Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Case Histories.**Evidence Collection and Data Seizure:** Why Collect Evidence?, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collecting and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody.

**UNIT III:**

**Duplication and Preservation of Digital Evidence:** Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting And Preserving Computer Forensic Evidence.**Computer Image Verification and Authentication :** Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation.

**UNIT IV:**

**Computer Forensics Analysis: Discovery of Electronic Evidence:** Electronic Document Discovery: A Powerful New Litigation Tool, **Identification of Data:** Timekeeping, Time Matters,Forensic Identification and Analysis of Technical Surveillance Devices. **Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files. **Networks:** Network Forensics Scenario, A Technical Approach, Destruction of Email, Damaging Computer Evidence, International Principles Against Damaging of Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, Incident Reporting and Contact Forms.

**UNIT V:**

**Current Computer Forensics Tools:** Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.

**TEXT BOOKS:**

1. "Computer Forensics : Computer Crime Scene Investigation", JOHN R. VACCA, Firewall Media.
2. "Guide to Computer Forensics and Investigations"4e, Nelson, Phillips Enfinger, Steuart, Cengage Learning.

**REFERENCES:**

1. "Computer Forensics and Cyber Crime", Marjie T Britz, Pearson Education.
  2. "Computer Forensics", David Cowen, Mc Graw Hill.
  3. Brian Carrier , "File System Forensic Analysis" , Addison Wesley, 2005
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4. Dan Farmer & Wietse Venema , "Forensic Discovery", Addison Wesley, 2005
5. Eoghan Casey , —Digital Evidence and Computer Crime —, Edition 3, Academic Press, 2011
6. Chris Pogue, Cory Altheide, Todd Haverkos , Unix and Linux Forensic Analysis DVD ToolKit, Syngress Inc. , 2008
7. Harlan Carvey , Windows Forensic Analysis DVD Toolkit, Edition 2, Syngress Inc. , 2009
8. Harlan Carvey , Windows Registry Forensics: Advanced Digital Forensic Analysis of the Windows Registry , Syngress Inc, Feb 2011
9. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2009
10. Gonzales/ Woods/ Eddins, Digital Image Processing using MATLAB, 2nd edition, Gatesmark Publishing, ISBN 9780982085400
11. N.Efford, Digital Image Processing, Addison Wesley 2000, ISBN 0-201-59623-7
12. M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS
13. 1999, ISBN 0-534-95393-
14. Pratt.W.K., Digital Image Processing, John Wiley and Sons, New York, 1978

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

MCA

### CYBER SECURITY (Open Elective)

#### **Objectives:**

To learn about cyber crimes and how they are planned  
To learn the vulnerabilities of mobile and wireless devices  
To learn about the crimes in mobile and wireless devices

#### **UNIT-I**

##### **Introduction to Cybercrime:**

Introduction, Cybercrime and Information security, who are cybercriminals, Classifications of Cybercrimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

##### **Cyber offenses:** How criminals Plan Them

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

#### **UNIT-II**

##### **Cybercrime:** Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

#### **UNIT III**

##### **Cybercrimes and Cyber security:** the Legal Perspectives Introduction

Cyber Crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario In India, Digital signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment ,Cyber law, Technology and Students: Indian Scenario.

#### **UNIT IV**

**Understanding Computer Forensics :**Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody concept, Network Forensics, Approaching a computer, Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques,Forensics Auditing

#### **UNIT V**

##### **Cyber Security:** Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

#### **Text book:**

1. **Cyber Security:** *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Nina Godbole and Sunil Belapure, Wiley INDIA.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group
- 3 **Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.**

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**MCA**

**DISTRIBUTED SYSTEMS SECURITY  
(Open Elective)**

**Objective :**

To learn about the distributed systems and security

To learn about the host-level, application level threats and vulnerabilities

To learn about service –level solutions

**Unit-I**

Introduction – Distributed Systems, Distributed Systems Security. Security in Engineering: Secure Development Lifecycle Processes - A Typical Security Engineering Process – Security Engineering Guidelines and Resources. Common Security Issues and Technologies: Security Issues, Common Security Techniques.

**Unit-II**

Host-level Threats and Vulnerabilities: Transient code Vulnerabilities - Resident Code Vulnerabilities - Malware: Trojan Horse – Spyware - Worms/Viruses – Eavesdropping – Job Faults. Infrastructure-Level Threats and Vulnerabilities: Network-Level Threats and Vulnerabilities - Grid Computing Threats and Vulnerabilities – Storage Threats and Vulnerabilities – Overview of Infrastructure Threats and Vulnerabilities.

**Unit-III**

Application-Level Threats and Vulnerabilities: Application-Layer Vulnerabilities –Injection Vulnerabilities - Cross-Site Scripting (XSS) - Improper Session Management - Improper Error Handling - Improper Use of Cryptography - Insecure Configuration Issues - Denial of Service - Canonical Representation Flaws - Overflow Issues. Service-Level Threats and Vulnerabilities: SOA and Role of Standards - Service-Level Security Requirements - Service-Level Threats and Vulnerabilities - Service-Level Attacks - Services Threat Profile.

**Unit-IV**

Host-Level Solutions: Sandboxing – Virtualization - Resource Management - Proof-Carrying Code - Memory Firewall – Antimalware. Infrastructure-Level Solutions: Network-Level Solutions - Grid-Level Solutions - Storage-Level Solutions. Application-Level Solutions: Application-Level Security Solutions.

**Unit-V**

Service-Level Solutions: Services Security Policy - SOA Security Standards Stack – Standards in Dept - Deployment Architectures for SOA Security - Managing Service-Level Threats - Compliance in Financial Services - SOX Compliance - SOX Security Solutions – Multilevel Policy-Driven Solution Architecture - Case Study: Grid - The Financial Application – Security Requirements Analysis. Future Directions - Cloud Computing Security – Security Appliances - Usercentric Identity Management - Identity-Based Encryption (IBE) - Virtualization in Host Security.

**REFERENCES**

1. Abhijit Belapurkar, Anirban Chakrabarti and et al., “Distributed Systems Security: Issues. Processes and solutions”, Wiley, Ltd., Publication, 2009.
2. Abhijit Belapurkar, Anirban Chakrabarti, Harigopal Ponnappalli, Niranjana Varadarajan, Srinivas Padmanabhuni and Srikanth Sundarajan,
3. “Distributed Systems Security: Issues, Processes and Solutions”, Wiley publications, 2009.
4. Rachid Guerraoui and Franck Petit, “Stabilization, Safety, and Security of Distributed Systems”, Springer, 2010.

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**E – COMMERCE  
(Open Elective)**

**Objectives:**

Identify the major categories and trends of e-commerce applications.  
Identify the essential processes of an e-commerce system.  
Identify several factors and web store requirements needed to succeed in e-commerce.  
Discuss the benefits and trade-offs of various e-commerce clicks and bricks alternatives.  
Understand the main technologies behind e-commerce systems and how these technologies interact.  
Discuss the various marketing strategies for an online business.  
Define various electronic payment types and associated security risks and the ways to protect against them.

**UNIT - I**

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.  
Consumer Oriented Electronic commerce - Mercantile Process models.

**UNIT - II**

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.  
Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.

**UNIT - III**

Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.  
Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses.

**UNIT- IV**

Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.  
Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

**UNIT - V**

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

**TEXT BOOK:**

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

**REFERENCES BOOKS:**

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
4. Electronic Commerce – Gary P.Schneider – Thomson.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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## EMBEDDED SYSTEMS (Open Elective)

### Objectives:

- To explain various embedded system applications and design requirements.
- To construct embedded system hardware.
- To develop software programs to control embedded system.
- To generate product specification for embedded system.

### UNIT I

Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software, Complex System Design, Design Process in Embedded System, Formalization of System Design, Classification of Embedded Systems

### UNIT II

8051 and Advanced Processor Architecture: 8051 Architecture, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts, Introduction to Advanced Architectures, Real World Interfacing, Processor and Memory organization - Devices and Communication Buses for Devices Network: Serial and parallel Devices & ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Internet Enabled Systems, Wireless and Mobile System protocols

### UNIT III

Embedded Programming Concepts: Software programming in Assembly language and High Level Language, Data types, Structures, Modifiers, Loops and Pointers, Macros and Functions, object oriented Programming, Embedded Programming in C++ & JAVA

### UNIT IV

Real – Time Operating Systems: OS Services, Process and Memory Management, Real – Time Operating Systems, Basic Design Using an RTOS, Task Scheduling Models, Interrupt Latency, Response of Task as Performance Metrics - RTOS Programming: Basic functions and Types of RTOS, RTOS VxWorks, Windows CE

### UNIT V

Embedded Software Development Process and Tools: Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-Design - Testing, Simulation and Debugging Techniques and Tools: Testing on Host Machine, Simulators, Laboratory Tools

### TEXT BOOK:

1. Embedded Systems, Raj Kamal, Second Edition TMH.

### REFERENCE BOOKS:

1. Embedded/Real-Time Systems, Dr.K.V.K.K.Prasad, dreamTech press
2. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Pearson.
3. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.
4. An Embedded Software Primer, David E. Simon, Pearson Education.
5. Micro Controllers, Ajay V Deshmukhi, TMH.
6. Microcontrollers, Raj kamal, Pearson Education.
7. Introduction to Embedded Systems,Shibu K.V,TMH.

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**INTELLECTUAL PROPERTY RIGHTS  
(Open Elective)**

**Unit-I**

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law Ethical obligations in Para Legal Tasks in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right

**Unit-II**

Introduction to Trade mark – Trade mark Registration Process – Post registration Procedures – Trade mark maintenance - Transfer of Rights - Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trade mark Law

**Unit-III**

Introduction to Copyrights – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act

**Unit -IV**

The law of patents-patent searches –Patent ownership and transfer-Patent infringement-International Patent Law

**Unit-V**

Introduction to Trade Secret – Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law

**TEXT BOOKS:**

1. Debirag E.Bouchoux: “Intellectual Property” 4e . Cengage learning, New Delhi
2. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw –Hill, New Delhi
5. J Martin and C Turner “Intellectual Property” CRC Press
6. Richard Stimm “ Intellectual Property” Cengage Learning

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**INTERNET OF THINGS  
(Open Elective)**

**Objectives:**

To introduce the terminology, technology and its applications  
To introduce the concept of M2M (machine to machine) with necessary protocols  
To introduce the Python Scripting Language which is used in many IoT devices  
To introduce the Raspberry PI platform, that is widely used in IoT applications  
To introduce the implementation of web based services on IoT devices.

**Unit I**

**Introduction to Internet of Things** –Definition and Characteristics of IoT,  
Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs  
IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics,  
Communication protocols, Embedded Systems, IoT Levels and Templates  
Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health  
and Lifestyle.

**Unit II**

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and  
NFV for IoT  
Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

**Unit III**

Introduction to Python - Language features of Python, Data types, data structures, Control of flow,  
functions, modules, packaging, file handling, data/time operations, classes, Exception handling  
Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

**Unit IV**

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C)  
Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling  
output, reading input from pins.

**Unit V**

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication  
APIs, Webserver – Web server for IoT, Cloud for IoT, Python web application framework  
Designing a RESTful web API

**Text Book:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities  
Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,  
ISBN: 9789350239759

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

MCA

### INTERNET TECHNOLOGIES AND SERVICES (Open Elective)

#### **Objective:**

The student who has knowledge of programming with java should be able to develop web based solutions using multi-tier architecture. S/he should have good understanding of different technologies on client and server side components as Follows:

Client Side: HTML5, CSS3, Javascript, Ajax, JQuery and JSON

Server Side: Servlets, JSP

Database: MySQL with Hibernate and Connection Pooling

Framework: Struts with validation framework, Internationalization (I18N)

SOA: Service Oriented Architecture, Web services fundamentals, Axis framework for WS

#### **UNIT I**

##### **Client Side Technologies:**

Overview of HTML - Common tags, XHTML, capabilities of HTML5

Cascading Style sheets, CSS3 enhancements, linking to HTML Pages, Classes in CSS

Introduction to JavaScripts, variables, arrays, methods and string manipulation, BOM/DOM (Browser/Document Object Model), accessing elements by ID, Objects in JavaScript

Dynamic HTML with JavaScript and with CSS, form validation with JavaScript, Handling Timer Events

Simplifying scripting with JQuery, JASON for Information exchange.

#### **UNIT II**

##### **Introduction to Java Servlets:**

Introduction to Servlets: Lifecycle of a Servlet, Reading request and initialization parameters, Writing output to response, MIME types in response, Session Tracking: Using Cookies and Sessions

Steps involved in Deploying an application

Database Access with JDBC and Connection Pooling

Introduction to XML, XML Parsing with DOM and SAX Parsers in Java

Ajax - Ajax programming with JSP/Servlets, creating XML Http Object for various browsers, Sending request, Processing response data and displaying it.

Introduction to Hibernate

#### **UNIT III**

##### **Introduction to JSP:**

JSP Application Development: Types of JSP Constructs (Directives, Declarations, Expressions, Code Snippets), Generating Dynamic Content, Exception Handling, Implicit JSP Objects, Conditional Processing, Sharing Data Between JSP pages, Sharing Session and Application Data, Using user defined classes with jsp:useBean tag, Accessing a Database from a JSP

#### **UNIT IV**

##### **Introduction to Struts Framework:**

Introduction to MVC architecture, Anatomy of a simple struts2 application, struts configuration file, Presentation layer with JSP, JSP bean, html and logic tag libraries, Struts Controller class, Using form data in Actions, Page Forwarding, validation frame work, Internationalization

#### **UNIT V**

##### **Service Oriented Architecture and Web Services**

Overview of Service Oriented Architecture – SOA concepts, Key Service Characteristics, Technical Benefits of a SOA

Introduction to Web Services– The definition of web services, basic operational model of web services, basic steps of implementing web services.

Core fundamentals of SOAP – SOAP Message Structure, SOAP encoding, SOAP message exchange models,



Describing Web Services –Web Services life cycle, anatomy of WSDL  
Introduction to Axis– Installing axis web service framework, deploying a java web service on axis.  
Web Services Interoperability – Creating java and .Net client applications for an Axis Web Service  
(Note: The Reference Platform for the course will be open source products Apache Tomcat Application Server, MySQL database, Hibernate and Axis)

#### **TEXT BOOKS:**

1. Web Programming, building internet applications, Chris Bates 3<sup>rd</sup> edition, WILEY Dreamtech .
2. The complete Reference Java 7<sup>th</sup> Edition , Herbert Schildt., TMH.
3. Java Server Pages,Hans Bergsten, SPD, O'Reilly.
4. Professional Jakarta Struts - James Goodwill, Richard Hightower, Wrox Publishers.
5. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, rp – 2008.
6. Understanding SOA with Web Services, Eric Newcomer and Greg Lomow, Pearson Edition – 2009
7. Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier - 2009

#### **REFERENCE BOOKS:**

1. Programming the world wide web,4<sup>th</sup> edition,R.W.Sebesta,Pearson
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE
3. TECHNOLOGIES , Marty Hall and Larry Brown Pearson
4. Internet and World Wide Web – How to program , Dietel and Nieto PHI/Pearson.
5. Jakarta Struts Cookbook , Bill Siggelkow, S P D O'Reilly.
6. Professional Java Server Programming,S.Allamaraju & othersApress(dreamtech).
7. Java Server Programming ,Ivan Bayross and others,The X Team,SPD
8. Web Warrior Guide to Web Programmng-Bai/Ekedaw-Cengage Learning.
9. Beginning Web Programming-Jon Duckett ,WROX.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**MOBILE COMPUTING  
(Open Elective)**

**UNIT-I**

Introduction, Mobile Computing Architecture, Mobile Computing through Telephony, Emerging Technologies

**UNIT-II**

Global System for Mobile Communications (GSM), Short Message Service (SMS), General Packet Radio Services (GPRS), Wireless Application Protocol (WAP), CDMA and 3G.

**UNIT-III**

Wireless LAN, Intelligent Network and Internetworking, Client Programming, Programming for PalmOS, Wireless Devices with Symbian OS.

**UNIT-IV**

J2ME Introduction, J2ME Architecture, MIDLET, MidLet Suite , J2ME Profiles, Wireless Devices with WindowsCE, Voice Over Internet Protocol and Convergence, Session Internet Protocol(SIP),other protocols.

**UNIT-V**

Multimedia, IP Multimedia Subsystems, Security Issues in Mobile Computing, Next Generation Networks.

**TEXTBOOKS:**

1. Mobile Computing Technology, Applications and Service Creation by Ashok Talukder , Hasan Ahmed, Roopa R Yavagal.
2. Mobile Computing Principles by Raza B'Far, Cambridge.
3. Mobile Computing by Raj Kamal 2e.
4. Mobile Computing by Jochen schiller.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**MOBILE APPLICATION SECURITY  
(Open Elective)**

**Objectives:**

To understand the mobile issues and development strategies

To understand the WAP and mobile security issues

To understand the Bluetooth security issues.

**UNIT I:**

Top Mobile Issues and Development Strategies: Top Issues Facing Mobile Devices, Physical Security , Secure Data Storage (on Disk), Strong Authentication with Poor Keyboards , Multiple-User Support with Security, Safe Browsing Environment , Secure Operating Systems, Application Isolation, Information Disclosure, Virus, Worms, Trojans, Spyware, and Malware , Difficult Patching/Update Process, Strict Use and Enforcement of SSL, Phishing , Cross-Site Request Forgery (CSRF), Location Privacy/Security, Insecure Device Drivers, Multifactor Authentication, Tips for Secure Mobile Application Development .

**UNIT II:**

WAP and Mobile HTML Security :WAP and Mobile HTML Basics , Authentication on WAP/Mobile HTML Sites , Encryption , Application Attacks on Mobile HTML Sites ,Cross-Site Scripting , SQL Injection , Cross-Site Request Forgery , HTTP Redirects , Phishing , Session Fixation , Non-SSL Login , WAP and Mobile Browser Weaknesses , Lack of HTTPOnly Flag Support , Lack of SECURE Flag Support , Handling Browser Cache , WAP Limitations.

**UNIT III:**

Bluetooth Security: Overview of the Technology , History and Standards , Common Uses , Alternatives , Future , Bluetooth Technical Architecture , Radio Operation and Frequency, Bluetooth Network Topology , Device Identification , Modes of Operation , Bluetooth Stack ,Bluetooth Profiles , Bluetooth Security Features , Pairing , Traditional Security Services in Bluetooth, Security “Non-Features” , Threats to Bluetooth Devices and Networks, Bluetooth Vulnerabilities , Bluetooth Versions Prior to v1.2, Bluetooth Versions Prior to v2.1.

**UNIT IV:**

SMS Security: Overview of Short Message Service, Overview of Multimedia Messaging Service, Wireless Application Protocol (WAP), Protocol Attacks , Abusing Legitimate Functionality, Attacking Protocol Implementations, Application Attacks , iPhone Safari , Windows Mobile MMS, Motorola RAZR JPG Overflow, Walkthroughs ,Sending PDUs ,Converting XML to WBXML .

**UNIT V**

Enterprise Security on the Mobile OS: Device Security Options , PIN , Remote , 346 Secure Local Storage , Apple iPhone and Keychain , Security Policy Enforcement ,Encryption ,Full Disk Encryption ,E-mail Encryption , File Encryption , Application Sandboxing, Signing, and Permissions , Application Sandboxing , Application Signing , Permissions , Buffer Overflow Protection ,Windows Mobile , iPhone ,Android ,BlackBerry , Security Feature Summary.

**TEXT BOOK:**

1. “Mobile Application Security”, Himanshu Dwivedi, Chris Clark, David Thiel, TATA McGRAW-Hill.

**REFERENCES:**

1. “Mobile and Wireless Network Security and Privacy”, Kami S.Makki,et al, Springer.

2. “Android Security Attacks Defenses”, Abhishek Dubey, CRC Press.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

MCA

## OPEN STACK CLOUD COMPUTING (Open Elective)

### UNIT I

Keystone OpenStack Identity Service. Installing OpenStack Identity service. Starting OpenStack Image Service. Installing OpenStack Image Service, Configuring OpenStack Image Service with MySQL, Configuring OpenStack Image Service with OpenStack Identity Service, Managing images with OpenStack Image Service, Registering a remotely stored image, Sharing images among tenants, Viewing shared images. Starting OpenStack Compute. Installing OpenStack Compute Controller services, Creating a sandbox Compute server with VirtualBox and Vagrant, Installing OpenStack Compute packages, Stopping and starting Nova services.

Installation of command-line tools on Ubuntu. OpenStack Compute services. Compute Managing security groups. Launching our first Cloud instance, Terminating your instance.

### Unit II.

Installing OpenStack Object Storage. Configuring OpenStack Object Storage Service, Making rings, Stopping and starting OpenStack Object Storage. Configuring OpenStack Object Storage with OpenStack Identity Service, Setting up SSL access, Testing OpenStack Object Storage.

Using OpenStack Object Storage. Installing the swift client tool. Creating containers, Uploading objects, Listing containers and objects, Downloading objects, Deleting containers and objects. Using OpenStack Object Storage ACLs.

Administering OpenStack Object Storage. Preparing drives for OpenStack Object Storage, Managing OpenStack Object Storage cluster with swift-init, Checking cluster health. Benchmarking OpenStack Object Storage. Detecting and replacing failed hard drives , Collecting usage statistics.

### Unit III.

Starting OpenStack Block Storage. Configuring OpenStack Compute for Cinder volume. OpenStack Networking. Configuring Flat networking with DHCP. Configuring VLAN Manager networking. Configuring per tenant IP ranges for VLAN Manager. Automatically assigning fixed networks to tenants, Modifying a tenant's fixed network, Manually associating floating IPs to instances, Manually disassociating floating IPs from instances, Automatically assigning floating IPs. Creating a sandbox Network server for Neutron with VirtualBox and Vagrant. Installing and configuring OVS for Neutron. Creating a Neutron network 203, Deleting a Neutron network, Creating an external Neutron network.

### Unit IV

Using OpenStack Dashboard. Installing OpenStack Dashboard, Using OpenStack Dashboard for key management, Using OpenStack Dashboard to manage Neutron networks, Using OpenStack Dashboard for security group management, Using OpenStack Dashboard to launch instances, Using OpenStack Dashboard to terminate instances, Using OpenStack Dashboard for connecting to instances using VNC, Using OpenStack Dashboard to add new tenants, Using OpenStack Dashboard for user management.

Automating OpenStack Installations. Installing Opscode Chef Server. Installing Chef Client, Downloading cookbooks to support DHCP, Razor, and OpenStack. Installing PuppetLabs Razor and DHCP from cookbooks. Setting up a Chef environment for OpenStack. Booting the first OpenStack node into Razor, Defining a Razor broker, model, and policy. Monitoring the node installation. Using Chef to install OpenStack, Expanding our OpenStack environment.

### Unit V.

Highly Available OpenStack. Using Galera for MySQL clustering. Configuring HA Proxy for MySQL Galera load balancing, Installing and setting up Pacemaker and Corosync, Configuring Keystone and Glance with Pacemaker and Corosync, Bonding network interfaces for redundancy.

Troubleshooting. Understanding logging. Checking OpenStack services. Troubleshooting OpenStack Compute services. Troubleshooting OpenStack Object Storage services. Troubleshooting OpenStack Dashboard. Troubleshooting OpenStack Authentication, Troubleshooting OpenStack Networking, Submitting Bug reports, Getting help from the community.

Monitoring. Monitoring OpenStack services with Nagios. Monitoring Compute services with Munin. Monitoring instances using Munin and Collectd. Monitoring the storage service using StatsD/Graphite. Monitoring MySQL with Hyperic.

**Text Book:**

1. OpenStack Cloud Computing Cookbook - Second Edition, Kevin Jackson , Cody Bunch, October 2013, Packt Publishing-OpenSource.

Reference:

<https://www.packtpub.com/virtualization-and-cloud/openstack-cloud-computing-cookbook-second-edition>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**PRINCIPLES OF INFORMATION SECURITY  
(Open Elective)**

**UNIT – I**

Introduction to Information Security, Need For Security,

**UNIT –II**

Legal Ethical and Professional Issues in Information Security, Planning For Security.

**UNIT – III**

Risk Management, Security Technology: Firewalls and VPNs, Security Technology: Intrusion Detection and Prevention Systems, and Other Security Tools.

**UNIT – IV**

Cryptography, Physical Security, Implementing Information Security,

**UNIT – V**

Security and Personnel, Information Security Maintenance.

**TEXT BOOKS:**

1. Principles of Information Security by Whitman, Thompson

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

MCA

### SOCIAL MEDIA INTELLIGENCE (Open Elective)

#### UNIT – I

The Beginnings of Social Media Intelligence: What is Social Media monitoring? Anecdotal referencing of Social Media Comments, Text Mining, Some Simple Metrics, Using Social Media as Early Warning System.

Fundamental of Opinion Formation: Affecting Opinion versus Biasing Expression, How Do We Form Opinions?, How Do Expectations Affect Opinion?, How Do Expertise and Knowledge Influence How We Form Opinions?, Opinion Formation in a Social Context, Bandwagon behavior and Information Cascades, Implications for Social Media Intelligence.

#### UNIT – II

Why Do We Share our Opinions : Poster versus Lurkers, What Motivates Us to Post/, Posting Motivations and Selection effects, Implications for Social Media Intelligence.

The Social effects of Strangers : How Does Social Context Affect Our Behavior?, How Influential is the Social Context/, How Does Social Context Affect Opinion Expression/, Bandwagon Behavior in Opinion expression, Differentiating Our opinions, Multiple Audience Effects, /can We Trust the Wisdom of Crowds.

#### UNIT – III

Opinion Ecosystems and the Evolution Within : Life Cycle Dynamics, Preference Mismatching and Sequential Dynamics, Social Dynamics, Are Social Media Communities the Cause of Opinion Radicalization ?, Online Echo Chambers, Implications for Social Media Monitoring and Metrics.

Are Social Media Fragmenting the Population ? : Self-Organization, Birds of a Feather Flock Together, Geography No Longer Defines Our Communities, The influential Hypothesis, The New Influential, How Can We Identify Influentials, Influence in e-Commerce, Some Concluding Remarks.

#### UNIT – IV

Managing Social Media Communities for Better Social Media Intelligence: Creating an Inviting Environment, The Benefits of a Well-Managed Opinion Community (and the Costs of Not Managing the Community at All) Quality of Intelligence Depends on the Quality of the Opinion Community, Creating and Manipulating Buzz, Buzz Campaign or Fraud?, Identifying Fraudulent Opinions

Cutting Through the Online Chatter : A New Paradigm for Marketing Research, Measure What Matters, Cast a Wide Net, Analyze the Text, Understand the biases, Establish Links to Performance metrics.

#### UNIT – V

Intelligence Integration : Overview of Marketing Research Methods, Using Social Media for Marketing research, Tracking Brand Health, Understanding Market Structure, Social Shopping, Integration with Data from Other Parts of the Organization, Intelligence Dashboards.

Building Social Media Intelligence into Our Strategies : How Can Social Media Intelligence Help Integrate an Organization's Strategy?, Multichannel Strategies, Rapid Response System, Integrated CRM, Leveraging Social Data, Seeding Strategies.

Moving from Social Media monitoring to Social Media Intelligence : Social Media Intelligence today, Social Media Intelligence tomorrow, Building on the Science of Opinion, tapping into Opinion Ecosystems, Developing an Integrated Strategy.

#### References:

1. SOCIAL MEDIA INTELLIGENCE : by Wendly W.Moe, David A. Schweidel, Cambridge University, edition 2014.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**STORAGE AREA NETWORKS  
(Open Elective)**

**Objectives:**

To understand Storage Area Networks characteristics and components.

To become familiar with the SAN vendors and their products

To learn Fibre Channel protocols and how SAN components use them to communicate with each other

To become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switches

Thoroughly learn Cisco SAN-OS features.

To understand the use of all SAN-OS commands. Practice variations of SANOS features

**UNIT I**

Introduction to Storage Technology Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

**UNIT II**

Storage Systems Architecture Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system

**UNIT III**

Introduction to Networked Storage Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments

**UNIT IV**

Information Availability & Monitoring & Managing Datacenter List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, Architecture of backup/recovery and the different backup/recovery topologies , replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities

Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center.



## **UNIT V**

Securing Storage and Storage Virtualization Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

### **Case Studies**

The technologies described in the course are reinforced with EMC examples of actual solutions. Realistic case studies enable the participant to design the most appropriate solution for given sets of criteria.

### **TEXT BOOK:**

1. EMC Corporation, Information Storage and Management, Wiley.

### **REFERENCE BOOKS:**

1. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**MCA**

**WEB USABILITY  
(Open Elective)**

**UNIT I**

Introduction to Usability, Human Factors,

**UNIT II**

User-Centered Design, Usability Aware Design,

**UNIT III**

Accessibility, Understanding your Users and Goals,

**UNIT IV**

Heuristic Evaluation, Usability Testing,

**UNIT V**

Other Tools and Techniques, Transferring Data into Change

**TEXT BOOKS:**

**Web Usability Hand Book by Mark Pearrow, Thomson Delmar learning**