Scheme and Syllabus of Master of Technology (Computer Science Engineering) Batch 2015

By Board of Studies CSE/IT/AMT
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<tr>
<th>Course Code</th>
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1st Semester
MTCS-101 Advanced Software Engineering

Section- A

Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, using Z to represent an example software component, the ten commandments Of formal methods, Formal methods- the road ahead.

Section- B
Component-Based Software Engineering: CBSE process, Domain engineering, Component-based development, Classifying and retrieving components and economics of CBSE.

Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues

Section- C
Web Engineering: Attributes Of web-based applications, the WebE process, a framework for WebE. Formulating, Analysing web-based systems, design and testing for web-based applications, Management issues.

Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.

Section- D

Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy Of CASE tools, integrated CASE environments, Integration architecture, and CASE repository

Recommended Books
MTCS-102 ADVANCED COMPUTER ARCHITECTURE

Section-A
Fundamentals of Processors: Instruction set architecture; single cycle processors, hardwired and micro-coded FSM processors; pipelined processors, multi-core processors; resolving structural, data, control and name hazards; analyzing processor performance.

Section-B
Fundamentals of Memories: memory technology; direct-mapped, associative cache; write-through and write-back caches; single-cycle, FSM, pipe-lined cache; Analyzing memory performance.

Section-C
Advanced Processors: Superscalar execution, out-of-order execution, register renaming, memory disambiguation, dynamic instruction scheduling, branch prediction, speculative execution; multi-threaded, VLIW and SIMD processors.

Section-D
Advanced Memories: non-blocking cache memories; memory protection, translation and virtualization; memory synchronization, consistency and coherence.

Recommended Books:
MTCS-103 INFORMATION SECURITY

Section -A

Section- B

Section-C

Section- D


Suggested Readings
MTCS-104 Advanced Database Systems

Section A

Advanced Transaction Processing and Concurrency Control:
Transaction Concepts, Concurrency Control: Locking Methods, Timestamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems.

Section B
Query Compiler: Introduction, parsing, generating logical query plan from parse tree.


Query Evaluation: Introduction, Approaches to QE, Transformation of relational expressions in Query optimization, heuristic optimization, cost estimation for various operations, transformation rule.

Section C
Distributed Database
Centralized DBMS and Distributed DBMS, functions and architecture of a DDBMS, Distributed Data Storage, Transparency issues in DDBMS, Query Processing DDBMS, Distributed transaction Management and Protocols, Distributed Concurrency Control and Deadlock Management.

Object Oriented Database
Limitations of RDBMS, Need of Complex Datatype, Data Definition, ODBMS Fundamentals, issues in OODBMS, Object-oriented database design.Comparison of ORDBMS and OODBMS.

Section D
Emerging Database Models, Technologies and Applications
Multimedia database-Emergence, difference from other data types, structure, deductive databases, GIS and spatial databases, Knowledge database, Information Visualization, Wireless Networks and databases, Personal database, Digital libraries, web databases, case studies.

References
1. Advanced database management system by RiniChkrabarti and ShibhadraDasgupta, Dreamtech.
2. Distributed Databases by Ozu and Valduriez ,Pearson Education.
3. Fundamentals of Database Systems by RamezElmasri, ShamkantNavathe, Pearson Education
MTCS-105 DIGITAL IMAGE PROCESSING

Section-A

Section-B
Image Enhancement : Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Background, Smoothing Filters, Sharpening Filters, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications.

Section-C

Section-D
Image Segmentation: Edge Detection - Line Detection - Curve Detection - Edge Linking And Boundary Extraction, Boundary Representation, Region Representation And Segmentation, Morphology-Dilation, Erosion, Opening And Closing. Hit And Miss Algorithms Feature Analysis

Text Book:
Reference Books:
2nd Semester
MTRM-101 Research Methodology

METHODS OF RESEARCH:
Nature and Objectives of research; historical, descriptive and experimental. Study and formulation of research problem. Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal.

INTRODUCTION TO STATISTICAL ANALYSIS:
Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis. Probability and probability distributions; Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Normal and Log-normal distribution. Basic ideas of testing of hypotheses; Tests of significance based on normal, t and Chi-square distributions. Analysis of variance technique.

DESIGN OF EXPERIMENTS:
Basic principles, study of completely randomized and randomized block designs. Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography. Use of common softwares like SPSS, Mini Tab and/or Mat Lab. For statistical analysis.

BOOKS RECOMMENDED:
1. G. C. Ramamurthy, Research Methodology, Dreamtech Press,
MTCS-201 ADVANCED DATA STRUCTURE


Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized Algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min-Cut, 2-SAT; Game Theoretic Techniques, Random Walks.

Recommended Books:

MTCS-202 Soft Computing


Fuzzy Logic: Introduction to Fuzzy logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership functions, Defuzzification, Fuzzy Arithmetic and Fuzzy measures, Fuzzy Rule base and approximate reasoning, Fuzzy decision making


Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems,

References:
2. NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND APPLICATIONS By S. RAJASEKARAN, G. A. VIJAYALAKSHMI, PHI.
MTCS-203 Software metrics

Basics of measurement: Measurement in everyday life, measurement in software engineering, scope of software metrics, representational theory of measurement, measurement and models, measurement scales, meaningfulness in measurement, goal-based framework for software measurement, classifying software measures, determining what to measure, software measurement validation, empirical investigation, types of investigation, planning and conducting investigations.

Software-metrics data collection and analysis: What is good data, how to define the data, how to collect the data, how to store and extract data, analyzing software-measurement data, frequency distributions, various statistical techniques.

Measuring internal product attributes: Measuring size, aspects of software size, length, functionality and complexity, measuring structure, types of structural measures, control-flow structure, modularity and information flow attributes, data structures.

Measuring external product attributes: Modeling software quality, measuring aspects of software quality, software reliability, basics of software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, recalibration of software-reliability growth predictions, importance of operational environment, wider aspects of software reliability.

Metrics for object-oriented systems: Intent and characteristics of object-oriented metrics, various object-oriented metric suites LK suite, CK suite and MOOD metrics.

Dynamic Metrics: Runtime Software Metrics, Extent of Class Usage, Dynamic Coupling, Dynamic Cohesion, and Data Structure Metrics.

Metrics for component-based systems: The intent of component-based metrics, distinguishing characteristics of component-based metrics, various component-based metrics.

Resource measurement: Measuring productivity, teams, tools, and methods.

REFERENCES
MTCS-204 NATURAL LANGUAGE PROCESSING

Introduction: Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Processing of Indian Languages.

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution.

Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.


Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Speech Recognition: Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

Recommended Books:
MTCS-205 ADVANCED OPERATING SYSTEM

Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport’s logical clock, Global states, Chandy-Lampert’s global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport’s Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing.


Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls.

Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Checkpointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols

Multiprocessor System: Definition, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.

Real Time Operating systems: Fundamentals of real time operating systems, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization.

Analytic Modeling: Introductions, Queuing Theory, Markov Process.

BOOKS RECOMMENDED

1. OperatingSystemsConcepts &design-MilanMilenkovic,TMH
3. AdvancedConcepts inoperatingSystems-MukeshSinghal andNiranjanG.Shivaratri,TMH
MTCS-206 CLOUD COMPUTING


Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance.

Cloud based Data Storage: Introduction to MapReduce or simplified data processing on Large clusters, Design of data applications based on MapReduce in Apache Hadoop, Task Partitioning, Data partitioning, Data Synchronization, Distributed Filesystem, Data Replication

Cloud Services: Introduction, Contrast traditional software development and development for the cloud. Technologies and the processes required when deploying web services; deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Public vs Private cloud apps.

Management of Cloud Services: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics-Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization-application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Red hat)

Open Source Cloud Computing and Testing: OpenStack, OpenNebula-underlying technologies, Cloud Monitoring-Ganglia; Physical and virtual machine memory, CPU management and abstraction techniques using a hypervisor. Software Testing in the Cloud - SMART-T- Migrating Testing to the Cloud, Hadoop Unit- Test Execution in the Cloud.

Advance Topics: Mobile Cloud Computing, Big-Data and Internet of Things (IoT): Definition of Big-Data, Structured and Unstructured Data, V’s of Big-Data, Hadoop, Definition of IoT, Characteristics of IoT, Combining Big-Data, IoT and Cloud Computing.

Text Books and References:
MTCS-207 Data Warehousing and Data Mining

Data warehousing: Introduction, ETL, Data warehouses—design guidelines for data warehouse implementation, Multidimensional Models; OLAP—introduction, Characteristics, Architecture, Multidimensional view and data cube, Data cube operations, data cube computation.


Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms,

Classification: Introduction, decision tree, tree induction algorithms—split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method;

Cluster analysis: Introduction, partitional methods, hierarchical methods, density-based methods, dealing with large databases, cluster software;


Recommended Books:
1. Carlo Vercellis, Business Intelligence: Data mining and Optimization for Decision Making, WILEY.
MTCS-208 Service Oriented Architecture


Introduction to Web services: Service descriptions, Messaging with SOAP, Message exchange Patterns, Coordination, Atomic Transactions, Business activities, Orchestration, Choreography, Service layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer.

Analysis: Service oriented analysis, Business-centric SOA, Deriving business services-service modeling, Service Oriented Design, WSDL basics, SOAP basics, SOA composition guidelines, Entity-centric business service design, Application service design, Task centric business service design

SOA platform basics: SOA support in J2EE, Java API for XML-based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), Java API for XML based RPC (JAX-RPC), Web Services Interoperability Technologies (WSIT), SOA support in .NET, Common Language Runtime, ASP.NET web forms, ASP.NET web services, Web Services Enhancements (WSE)


Recommended Books
Semester 3
MTCS- 301 Component Based Development

Section- A

Section- B


Section- C

Section-D

Recommended Books
2. Essential COM, Don Box, Dorling Kingsley, 2006.
MTCS- 302 Big Data Analytics

Section- A
An Overview of Big Data and Big Data Analytics. Understanding Hadoop Ecosystem (Hadoop Distributed File System, MapReduce, Hadoop YARN, HBase, Combining HBase and HDFS, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie). MapReduce Framework, Techniques to Optimize MapReduce Jobs, Role of HBase in Big Data Processing

Section- B
Developing Simple MapReduce Application, Points to Consider while Designing MapReduce. Controlling MapReduce Execution with InputFormat, Reading Data with Custom RecordReader, Organizing Output Data with OutputFormats, Customizing Data with RecordWriter, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners.

Section- C

Section- D

References:
2. Big Data Computing and Communications edited by Yu Wang, Hui Xiong, Shlomo Argamon, XiangYang Li, JianZhong Li Springer
MTCS- 303 Optimization Techniques

SECTION-A

SECTION-B
Linear Programming: Mathematical formation of linear programming problem, Special types of linear programming problems -Transportation and assignment problems, Unbalanced Assignment problems, Crew based assignment problems, Test for Optimality, Degeneracy in Transportation Problems, Unbalanced Transportation Problems.

SECTION-C

SECTION-D
Decision Theory, Integer Programming, Gomory Method and Branch & Bound Method.

References:
Section- A
Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality

Section-B
Agile Product Management: Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue

Section- C

Section- D

Recommended Books
MTCS- 305 Information Retrieval

Section- A
Introduction: Text analysis, Types of text analysis, Information retrieval, IR system architecture:
Text processing (Text format, Tokenization, stemming, lemmatization, Language modelling),
Indexes and query matching.

Informational Retrieval: Query processing models. Probabilistic models (Binary independence model, Robertson/Spark Jones weighting formula, Two-Poisson model), Relevance feedback (Term selection, Pseudo relevance feedback); language models: Unigram, Bigram language models, Generating queries from documents, Language models and smoothing, Ranking with language models, KullbackLeibler divergence, Divergence from randomness, Passage retrieval and ranking.

Section- B

Types of information retrieval systems: Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system(GIS).

Section- C
Indexing: Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction, Query processing for ranked retrieval, Compression: General-purpose data compression, Symbol-wise data compression, Compressing posting lists, Compressing the dictionary.

Information categorization and filtering: Classification, Probabilistic classifiers, linear classifiers, Similarity-based classifiers, Multi category ranking and classification, learning to rank, Introduction to the clustering problem, Partitioning methods, Clustering versus classification, Reduced dimensionality/spectral methods.

Section- D
Sentiment Analysis: Introduction to sentiment analysis, Document-level sentiment analysis, Sentence-level sentiment analysis, Aspect-based sentiment analysis, Comparative sentiment analysis, baseline algorithm, Lexicons, Corpora, Tools of Sentiment analysis, Applications.

Recommended Books
MTCS-306 Advanced AI

Section- A

Section-B
Basic Search Strategies: Problem spaces (states, goals and operators), Problem solving by search, Factored representation (factoring state into variables), Uninformed search (breadth-first, depth-first, depth-first with iterative deepening), Heuristics and informed search (hill-climbing, generic best-first, A*), Space and time efficiency of search, Constraint satisfaction (backtracking and local search methods).
Advanced Search: Constructing search trees, Dynamic search space, Combinatorial explosion of search space, Stochastic search: Simulated annealing, Genetic algorithms, Monte-Carlo tree search, Implementation of A* search, Beam search, Minimax Search, Alpha-beta pruning, Expectimax search (MDP-solving) and chance nodes.

Section-C
Knowledge Representation: Propositional and predicate logic, Resolution in predicate logic, Question answering, Theorem proving, Semantic networks, Frames and scripts, conceptual graphs, conceptual dependencies.
Reasoning under Uncertainty: Review of basic probability, Random variables and probability distributions: Axioms of probability, Probabilistic inference, Bayes’ Rule, Conditional Independence, Knowledge representations using Bayesian Networks, Exact inference and its complexity, Randomized sampling (Monte Carlo) methods (e.g. Gibbs sampling), Markov Networks, Relational probability models, Hidden Markov Models, Decision Theory Preferences and utility functions, Maximizing expected utility.

Section-D
Agents: Definitions of agents, Agent architectures (e.g., reactive, layered, cognitive), Agent theory, Rationality, Game Theory Decision-theoretic agents, Markov decision processes (MDP), Software agents, Personal assistants, and Information access Collaborative agents, Information-gathering agents, Believable agents (synthetic characters, modelling emotions in agents), Learning agents, Multi-agent systems Collaborating agents, Agent teams, Competitive agents (e.g., auctions, voting), Swarm systems and Biologically inspired models.

Suggested readings