J. S. University, Shikohabad

M. Tech.

(Computer Science & Engineering)

Scheme

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Syllabus

[Effective from the session 2015-16]

M. Tech. - CS/IT

SEMESTER-1

S.N.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			ESE	
		Theory	L	T	Lab	CT	TA	Total	Total	
1.	MTCS-11	Foundations of Computer Science	3	1		20	30	50	100	150
2.	MTCS-12	Computer Organization and Architecture	3	1		20	30	50	100	150
3.	MTCS-13	OS and DBMS	3	1	2	20	30*	50	100	150
4.	MTCS-14	Data Networks	3	1	2	20	30*	50	100	150
		Total	**12**	**4**	**4**			**200**	**400**	**600**

UPTU M. Tech. – CS/IT

SEMESTER-II

S.N.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			ESE	
		Theory	L	T	Lab (*)	CT	TA	Total	Total	
1.	MTCS-21	Distributed Computing	3	1		20	30*	50	100	150
2.	MTCS-22	Object Oriented Programming	3	1		20	30*	50	100	150
3.	MTCS-23	Artificial Intelligence	3	1		20	30*	50	100	150
4.	MTCS-24	Parallel Algorithms	3	1		20	30*	50	100	150
		Total	**12**	**4**				**200**	**400**	**600**

* 30 marks are kept for tutorials, assignments, quizzes and lab

** Refer the list of streams and their respective courses for the values of x and y

UPTU M. Tech. – CS/IT

SEMESTER-III

S.N.	Course Code	Subject	Periods	Evaluation Scheme						Subject Total
				Sessional					ESE	
		Theory	L	T	Lab	CT	TA	Total	Total	
1.	MTCS-31	Data Warehousing & Data Mining	3	1		20	30*	50	100	150
2.	MTCS-32	Software Project Planning & Management	3	1		20	30*	50	100	150
3	MTME-33	Seminar	-	-	2	-		100	-	100
4	MTME-34	Project	-	-	8	-		50	-	50
		Total	**8**	**2**		-	-	**250**	**200**	**450**

UPTU M. Tech. – CS/IT

SEMESTER-IV

S.N.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			ESE	
		Theory	L	T	Lab (*)	CT	TA	Total	Total	
1.	MTCS- 41	Dissertation	-	-	12	-	-	150	200	350
		Total						**150**	**200**	**350**

(*) The existence and duration of lab will be decided as per the nature of the dissertation

SEMESTER-I

MTCS-11 FOUNDATIONS OF COMPUTER SCIENCE

SECTION A: Discrete Mathematical Structure

Algebraic Structures:
Semigroups, Monoids, Groups, Substructures and Morphisms, Rings, Fields, Lattices, distributive, modular and complemented lattice, Boolean Algebras.

Formal Logic:
Propositional logic: Predicate logic, limitations of predicate logic, universal and existential quantification; modus ponens and modus tollens. Proof technique: Notions of Implication, converse, inverse, contra positive, negations and contradiction

Introduction to Counting
Basic counting techniques, principles of inclusion and exclusion, permutations, combinations, summations, probability, Recurrence Relations, Generating Functions.

Introduction to Graphs:
Graphs and their basic properties, Eulerian and Hamiltonian walk, graph colouring, planar graph, enumeration, vector graph

References

1. Kenneth Rosen, Discrete Mathematics and its application, TMH
2. C.L. Liu , Element of Discrete mathematics ,TMH
3. D.B. West ,Introduction to Graph Theory ,PHI

SECTION B: Data Structures and Algorithm

Algorithm and Complexity, Notation of complexity. Sorting and Divide and Conquer Strategy: Merge-Sort, Quick Sort with average case analysis. Heaps and heap sort. Lower bound on comparison –based sorting

Advanced search Structures: Representation, Insertion and Deletion operations on Red-Black trees, B-Trees, Hashing

Dynamic programming , matrix multiplications, longest common subsequence, Greedy method, Knapsack Problem, 8 queens Problems , Backtracking, branch and bound , Fibonacci Heap

Graph Algorithm
Graphs and their representation. BFS, DFS, Minimum spanning trees, shortest paths Kruskal and Prim's algorithms, connected components.

References

1.Coreman ,Leiserson and Rivest, Algorithm , MIT Press
2.E. Horowithz and S. Sahni , Fundamentals of Computer Algorithm, Galgottia
3.Donald Knuth,, The Art of Computing Programming –vol-1 and 3 ,Pearson
4.V.Aho, J.E.Hopcroft and Ullman, Design and Analysis of Computer Algorithm ,Addison Wesley

SECTION C: Theory of Computation

Regular Languages
Alphabet Langauges and grammars, Regular grammars, regular expressions and finite auotomata, deterministic and non-deterministic. Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata.

Context free Language
Context free grammars and pushdown automata. Chomsky and Griebach normal forms. Cook, younger and Kasami Algorithm, Ambiguity and properties of context free languages pumping lemma. Deterministic pushdown automata. Closure properties of deterministic context free languages.

Turing Machine
Turing machines and variation of turing machine model, Halting problem, Universal turing machine, Type 0 Languages. Linear bounded automata and context sensitive languages. Turing Computable functions, Church Turing hypothesis. Recursive and recursively enumerable sets, Universal Turing machine and undecidable problems, Rice's Theorems for RE sets, Undecidability of Post correspondence problem. Valid and invalid computations of Turing machines, undecidable properties of context free language problems, Basics of Recursive function theory.

References
1. C. Papadimitrou and C.L. Lewis Elements of Theory of Computation,PHI
2. J.E. Hopcroft and J.D. Ullman, Introduction to Automata Theory,Languages of Computations, Addison-Wesley

MTCS-12 COMPUTER ORGANIZATION & ARCHITECTURE

Computer Organization

Unit I

Basic Computer Organization and design: Instruction set Principles: Classifying Instruction set Architectures, Memory Addressing , Type and Size of operands, Operations in the instruction set; Instruction Codes, Computer Register, Register , Register Transfer Language, time and Control , Instruction Cycle, Memory references instructions, Input Output and Interrupt, Design of Basic Computer and Arithmetic and Logic Unit.

Micro programmed Control: Control Memory, address Sequencing, Design of Control unit

Central Processing Unit: General Register Organization**,** Stack Organization, Instruction format, Data Transfer and manipulations program control.

Unit 2

Computer Arithmetic: Addition, Subtraction, Multiplication and Division Algorithms. Floating point arithmetic operation, IEEE-754, Decimal arithmetic unit and Decimal Arithmetic operations.

Unit 3

Input- Output Organization: Peripheral Devices, Input–Output Interface, Asynchronous data transfer, Modes & Transfer, Priority interrupt, Direct Memory access, I/O Performance Measures, Benchmarks of Storage Performance and Availability.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Shared Cache memory
Cache Memory and its performance, Reducing Cache Miss Penalty, Reducing Miss Rate, Reducing cache Miss Penalty or Miss Rate via Parallelism, Reducing Hit Time, Virtual Memory

Computer Architecture

Unit 4

Principle of Scalable Performance: Performance metric and measures, speedup performance laws, scalability analysis and approaches. Parallel processing and application

Advanced Processor Technology: Design space of processors, Instruction set architectures, CISC, RISC

Pipelining: Linear and Non-Linear pipeline processors, Instruction pipeline design, arithmetic pipeline design, super scalar and super pipeline design, Superscalar and Vector processors.

Unit 5

Multiprocessor system Interconnects, Cache coherence and synchronization and mechanisms, message passing mechanism
System Interconnect Architecture: network property and routing, static connection network and dynamic connection network.

REFERENCES

1. Mano M: computer System Architecture –PHI 3rd Edition
2. Henessy J L, Patterson D A: Computer Architecture: A Quantitative approach – 3rd (Elsevier)
3. Kai Hwang: Advanced Computer Architecture TMH
4. Hamacher V C, et al: Computer Organization – 4 Edition (McGraw Hill)

MTCS-13 OPERATING SYSTEM AND DATABASE MANAGEMENT SYSTEM

Unit I

Operating System: Structure, Components and Services, Time Sharing and Real-Time System, process Management, Concurrency Critical Section, Semaphores, InterProcess Communication,

Process scheduling producer/ consumer and reader writer problem, Concept of Distributed and Real-Time operating system.

Unit II

CPU Scheduling: Concept and Scheduling algorithm, multiprocessor scheduling, deadlock prevention, avoidance and detection, recovery from deadlock.

Memory Management: Multiprogramming with fixed partition, multiprogramming with variable partition, segmentation virtual memory and demand paging. Page Replacement Policies Thrashing and pre-paging

Unit III

I/O Management, File System: File organization and access mechanism, file sharing and file directories, Case Study of Linux Kernel- File Management, Memory Management and Process Management

Unit IV

Overview of Database Management System, Data Model- Relational Algebra, Relational Calculus – Tuple Relation Calculus and Domain Relation Calculus, Normal Forms
SQL, DDL, DCL DML, PL/SQL

Unit V

Deadlock – Prevention and avoidance, Transaction and Data Recovery Method. Introduction of Object Oriented DBMS, Object Relational DBMS, Distributed DBMS and Data mining & Data warehousing

References:

1. A.S. Tanenbaum: "Modern Operating System" , Prentice Hall
2. William Stalling: "Operating System" Maxwell McMellon
3. J. Peterson ,A. Silberschatz and P. Galvin: Operating System Concepts, Addison Wesley ,3rd edition
4. Milenkovic :Operating System Concept ,TMH

MTCS-14 DATA NETWORK

Unit-I Overview of Wired and Wireless DataNetworks

Review of Layered Network Architecture ,ISO-OSI and TCP/IP Network Model Datagram Networks and Virtual Circuit Networks, Point to Point and Point to Multipoint Networks Layer 2 Switches.
IEEE 802.3U(Fast Ethernet) and IEEE 802.3Z(Gigabit Ethernet)
Virtual LAN
Wireless LAN: IEEE 802.11, Bluetooth
Broadband Wireless LAN : 802.16, WIMAX

Unit-II Internetworking

Review of IP Addressing and Routing
Internet Architecture :Layers 3 Switch, Edge Router and Core Router
Overview of Control Plane, Data Plane ,Management Plane

Internet Routing Protocols: OSPF, BGP
Broadcast and Multicast Routing: Flooding, Reverse Path Forwarding, Pruning, Core based trees, PIM
Mobility Issues and Mobile IP
Adhoc Routing: Dynamic Source Routing, Destination Sequenced Distance Vector Routing, Hierarchial Routing
Signalling :Introduction ,ICMP,LDP and MPLS Architecture

Unit III Transport Layer Protocols

Process to Process Delivery
Review of UDP, TCP
SCTP Protocol: Services, Features, Packet Format, Association, Error Control Wireless TCP and RTP, RTCP
Real Time Application: Voice and Video over IP

Unit-IV Traffic Control and Quality of Service

Flow Control: Flow Model, Open Loop: Rate Control, LBAP, Closed Loop: Window scheme, TCP and SCTP Flow Control
Congestion Control: Congestion Control in packet networks, ECN and RED Algorithm, TCP and SCTP Congestion Control
Quality of Service: IP Traffic Models, Classes and Subclasses, Scheduling: GPS, WRR, DRR, WFQ, PGPS, VC Algorithm; Integrated Services Architecture, Differentiated Services Architecture, RSVP and RSVP- TE
Traffic Management Framework: Scheduling, Renegotiation, Signaling, Admission Control, Capacity Planning

Unit-V

Security Issues,Symmetric Encryption: DES , TripleDES ,Modes, AES Public Key Encryption: RSA , Diffie Hellman, Elliptic Curve Hashing :MDS , SHA-1 , DSA Protocols: Kerberos,SSL/TLS, IPSec

Reference

1. Srinivasan Keshav" An Engineering Approach To Computer Networking ",Pearson
2. W. Richard Stevens "TCP/IP ILLustrated "-Vol1 Pearson
3. D. Bertsekas , R Gallagar ,"Data Networks and Internets" PHI
4. W. Stalling "High Speed Networks and Internets", Pearson

SEMESTER-II

MTCS-21 Distributed Computing

Basic Concept

Characterization, Resource Sharing, Internet Implementations, Name Resolution, DNS

Computation: Full Asynchronism and Full Synchronism, Computation on Anonymous Systems, Events, Orders, Global States, Complexity

Distribution Synchronization

Processes and Threads, IEEE POSIX.1c
Mutual Exclusion: Classification, Algorithms, Mutual Exclusion in Shared Memory; Clock Synchronization, NTP
Distributed Deadlock: Detection Methods, Prevention Methods, Avoidance Methods

BSD Sockets

TCP/IP Model, BSD Sockets Overview, TCP Sockets and Client/Server, UDP Sockets and Client/Server, Out of Band Data, Raw Sockets, PING & TRACEROUTE Programs, Routing, Multicasting using UDP Sockets

Distributed OS

Communication between distributed objects, RPC Model and Implementation Issues, Sun RPC, Events and Notifications, Java RMI and its Applications

CORBA Architecture: Introduction and Applications

Distributed File System Design and Case Studies: NFS, Coda, Google FS

Distributed Databases

Introduction, Structure, Data Models, Query Processing, Transactions, Nested Transactions, Atomic Commit Protocols, Transaction Recovery, Transactions with replicated data, Concurrency Control Methods, Distributed Deadlocks

References:

1. Tanenbaum, “Distributed Systems”, Pearson
2. W Richard Stevens, “UNIX Network Programming Vol 1 & 2”, Pearson
3. Sinha, ”Distributed Operating Systems”, Prentice Hall of India/ IEEE Press
4. Barbosa, “Distributed Algorithms”, MIT Press
5. Ceri, Palgatti,”Distributed Databases”, McGraw-Hill

MTCS-22 [Object –Oriented Programming]

UNIT-I

The OO manifesto for Programming Languages. Definition of Object, representing an object, Object classes: constructor, destructor, copy constructor and their defaults, public and private protection.

UNIT-II

Complex Objects and complex classes, their constructors and destructors and policies for these. Privacy for complex objects. Inheritance: simple, multiple, repeated. Resolving inheritance conflicts. Rules for constructors, destructors. Protection policies for Inheritance.

UNIT-III

Notion of Late Binding. Polymorphism and its forms. Abstract classes and their use, Meta-classes and templates. Special language features like friend functions, type casting etc. Separation of specification from implementation. Object-orientation for reuse and maintenance. All the above to be introduced through C++.

References:

1. Bjarne Stroustrap, “The C++ Programming Language”, Pearson
2. Parimala N. “Object orientation Through C++”, MacMillam
3. Lippman, Lajoie, and Moo, “C++ Primer”, Addison Wesley
4. Robert Lafore, “Object Orientation in C++”, Galgotia

MTCS-23 [Artificial Intelligence]

Knowledge: Introduction, definition and importance, knowledge base system, representation of knowledge, organization of knowledge, knowledge manipulation, knowledge acquisition, introduction to PROLOG.

Formalized symbolic Logics, Syntax and Semantics for FOPL, Inference rules, The resolution principle, No deductive inference methods, Bayesian probabilistic informer, Dimpster-Shafer theory, Heuristic Reasoning Methods.

Search and Control strategies: introduction, concepts, uniformed or blind search, informal search, searching and-or graphs, Matching techniques, structures used in retrieval techniques, integrating knowledge in memory, memory organization system.

Fuzzy Logic: Basic concepts, Fuzzy sets, Membership Function, Types of membership Function, Basic operations in Fuzzy sets, Intersection & Union-Complementary, Subsethood, Properties of Fuzzy sets.

Expert System architectures: Rule-Based system architectures, Non production system architecture, dealing with uncertainty, knowledge organization and validation.

References:

1. Dan W Patterson, "Introduction to Artificial Intelligence and Expert System". PHI
2. Peter Jackson, "Introduction to Expert System", Pearson
3. A Gonzalbz and D.Dankel, "The Engineering Knowledge Base System", PHI
4. Stuart Russell and Peter nerving, "Artificial Intelligence: A Modern approach", PHI
5. John Yen & Reza Langari , "Fuzzy: Intelligence, Control and Information" , Pearson

MTCS-24[Parallel Algorithms]

Sequential model, need of alternative model , parallel computational models such as PRAM , LMCC , Hypercube , Cube Connected Cycle , Butterfly , Perfect Shuffle Computers , Tree model , Pyramid model , Fully Connected model , PRAM-CREW , EREW models , simulation of one model from another one.

Performance Measures of Parallel Algorithms , speed-up and efficiency of PA , Cost-optimality , An example of illustrate Cost-optimal algorithms- such as summation , Min/Max on various models.

Parallel Sorting Networks , Parallel Merging Algorithms on CREW/EREW/MCC/ , Parallel Sorting Networks on CREW/EREW/MCC/, linear array

Parallel Searching Algorithm , Kth element , Kth element in X+Y on PRAM , Parallel Matrix Transportation and Multiplication Algorithm on PRAM , MCC , Vector-Matrix Multiplication , Solution of Linear Equation , Root finding.

Graph Algorithms - Connected Graphs , search and traversal , Combinatorial Algorithms- Permutation , Combinations , Derrangements.

References:

1. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
2. S.G. Akl, "Design and Analysis of Parallel Algorithms"
3. S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

SEMESTER-III

MTCS-31 [DATA WAREHOUSING & DATA MINING]

UNIT-I:

Data Warehousing and Business Analysis: - Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT-II:

Data Mining: - Data Mining Functionalities – Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint- Based Association Mining.

UNIT-III:

Classification and Prediction: - Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor , Ensemble Methods, Model Section.

UNIT-IV:

Cluster Analysis: - Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods. Grid-Based Methods, Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint- Based Cluster Analysis, Outlier Analysis.

UNIT-V:

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

REFERENCES:

1. Jiawei Han and Micheline Kamber "Data Mining Concepts and Techniques" Second Edition,
2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

MTCS-32 [SOFTWARE PROJECT PLANNING & MANAGEMENT]

UNIT-I:

Metrics: Introduction, The Metrics Roadmap, A Typical Metrics Strategy, What Should you Measure?, Set Targets and track Them, Understanding and Trying to minimize variability, Act on data, People and Organizational issues in Metrics Programs, Common Pitfalls to watch out for in Metrics Programs, Matrices implementation checklists and tools, **Software configuration management:** Introduction, Some Basic Definitions and terminology, the processes and activities of software configuration management, configuration status accounting, configuration audit, software configuration management in geographically distributed teams, Metrics in software configuration management, software configuration management tools and automation.

UNIT-II:

Risk Management: Introduction, What is risk management and why is it important?, Risk management cycle, Risk identification: common tools and techniques, Risk Quantifications, Risk Monitoring, Risk Mitigation, Risks and Mitigation in the context of global project teams, some practical techniques risk management, Metrics in risk management. **Project Planning and Tracking:** Components of Project Planning and Tracking, The "What " Part of a Project Plan, The "What Cost " Part of a Project Plan, The "When " Part of Project Planning, The "How " Part of a Project Planning: Tailoring of Organizational Processes For the Project, The " By Whom " Part of the Project Management Plan : Assigning Resources, Putting it all together : The Software Management Plan, Activities Specific to Project Tracking, Interfaces to the Process Database. **Project Closure:** When Does Project Closure Happen?. Why Should We Explicitly do a Closure?, An Effective Closure Process, Issues that Get Discussed During Closure, Metrics for Project Closure, Interfaces to the Process Database.

UNIT-III:

Software Requirements gathering: Inputs and start criteria for requirements gathering, Dimensions of requirements gathering, Steps to be followed during requirements gathering, outputs and quality records from the requirements phase, skill sets required during requirements phase, differences for a shrink-wrapped software, challenges during the requirements management phase, Metrics for requirements phase. **Estimation:** What is Estimation? when and why is Estimation done?, the three phases of Estimation, Estimation methodology, formal models for size Estimation, Translating size Estimate into effort Estimate, Translating effort Estimates into schedule Estimate, common challenges during Estimation , Metrics for the Estimation processes. **Design and Development Phases:** Some differences in our chosen approach, salient features of design, evolving an architecture/ blueprint, design for reusability, technology choices/ constraints, design to standards, design for portability, user interface issues, design for testability, design for diagnose ability, design for maintainability, design for install ability, inter-operability design, challenges during design and development phases, skill sets for design and development, metrics for design and development phases.

UNIT-IV:

Project management in the testing phase: Introduction, What is testing?, what are the activities that makeup testing?, test scheduling and types of tests, people issues in testing, management structures for testing in global teams, metrics for testing phase. **Project management in the Maintenance Phase:** Introduction, Activities during Maintenance Phase, management issues during Maintenance Phase, Configuration management during Maintenance Phase, skill sets for people in the maintenance phase, estimating size, effort, and people resources for the maintenance phase, advantages of using geographically distributed teams for the maintenance phase, metrics for the maintenance phase.

UNIT-V:

Globalization issues in project management: Evolution of globalization, challenges in building global teams, Models for the execution of global projects, some effective management techniques for managing global teams. **Impact of the internet on project management:** Introduction, the effect of internet on project management, managing projects for the internet, Effect on the project management activities. **People focused process models:** Growing emphasis on people centric models, people capability maturity model(P-CMM), other people focused models in the literature, how does an organization choose the models to use?

REFERENCES:

1. Ramesh Gopalaswamy: "Managing Global Projects ", Tata McGraw Hill, 2013.
2.Watts Humphrey, "Managing the Software Process ", Pearson Education, New Delhi, 2000
3. Pankaj Jalote, "Software Project Management in practice", Pearson Education, New Delhi,2002

[MTCS-33] SEMINAR

OBJECTIVE

The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.

Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews

[MTCS-41] DISSERTATION

The student will submit a synopsis at the beginning of the semester for the approval from the University project committee in a specified format. Synopsis must be submitted within a two weeks. The first defence, for the dissertation work, should be held within a one month. Dissertation Report must be submitted in a specified format to the University for evaluation purpose.