UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

Syllabus

for

Master of Computer Applications

of

Third Year

(Effective from the Session: 2015-16)
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Period</th>
<th>Evaluation Scheme</th>
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<td>NMCA-511/NMCA-513</td>
<td>Computer Network / Dot Net Framework &amp; C#*</td>
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<td>Computer Network Lab/ Dot Net Framework &amp; C# Lab*</td>
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<td>Project Based On Software Engineering</td>
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<td>NGP-501</td>
<td>General Proficiency</td>
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Note: *To be opted by the students who did not study these courses in earlier semesters.
Year-III, Semester VI

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List of Electives for MCA

**MCA-Elective-II**

- NMCAE 21          Network Security & Cryptography
- NMCAE 22          Neural Network
- NMCAE 23          Pattern Recognition
- NMCAE 24          Cloud Computing
- NMCAE25*          Computer Network
- NMCAE 26*          Dot Net Framework & C#

**MCA-Elective-III**

- NMCAE 31           Image Processing
- NMCAE 32           Simulation & Modeling
- NMCAE 33           Software Project Management
- NMCAE 34           Real Time Systems

**MCA-Elective-IV**

- NMCAE 41           Advanced Database Management Systems
- NMCAE 42           Information Storage & Management
- NMCAE 43           Software Testing
- NMCAE 44           Big Data

Note:- *To be opted by the students who did not study these courses in earlier semesters.
NMCA-511 COMPUTER NETWORK

Unit -I

Unit-II

Unit - III

Unit - IV

Unit-V

Text Books :
  1. Forouzen, "Data Communication and Networking", TMH
  2. A.S. Tanenbaum, Computer Networks, Pearson Education

References :
  2. G. Shanmugarathinam, ”Essential of TCP/ IP”, Firewall Media
Unit-I: Introduction

Unit-II: Software Requirement Specifications (SRS)


Unit-III: Software Design

Unit-IV: Software Testing

Unit-V: Software Maintenance and Software Project Management

References:
4. Pankaj Jalote, Software Engineering, Wiley
NMCA 513: Dot Net Framework and C#

Unit-I

Unit-II
C -Sharp Language (C#): Introduction, Data Types, Identifiers, Variables, Constants, Literals, Array and Strings, Object and Classes, Inheritance and Polymorphism, Operator Overloading, Interfaces, Delegates and Events. Type conversion.

Unit-III

Unit-IV
Advanced Features Using C#: Web Services, Window Services, Asp.net Web Form Controls, ADO.Net. Distributed Application in C#, Unsafe Mode, Graphical Device interface with C#.

Unit-V

References
1. Wiley,” Beginning Visual C# 2008”,Wrox
2. Fergal Grimes,” Microsoft .Net for Programmers”. (SPI)
3. Balagurusamy,” Programming with C#”, (TMH)
NMCA-551 Computer Network Lab

1. Programs using TCP Sockets (like date and time server & client, echo server & client, etc.)
2. Programs using UDP Sockets (like simple DNS)
3. Programs using Raw sockets (like packet capturing and filtering)
4. Programs using RPC
5. Simulation of sliding window protocols
**MCA-Elective-II**

**NMCAE21: Network Security & Cryptography**

**Unit-I**
Introduction to security attacks, services and mechanism, Classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers.

Modern Block Ciphers: Block ciphers principles, Shannon’s theory of confusion and diffusion, fiestal structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES

**Unit-II**
Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm,

Advanced Encryption Standard (AES) encryption and decryption

Fermat’s and Euler’s theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem,

Principals of public key crypto systems, RSA algorithm, security of RSA

**Unit-III**
Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA)

Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,

**Unit-IV**
Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure.

Authentication Applications: Kerberos

Electronic mail security: pretty good privacy (PGP), S/MIME.

**Unit-V**

Introduction to Secure Socket Layer, Secure electronic, transaction (SET)

System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls
References:
2. Behrouz A. Frouzan: Cryptography and Network Security, TMH
NMCAE22: Neural Networks

Unit-I:
Neurocomputing and Neuroscience
Historical notes, human Brain, neuron Mode l, Knowledge representation, AI and NN. Learning process: Supervised and unsuperv ised learning, Error correction learning, competitive learning, adaptation, statistical nature of the learning process.

Unit-II:
Data processing
Scaling, normalization, Transformation (FT/FFT), principal component analysis, regression, co-variance matrix, eigen values & eigen vectors. Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation, multilayer perceptron, least mean square algorithm, gradient descent rule, nonlinearily separable problems and bench mark problems in NN.

Unit-III
Multilayered network architecture, back propagation algorithm, heuristics for making BP-algorithm performs better. Accelerated learning BP (like recursive least square, quick prop, RPROP algorithm), approximation properties of RBF networks and comparison with multilayer perceptron.

Unit-IV
Recurrent network and temporal feed-forward network, implementation with BP, self organizing map and SOM algorithm, properties of feature map and computer simulation. Principal component and Independent component analysis, application to image and signal processing.

Unit-V

References:
1. J.A. Anderson, An Introduction to Neural Networks, MIT
2. Hagen Demuth Beale, Neural Network Design, Cengage Learning
3. R.L. Harvey, Neural Network Principles, PHI
4. Kosko, Neural Network and Fuzzy Sets, PHI
NMCAE23: Pattern Recognition

Unit-I

Unit-II
Statistical Pattern Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions,

Unit – III
Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Unit - IV

Unit - V

References:
UNIT I
Introduction

UNIT II
Cloud Services
Types of Cloud services: Software as a Service-Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services.Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.

UNIT III
Collaborating Using Cloud Services

UNIT IV
Virtualization For Cloud
Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

UNIT V
Security, Standards And Applications

TEXT BOOKS:

REFERENCES:
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
Unit -I

Unit -II

Unit - III

Unit - IV

Unit-V

Text Books :
1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education

References :
2. G. Shanmugarathinam, ”Essential of TCP/ IP”, Firewall Media
NMCAE 26*: Dot Net Framework and C#

Unit-I

Unit-II
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Unit-III

Unit-IV
Advanced Features Using C#: Web Services, Window Services, Asp.net Web Form Controls, ADO.Net. Distributed Application in C#, Unsafe Mode, Graphical Device interface with C#.

Unit-V

References
1. Wiley,” Beginning Visual C# 2008”, Wrox
2. Fergal Grimes,” Microsoft .Net for Programmers”. (SPI)
3. Balagurusamy,” Programming with C#”, (TMH)
MCA-Elective-III

NMCAE 31: Image Processing

UNIT-I
Introduction and Fundamentals

Image Enhancement in Frequency Domain
Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

UNIT-II
Image Enhancement in Spatial Domain
Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

UNIT-III
Image Restoration
A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

UNIT-IV
Morphological Image Processing
Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

UNIT-V Registration
Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation
References:

NMCAE32:  Simulation and Modeling

Unit-I
System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.

Unit-II
System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

Unit-III
Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

Unit-IV
System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

Unit-V
Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

References
UNIT-I: Introduction and Software Project Planning

UNIT-II: Project Organization and Scheduling

UNIT-III: Project Monitoring and Control

UNIT-IV: Software Quality Assurance and Testing

UNIT-V: Project Management and Project Management Tools

References:
2. Royce, Software Project Management, Pearson Education
UNIT-I: Introduction

UNIT-II: Real Time Scheduling

UNIT-III: Resources Sharing

UNIT-IV: Real Time Communication

UNIT-V: Real Time Operating Systems and Databases
Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases.

References:
MCA-Elective-IV

NMCAE41: Advanced Database Management Systems

UNIT-I
Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascadeless schedules.

UNIT –II
Lock based protocols, time stamp based protocols, Multiple Granularity and Multiversion Techniques, Enforcing serializability by Locks, Locking system with multiple lock modes, architecture for Locking scheduler

UNIT III
Distributed Transactions Management, Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions, Moss Concurrency protocol.

UNIT –IV

UNIT V
Distributed Query Processing, Multiway Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques

References
2. Ramakrishna and Gehrke,’ Database Management System, Mc Graw Hill
3. Garcia-Molina, Ullman,Widom,’ Database System Implementation’ Pearson Education
4. Ceei and Pelagatti,’Distributed Database’, TMH
Unit-I: Introduction to Storage Technology
Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

Unit-II: Storage Systems Architecture
Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

Unit-III: Introduction to Networked Storage

Unit-IV: Introduction to Information Availability
Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques.

Unit-V: Managing & Monitoring
Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

References
NMCAE43: Software Testing

Unit-I: Introduction
Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.

Unit-II: White Box and Black Box Testing
White box testing, static testing, static analysis tools, Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, state/graph based testing, Model based testing and model checking, Differences between white box and Black box testing.

Unit-III: Integration, System, and Acceptance Testing
Top down and Bottom up integration, Bi-directional integration, System integration, Scenario Testing, Defect Bash, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing, Acceptance testing: Acceptance criteria, test cases selection and execution,

Unit-IV: Test Selection & Minimization for Regression Testing
Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.

Unit-V: Test Management and Automation

References:
## NMCAE44: BIG DATA

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<tr>
<td>I</td>
<td>UNDERSTANDING BIG DATA</td>
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<td>What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics</td>
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<td>II</td>
<td>NOSQL DATA MANAGEMENT</td>
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<td>Introduction to NoSQL, aggregate data models, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations</td>
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<td>BASICS OF HADOOP</td>
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<td>Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures</td>
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<td>MAP REDUCE APPLICATIONS</td>
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<td>Map Reduce workflows, unit tests with MRUnit, test data and local tests – anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats</td>
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<td>HADOOP RELATED TOOLS</td>
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<td>Hbase, data model and implementations, Hbase clients, Hbase examples – praxis, Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Pig, Grunt, Pig data model, Pig Latin, developing and testing Pig Latin scripts, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation – HiveQL queries</td>
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**Text Books:**