NEW SCHEME AND SYLLABUS FOR
TWO YEAR POST GRADUATE DEGREE COURSE
MASTER OF COMPUTER APPLICATIONS (M.C.A.)
[W.E.F. 2020-21ADMITTED BATCH]

DEPARTMENT OF INFORMATION TECHNOLOGY AND
COMPUTER APPLICATIONS
AU COLLEGE OF ENGINEERING (AUTONOMOUS)
ANDHRA UNIVERSITY
VISAKHAPATNAM-530 003

III Semester

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MCA 3.1	Computer Networks	4	--	70	30	100	4
MCA 3.2	Python Programming	4	--	70	30	100	4
MCA 3.3	Software Engineering	4	--	70	30	100	4
MCA 3.4	Data Warehousing & Data Mining	4	--	70	30	100	4
MCA 3.5	Elective-II	4	--	70	30	100	4
MCA 3.6	Network Programming Lab	--	3	50	50	100	2
MCA 3.7	Python Programming Lab	--	3	50	50	100	2
Total		20	6	450	250	700	24

Elective II

Image Processing/Mobile Computing/ Network Security and Cryptography/E-Commerce

MCA 3.1	COMPUTER NETWORKS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce to the students the basic requirements of network hardware, software and its architecture.
2. to familiarize the students with layered architecture of the network software and hierarchal nature of the network physical infrastructure
3. to study various network interconnecting devices and other associated network hardware
4. to introduce advanced networking concepts, wireless and wireless sensor networks.

Course outcomes

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

1. understand the design and estimate the requirements for practical setup of a given network scenario and size
2. realize the operation, maintenance and management of the internet by mapping the theoretical networking concepts to the real-time network scenarios
3. demonstrate the applications of wireless networks and overview of advanced networking concepts
4. identify different networking devices and their usage and functionality.

Syllabus

1. Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications.
2. Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN , ATM Networks,
3. Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs.
4. Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Net work Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.
5. Internet Transport Protocols: TRANSPORT Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.
6. Over View of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.
7. Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Brouters, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.
8. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks.

Text Book

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI, ISBN:-81-203-1165-5

Reference Books

1. Data Communications and Networking , Behrouz A Forouzan , Tata McGraw- Hill Co Ltd , Second Edition, ISBN: 0-07-049935-7
2. Computer networks, Mayank Dave, CENGAGE.
3. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.
4. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

MCA 3.2	PYTHON PROGRAMMING	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course Objectives

1. To develop skills on procedural oriented and object oriented programming in Python.
2. To understand and apply different data wrangling techniques using Python.
3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes

At the end of the course, a student should be able to:

1. acquire programming knowledge on Basics of Python
2. acquire programming knowledge on Text and File Handling
3. develop Python programs to Mean, Median, Mode, Correlation
4. acquire programming knowledge on NumPy, Pandas Library
5. acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

Syllabus

1. **Introduction to Python: Rapid Introduction to Procedular Programming, Data Types**: Identifiers and Keywords, Integral Types, Floating Point Types

   Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str.format

   Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections

2. **Python Control Structures, Functions and OOP:Control Structures and Functions**: Conditional Branching, Looping, Exception Handling, Custom Fuctions

   Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics,creating a custom module

   Object Oriented Programming: Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access

   File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files

3. **NumPy Arrays and Vectorized Computation**: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

4. **Data Analysis with Pandas**: An overview of the Pandas package, The Pandas data structure-Series, The DataFrame, The Essential Basic Functionality: Reindexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

5. **Data Analysis Application Examples**: Data munging,Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data
6. **Data Visualization**: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications
2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications
2. Python for Data Analysis, Wes McKinney, Orielly Publications
3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers
4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall
5. Python Cookbook – Recipes for Mastering Python 3,3rdEdition, David Beazley, Brian K. Jones, Oreilly

MCA 3.3	SOFTWARE ENGINEERING	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. to explain the importance of OOSE in Software development.
2. to explain the importance of Requirements Engineering.
3. to explain the role of UML and Testing in Software Development.
4. to explain the entire Software Development Process with aid of case studies.

Course outcomes

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

1. define a problem and perform Requirements Engineering.
2. draw UML diagrams for the requirements gathered
3. implement the designed problem in Object Oriented Programming Language and
4. test whether all the requirements specified have been achieved or not.

Syllabus

1. **Introduction to Software Engineering:** Nature Of The Software, Types Of Software , Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction To Object Orientation, Concepts Of Data Abstraction, Inheritance & Polymorphism, Software Process Models- Waterfall Model, The Opportunistic Model , The Phased Released Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model
2. **Requirements Engineering:** Domain Analysis, Problem Definition And Scope, Requirements Definition, Types Of Requirements, Techniques For Gathering And Analyzing Requirements, Requirement Documents, Reviewing, Managing Change In Requirements.
3. **Unified Modeling Language & Use Case Modeling:** Introduction To UML, Modeling Concepts, Types Of UML Diagrams With Examples; User-Centred Design, Characteristics Of Users, Developing Use Case Models Of Systems, Use Case Diagram, Use Case Descriptions, The Basics Of User Interface Design, Usability Principles, User Interfaces.
4. **Class Design and Class Diagrams**: Essentials Of UML Class Diagrams, Associations And Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features Of Class Diagrams, Interaction And Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component And Deployment Diagrams.
5. **Software Design And Architecture**: The Process Of Design, Principles Leading To Good Design, Techniques For Making Good Design Decisions, Writing A Good Design Document., Pattern Introduction, Design Patterns: The Abstraction-Occurrence Pattern, General Hierarchical Pattern, The Play-Role Pattern, The Singleton Pattern, The Observer Pattern, The Delegation Pattern, The Adaptor Pattern, The Façade Pattern, The Immutable Pattern, The Read-Only Interface Pattern And The Proxy Pattern; Software Architecture Contents Of An Architecture Model, Architectural Patterns: The Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter And MVC Architectural Patterns

6. **Software Testing**: Overview Of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OO Test Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.
7. **Software Project Management**: Introduction To Software Project Management, Activities Of Software Project Management, Structure Of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking And Monitoring.

Text Book

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, Langaniere Mcgraw-Hill

Reference Books

1. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.
2. Software Engineering: A Practitioner's Approach, Roger S Pressman.
3. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-Wesley Professional.

MCA 3.4	DATA WAREHOUSING & DATA MINING	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. To understand the evolution of data warehousing and data mining systems
2. To understand extracting, cleaning and transformation of data into a warehouse.
3. To learn the principles of statistics, information theory, machine learning and other areas AI and implementation of data mining techniques.
4. To understand pattern mining using classification and clustering methods.

Course outcomes

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

1. The student understands the differences between OLTP and OLAP.
2. The student learns how data cube technology supports summarization and querying high dimensional data.
3. The student is introduced to similarity, distance, information gain and other performance and error metrics used for evaluation of mining results.
4. The student is introduced to various approaches to association rule mining , supervised and unsupervised learning and the corresponding classification and clustering approaches involving decision trees, Bayesian approaches, model based and agglomerative approaches.

Syllabus

1. **Introduction to Data Mining**: Motivation and importance, What is Data Mining, Relational Databases, Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications, Data Mining Functionalities, Interestingness of a pattern Classification of Data Mining Systems, Major issues in Data Mining.
2. **Data Warehouse and OLAP Technology for Data Mining**: Data Warehouse, Multi- Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining
3. **Data Preprocessing**: Pre-process the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation
4. **Data Mining Primitives, Languages and system Architectures,Data Mining Primitives**: What defines a Data Mining Task?, A Data Mining query language, Designing Graphical Use Interfaces Based on a Data Mining Query language,Architectures of Data Mining Systems
5. **Concept Description**: Characterization and comparison ,Concept Description?, Data Generalization and summarization-based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between different Classes, Mining Descriptive Statistical Measures in large Databases

6. **Mining Association rule** in large Databases, Association Rule Mining, Mining Single- Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining
7. **Classification and prediction**, Concepts and Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back-propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods like k-Nearest Neighbor Classifiers, Case- Based Reasoning, Generic Algorithms, Rough Set Approach, Fuzzy Set Approaches, Prediction, Classifier Accuracy
8. **Cluster Analysis**: Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods.

Text Book

1. Data Mining Concepts and Techniques, Jiawei Han and Kamber, Morgan Kaufman Publications

Reference Books

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

MCA 3.5	Elective-II IMAGE PROCESSING	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to explain fundamentals of image processing concepts
2. to provide mathematical foundation of image enhancement, image compression and image segmentation.
3. to explain about morphology and its applications in image processing.
4. to explain various methods and techniques for image transformation.

Course outcomes

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

1. develop algorithms for fundamental concepts in Image processing.
2. perform image enhancement , image compression and image segmentation using various methods.
3. implement image transformation techniques

Syllabus

1. **Fundamentals of Image Processing**: Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels, distance measures, connectivity , Image Geometry, Photographic film. Histogram: Definition, decision of contrast basing on histogram, operatio ns basing on histograms like image stretching, image sliding, Image classification. Definition and Algorithm of Histogram equalization.
2. **Image Transforms**: A detail discussion on Fourier Transform, DFT,FFT, properties, WALSH Transform , WFT, HADAMARD Transform, DCT.
3. **Image Enhancement**: (by SPATIAL Domain Methods)Arithmetic and logical operations, pixel or point operations, size operations, Smoothing filters-Mean, Median, Mode filters – Comparative study, Edge enhancement filters – Directorial filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, prewitt filter, Contrast Based edge enhancement techniques. – Comparative study, Low Pass filters, High Pass filters, sharpening filters. – Comparative Study, Comparative study of all filters, Color image processing.
4. **Image enhancement**: (By FREQUENCY Domain Methods) -esign of Low pass, High pass, EDGE Enhancement, smoothening filters in Frequency Domain. Butter worth filter, Homomorphic filters in Frequency Domain Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain.
5. **Image compression**: Definition: A brief discussion on – Run length encoding, contour coding, Huffman code, compression due to change in domain, compression due to quantization Compression at the time of image transmission. Brief discussion on:- Image Compression standards.
6. **Image Segmentation**: Definition, characteristics of segmentation.

7. Detection of Discontinuities, Thresholding Pixel based segmentation method. Region based segmentation methods – segmentation by pixel aggregation, segmentation by sub region aggregation, histogram based segmentation, spilt and merge technique. Use of motion in segmentation (spatial domain technique only)
8. **Morphology**: Dilation, Erosion, Opening, closing, Hit-and-Miss transform, Boundary extraction, Region filling, connected components, thinning, Thickening, skeletons , Pruning Extensions to Gray – Scale Images Application of Morphology in I.P.

Text Book

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods Addision Wesley

Reference Books

1. Fundamentals of Electronic Image Processing by Arthyr –R – Weeks, Jr.(PHI)
2. Image processing, Analysis, and Machine vision by Milan Sonka vaclan Halavac Roger Boyle, Vikas Publishing House.

MCA 3.5	Elective II MOBILE COMPUTING	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. to introduce students to infrastructure, principles, technologies, and applications of mobile computing and wireless IP
2. to familiarize students with wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices
3. understand the data issues in mobile computing including data replication and data dissemination.

Course outcomes

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

1. describe the infrastructure, principles, technologies, and applications of mobile computing technologies
2. understand wireless LANs, topologies and key concepts in wireless networking
3. understand key database issues in mobile computing, adaptive clustering and various data delivery mechanisms such as push-based mechanisms, pull-based mechanisms.

Syllabus

1. **Introduction to Mobile Communications and Computing**: Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.
2. **Wireless LANs:** Introduction, Advantages and Disadvantages of WLANs, WLAN Topologies, Introduction to Wireless Local Area Network standard IEEE 802.11, Comparison of IEEE 802.11a, b, g and n standards, Wireless PANs, Hiper LAN, Wireless Local Loop
3. **Wireless Networking:** Introduction, Various generations of wireless networks, Fixed network transmission hierarchy, Differences in wireless and fixed telephone networks, Traffic routing in wireless networks, WAN link connection technologies, X.25 protocol, Frame Relay, ATM, Virtual private networks, Wireless data services, Common channel signaling, Various networks for connecting to the internet.
4. **Database Issues:** Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations.
5. **Data Dissemination:** Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.
6. **Mobile IP and Wireless Application Protocol:** Introduction to Mobile IP, Introduction to Wireless Application Protocol, Application layer.

Text Books

1. Gottapu Sasibhushana Rao, “Mobile Cellular Communication”, Pearson Education, First Edition, 2013.
2. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002.

MCA 3.5	Elective II NETWORK SECURITY AND CRYPTOGRAPHY	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to key concepts in confidentiality and data integrity and issues involved in network security
2. to familiarize students with various cryptographic techniques
3. introduce students to number theory and algorithms in Public Key Cryptography
4. explore different types of security threats in IP, web, systems, electronic mail and their remedies.

Course outcomes

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

1. understand the importance of network and data security in the Internet and in the distributed environments
2. apply various cryptographic techniques in different contexts
3. identify the different types of network security issues and their remedies.

Syllabus

1. **Introduction**: Confidentiality -- Data Integrity -- Authentication -- Non-Repudiation-- Overview of Issues involved.
2. **Classical Encryption Techniques**: Monoalphabetic, Substitution Methods, Polyalphabetic Substation Methods -- Permutation Methods -- Cryptanalysis of these Methods.
3. **Modern Encryption Techniques**: Simplified DES -- DES -- Triple DES -- Block Cipher , Design Principles -- Block Cipher Modes of Operation. IDEA -- Security Issues Involved with these methods.
4. **Confidentiality Using Conventional Encryption**: Placement of Encryption -- Traffic Confidentiality -- Key Distribution -- Random Number , Generation.
5. **Introduction to Number Theory**: (Basics Pertaining to Security Related Algorithms).
6. **Public Key Cryptography**: Principles -- RSA Algorithm. Message Authentication and Hash Functions -- Hash an MAC Algorithms. Digi Signatures and Authentication Protocols -- Authentication Applications
7. Basic Overview of :Electronic Mail Security -- IP Security -- WEB Security
8. **System Security** : Intruders, Viruses and Worms – Firewalls.

Text Book

1. Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education Asia

Reference Books

1. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill
2. Handbook of Applied Cryptography.

MCA 3.5	Elective-II E-COMMERCE	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to various application of e-commerce in commerce, organizational and consumer domains
2. familiarize students with types of Electronic Payment Systems, their design principles and the risks in these systems
3. introduce the key concepts of Electronic Data Inter Change and Intra Organizational Commerce
4. explore the advertising, marketing and multimedia concepts in e-commerce.

Course outcomes

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

1. be familiar with the key application areas of e-commerce in different domains
2. understand the types of Electronic Payment Systems and risks involved in these systems
3. understand key concepts in Electronic Data Inter Change and Intra Organizational Commerce including Work Flow Automation and Supply Chain Management
4. be familiar with advertising, marketing and multimedia concepts in e-commerce such as information based marketing, consumer search, information retrieval and filtering.

Syllabus

1. Introduction: Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile Process Models.
2. Electronic Payment Systems – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems
3. Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value Added Networks.
4. Intra Organizational Commerce, Macro Forces And Internal Commerce, Work Flow Automation and Coordination, Customization And Internal Commerce, Supply Chain Management.
5. Business Cases for Document Library, Digital Document Types, Corporate Data Ware-Houses.
6. Advertising And Marketing: Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, Information Filtering.
7. Multimedia-Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

Text Book

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

Reference Books

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

MCA 3.6	NETWORK PROGRAMMING LAB	
Instruction: 3 Periods/week		**Credits:2**
Internal: 50 Marks	**University Exam: 50 Marks**	**Total: 100 Marks**

Course objectives

1. identification of well known ports on a remote system and providing user interface to contact them
2. development of chat application including one-to-one and broadcast
3. development of HTTP server and retrieval of data from remote database by executing SQL queries
4. sending and receiving mails using mail clients including POP and SMTP
5. transfer of files between systems and development of TFTP client

Course outcomes

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

1. identifying well known ports on a remote system and be able to simulate Telnet
2. develop chat application by opening socket connections
3. develop HTTP server to implement GET, POST, HEAD, DELETE commands and retrieve data from remote database
4. send email using SMTP commands and retrieve and manipulate mail box using POP commands
5. transfer files between two systems without protocols and develop a TFTP client.

List of programs

1. Identifying well known ports on a Remote System :By trying to listen to the various well known ports by opening client connections. If the exception does not occur then the remote port is active else the remote port is inactive.
2. Writing a Chat application :
    i. One-One: By opening socket connection and displaying what is written by one party to the other.
    ii. Many-Many (Broad cast): Each client opens a socket connection to the chat server and writes to the socket. Whatever is written by one party can be seen by all other parties.
3. Data retrieval from a Remote database: At the remote database a server listens for client connections. This server accepts SQL queries from the client, executes it on the database and sends the response to the client.
4. Mail Client:
    i. POP Client : Gives the server name , user name and password retrieve the mails and allow manipulation of mail box using POP commands.
    ii. SMTP Client : Gives the server name, send e-mail to the recipient using SMTP commands

5. Simulation of Telnet: Provide a user interface to contact well-known ports, so that client- server interaction can be seen by the user.
6. Simple file transfer between two systems (without protocols): By opening socket connection to our server on one system and sending a file from one system to another.
7. TFTP- Client:To develop a TFTP client for file transfer. (Unix Network programming- Stevens.)
8. HTTP-Server: Develop a HTTP server to implement the following commands. GET, POST, HEAD, DELETE. The server must handle multiple clients.

Reference Books

1. Java Network Programming, Harol, Orielly Publications
2. An Introduction to Computer Networking, Kenneth C. Mansfield Jr and James L. Antonakos, Pearson Education Asia

MCA 3.7	PYTHON PROGRAMMING LAB	
Instruction: 3 Periods/week		**Credits:2**
Internal: 50 Marks	**University Exam: 50 Marks**	**Total: 100 Marks**

Course objectives

1. familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling
2. introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation
3. familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and dataframes
4. introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others
5. implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course outcomes

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

1. implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries
2. calculate statistical measures using Python such as measures of central tendency, correlation
3. use Python data related libraries such as Numpy and Pandas and create data visualizations
4. implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

Syllabus

1. Python Programs on lists & Dictionaries
2. Python Programs on Searching and sorting
3. Python Programs on Text Handling
4. Python Programs on File Handling
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation
6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation
7. Python Programs on NumPy Arrays, Linear algebra with NumPy
8. Python Programs for creation and manipulation of DataFrames using Pandas Library
9. Write a Python program for the following**.**
    - Simple Line Plots,
    - Adjusting the Plot: Line Colors and Styles, Axes Limits, Labeling Plots,
    - Simple Scatter Plots,

- Histograms,
- Customizing Plot Legends,
- Choosing Elements for the Legend,
- Boxplot
- Multiple Legends,
- Customizing Colorbars,
- Multiple Subplots,
- Text and Annotation,
- Customizing Ticks

10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features
11. Python Program for Compressing data via dimensionality reduction: PCA
12. Python Programs for Data Clustering
13. Python Programs for Classification
14. Python Programs for Model Evaluation: K-fold cross validation

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall
2. Chris Albon, “Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning”, O’REILLY Publisher,2018
3. Mark Summerfield, Programming in Python 3--A Complete Introduction to the Python Language, Second Edition, Additson Wesley
4. Phuong Vo.T.H , Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd
5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd
6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd
7. Sebastian Raschka& Vahid Mirjalili, “Python Machine Learning”, Packt Publisher, 2017

IV Semester

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MCA 4.1	Data Science	4	--	70	30	100	4
MCA 4.2	Elective III	4	--	70	30	100	4
MCA 4.3	Project Work	--	6	50	50	100	14
Total		8	6	190	110	300	22

Elective III

Internet of Things (IoT) / Machine Learning / Cloud Computing / Distributed Systems

MCA 4.1	DATA SCIENCE	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to the process involved in data science projects
2. familiarize students with basics of preparation, exploration and visualization of data
3. introduce students to modeling methods such as clustering, classification, regression and model evaluation
4. introduce students to recommendation engines and various methods in time series forecasting
5. familiarize students with basics of anomaly detection and feature selection.

Course outcomes

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

1. describe about Data Science and its process
2. differentiate between the classification and regression methods
3. apply clustering and evaluate the methods
4. understand and analyze the text mining and time series forecasting applications.
5. assess different feature selection methods and use in applications.

Syllabus

1. **Introduction:** Data Science, Data Science Process: Process, Data, Data Preparation, Modeling. **Data Exploration:** Objectives, Types of data, Descriptive Statistics, Data Visualization, Roadmaps for data Exploration
2. **Classification Methods:** K-Nearest Neighbors, Decision Trees, Rule Induction, Naive Bayesian, Ensemble Learners **Regression Methods:** Linear Regression, Logistic Regression
3. **Clustering**: k-means, DBSCAN, Self-Organizing Maps **Model Evaluation**: Confusion Matrix, ROC and AUC, Lift Curves, Implementation
4. **Recommendation Engines:** Concepts, Collaborative Filtering, Content Based Filtering, Hybrid Recommendation **Time Series Forecasting:** Decomposition, Smoothing, Regression and Machine Learning Methods, Performance Evaluation
5. **Anomaly Detection:** Concepts, Distance and Density based Outlier Detection, Local Outlier Factor **Feature Selection:** Classifying Feature Selection Methods, PCA, and Information Theory based Filtering; Chi-Square based Filtering, Wrapper type feature selection.

Text Book

1. Vijay Kotu, BalaDeshpande, Data Science Concepts and Practice, Second Edition, Morgan Kaufmann Publishers, An imprint of Elsevier, 2019

References

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly 2014
2. Joel Grus, Data Science from scratch, Second Edition, O'Reilly 2019.

MCA 4.2	Elective-III Internet of Things (IoT)	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. provide students a conceptual framework and architectural view of IoT
2. introduce students to design principles for connected devices and for web connection
3. familiarize students with acquiring, organizing and processing of data and analytics using cloud platform and IoT cloud-based services
4. introduce students to key concepts in sensors, RFIDs, and wireless sensor networks
5. introduce students to prototyping embedded devices for IoT and various IoT supported hardware platforms.

Course outcomes

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

1. describe the framework, architecture of IoT, technology behind IoT and the key components that makeup an IOT system
2. understand the design principles for connected devices, for web connection and web communication protocols for connected devices
3. collect, store, organize and process data using IoT cloud-based services and appreciate the role of big data, cloud computing and data analytics in a typical IoT system
4. understand key concepts in sensors, RFIDs, and wireless sensor networks including applications in industrial IoT and automotive IoT,
5. understand embedded computing basics, prototyping, designing software for IoT applications and various IoT supported hardware platforms including Raspberry pi, ARM Cortex Processors.

Syllabus

1. Internet of Things - An Overview: Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT.
2. Design Principles for Connected Devices: IoT/M2M Systems Layers and Designs Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway
3. Design Principles for Web connection: Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected-Devices Network using Gateway, SOAP, REST, HTTP RESTful and Web Socket's
4. Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage, Organizing the Data, Transactions, Business Processes, Integration and Enterprise Systems, Analytics, Knowledge Acquiring, Managing and Storing Processes; Data Collection, Storage and Computing Using a Cloud Platform; Cloud Computing Paradigm for Data Collection, Storage and Computing, everything as a Service and Cloud Service Models, IoT Cloud-Based Services Using the Xively.

5. Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology.
6. Prototyping the Embedded Devices for IoT and M2M: Embedded Computing Basics, Embedded Platforms for Prototyping, Things Always Connected to the Internet; Prototyping and Designing the Software for IoT Applications; Prototyping Embedded Device Software, Devices, Gateways, Internet and Web/Cloud Services Software-Development, Prototyping Online Component APIs and Web APIs Key Concepts.
7. Overview of IoT supported Hardware platforms: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo IoT Case Studies; Design Layers, Design Complexity and Designing Using Cloud PaaS; IoT/IIot Applications in the Premises, Supply-Chain and Customer Monitoring.

Text Books

1. Internet of Things by Raj Kamal, McGrahill Publications 2017.
2. Internet of Things Principles and Paradigms by Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2016

MCA 4.2	Elective-III MACHINE LEARNING	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to the approaches to machine learning and related algorithms
2. familiarize students with ideas of concept learning, version spaces and issues regarding data sources
3. understand representation and learning using Decision Trees, Neural Networks, Genetic Algorithms
4. introduce students to Bayesian approaches and key concepts of Expectation Maximization
5. introduce students to inductive and analytical learning problems and related concepts of inductive bias, using prior knowledge to initialize the hypothesis.

Course outcomes

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

1. describe learning tasks and various approaches, algorithms in machine learning
2. understand concept learning, version spaces and related concepts of bias-free learning and active queries
3. represent and formulate problems in Decision Trees, Neural Networks, Genetic Algorithms
4. understand the basics of Bayes theorem and key concepts of Expectation Maximization in Bayesian approaches.

Syllabus

1. **Introduction:** Introduction to Machine Learning, learning task- illustration, Approaches to Machine Learning, Machine Learning algorithms- Theory, Experiment in biology and Psychology.
2. **Concept Learning**: Introduction, Concept Learning Task- Notation, Concept Learning Search, Version spaces, Candidate Elimination Algorithm, Inductive Bias, Biased hypothesis Space, Unbiased Learner, Bias-free Learning, Active queries, Mistake bound/PAC model – basic results. Overview of issues regarding data sources, success criteria
3. **Decision Tree Learning**: Decision Tree Representation, Basic decision Tree Learning, Inductive bias in Decision tree Learning, Issues in Decision Tree Learning, Minimum Description Length Principle, Occam's razor, Learning with active queries
4. **Neural Network Learning:** Neural Network Representation, Problems for Neural Network Learning, Perceptions and gradient descent, Multi Layer Network and Back propagation Algorithm, Illustrative Example of Back Propagation Algorithm- Face Recognition, Advanced Topics in ANN.
5. **Bayesian Approaches**: Basics of Bayes Theorem and Concept Learning, Expectation Maximization, Minimum Description Length Principle, Navie Bayes Classifier, Bayesian Belief Networks, EM Algorithm, K-Means Algorithm, Hidden Markov Models Instance-Based Techniques; Lazy vs. eager generalization, k nearest neighbor, Locally Weight Representation, Case-based Reasoning

6. **Analytical Learning**: Inductive and Analytical Learning problems, Learning with perfect Domain Theory, Explanation Based Learning, Inductive Bias in EBL, Search Control Knowledge with EBL, Inductive- Analytical Approaches to Learning, Using prior Knowledge for Initialize the Hypothesis, and Altering Search objective, FOCL Algorithm.
7. **Genetic Algorithms**: Representation of Hypothesis as GA,, Genetic Operators, Fitness function and Selection, Hypothesis Space search, Genetic Programming, Models of Evolution and Learning, Parallelizing GA, Different search methods for induction.

Text Books

1. Machine Learning, Tom Mitchell , McGraw Hill,1997
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani & Jerome Friedman, Springer Verlag, 2001

Reference Books

1. Pattern Classification, Richard 0. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc.,2001
2. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press, 1995

MCA 4.2	Elective-III CLOUD COMPUTING	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to the benefits, limitations, security concerns and regulatory issues in cloud computing
2. familiarize students with the hardware and infrastructure in cloud computing
3. provide the driving forces for Software as a Service, mobile device integration, local clouds and thin clients
4. introduce students to migrating to the cloud and best practices for migration.

Course outcomes

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

1. describe the benefits and limitations of cloud computing
2. identify the architecture and infrastructure of cloud computing including web APIs, cloud storage and deployment methods of cloud computing
3. understand the driving forces for Software as a Service
4. understand the concepts in development, troubleshooting, management of cloud computing applications
5. describe the best practices in cloud computing and understand how cloud computing might evolve in future.

Syllabus

1. Cloud Computing Basics - Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.
2. Organization and Cloud Computing - When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues, Cloud Computing with the Titans - Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBM Partnerships.
3. Hardware and Infrastructure - Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIs, Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.
4. Software as a Service - Overview, Driving Forces, Company Offerings, Industries Software plus Services - Overview, Mobile Device Integration, Providers, Microsoft Online.
5. Developing Applications - Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

6. Local Clouds and Thin Clients - Virtualization in Your Organization, Server Solutions, Thin Clients, Case Study: McNeilus Steel.
7. Migrating to the Cloud - Cloud Services for Individuals, Cloud Services Aimed at the Mid- Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

Text Book

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

MCA 4.2	Elective III **Distributed Systems**	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course objectives

1. introduce students to the principles, architecture of distributed databases
2. understand the concepts of global queries, fragment queries and equivalence transformations
3. familiarize students with concepts of atomicity, concurrency control for distributed transactions and distributed deadlocks
4. introduce students to multidatabase concurrency control and multidatabase recovery.

Course outcomes

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

1. describe the key principles, architecture and integrity constraints in distributed databases
2. transform global queries into fragment queries and understand strategies for optimized access
3. understand the management of distributed transactions, concurrency control for distributed transactions, distributed deadlocks, detection and resolution of inconsistency
4. describe multidatabase concurrency control, multidatabase recovery and database interoperability

Syllabus

1. Features of Distributed versus Centralized Databases, Principles Of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases , Types of Data Fragmentation, Integrity Constraints in Distributed Databases.
2. Translation of Global Queries to Fragment Queries, Equivalence Trans-formations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.
3. Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries.
4. The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions.
5. Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.
6. Reliability, Basic Concepts, Nonblocking Commitment Protocols, Re-liability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection
7. Architectural Issues, Alternative Client/Server Architectures, Cache Consistency Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution , Transaction Management, Transaction Management in Object DBMSs , Transactions as Objects.

8. Database Integration, Scheme Translation, Scheme Integration, Query Processing Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues. Transaction Management Transaction and Computation Model Multidatabase Concurrency Control, Multidatabase Recovery, Object Orientation And Interoperability Object Management Architecture CORBA and Database Interoperability Distributed Component Model COM/OLE and Database Interoperability, PUSH-Based Technologies.

Text Books

1. Distributed Database Principles and Systems, Stefano Ceri, Giuseppe Pelagatti, McGraw-Hill
2. Principles of Distributed Database Systems, M.Tamer Ozsu, Patrick Valduriez - Pearson Education.
3. Distributed Database Principles and Systems, Stefano Ceri, Giuseppe Pelagatti, McGraw-Hill.

Reference Book

1. Principles of Distributed Database Systems, M.Tamer Ozsu, Patrick Valduriez - Pearson Education.

IV Semester Project Guidelines

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MCA 4.3	Project Work	--	--	50	50	100	14

1. **Three Stages In Project adjudication:**
   Stage I: Presentation of Concept Note & Problem Approval by Guide
   Stage II; Progress Approval by System Demonstration with results Internal -50 Marks
   Stage III: Final Presentation with Documentation & External Viva-Voce - 50 Marks
2. **Candidates can do their thesis work within the department or in association with any industry/research organization. In case of thesis done in association with an industry/research organization, one advisor (Guide) should be from the department and one advisor(CO-Guide) should be from the industry/research organization.**
3. **A publication of a paper on the thesis work in a National/International Conference proceedings with presentation certificate or a paper on the thesis work be communicated to a National/International Journal & accepted for publication for the submission of thesis at the end of 4th semester is desirable.**
4. **The external examiner shall be nominated by the Chairman, Board of Examiners in ITCA as per the norms of the University.**

Code	Name of the subject			Max. Marks		Total	Credits
		Theory (Hrs)	Lab (Hrs)	Ext.	Int.		
Total (Complete Course)		**68**	**24**	**1540**	**860**	**2400**	**94**