DEPARTMENT OF COMPUTER SCIENCE
VIDYASAGAR UNIVERSITY
PASCHIM MEDINIPUR– 721102

CBCS Syllabus 2016

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First Year-First Semester

A. Theory								
Sl. No	Field	Theory	Marks	Contact Hours/Weeks				Cr. Points
				L	T	P		
1	101	Design And Analysis of Algorithm	50	3	1	0		4
2	102	Advanced Computer Architecture	50	3	1	0		4
3	103	Computer Networks	50	3	1	0		4
4	104 (M1) 104 (M2)	Computer Graphics Image processing	25 25	2 2	1 1	0 0		2 2
Total of theory			200					16
B. Practical								
5	105	Network Lab	50	0	0	4		4
6	106	Computer Graphics Lab	50	0	0	4		4

First Year-Second Semester

A. Theory								
Sl. No	Field	Theory	Marks	Contact Hours/Weeks				Cr. Points
				L	T	P		
1	201	Advanced Database Management System	50	3	1	0		4
2	202 (M1) 202 (M2)	Theoretical Computer Science Software Engineering	25 25	2 2	1 1	0 0		2 2
3	203 (M1) 203 (M2)	Object Oriented Design Object Oriented Programming with Java	25 25	2 2	1 1	0 0		2 2
Total of theory			150					12
CBCS								
4	204(M1) 204(M2)	Introduction to Programming C Programming	25 25	2 2	0 0	0 0		2 2
B. Practical								
5	205	Advanced DBMS Lab	50	0	0	4		4
6	206	JAVA Lab	50	0	0	4		4

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Second Year-Third Semester

A. Theory								
Sl. No	Field	Theory	Marks	Contact Hours/Weeks				Cr. Points
				L	T	P		
1	301	Advanced Operating System	50	3	1	0		4
2	302	Parallel Computing	50	3	1	0		4
3	303	Elective	50	3	1	0		4
Total of theory			150					12
CBCS								
4	304 (M1) 304 (M2)	DBMS Internetworking	25 25	2 2	0 0	0 0		2 2
B. Practical								
5	305	Advanced Operating System Lab	50	0	0	4		4
6	306(M1) 306(M2)	Seminar Grand Viva	25 25	0 0	0 0	0 0		2 2

Second Year-Fourth Semester

A. Theory								
Sl. No	Field	Theory	Marks	Contact Hours/Weeks				Cr. Points
				L	T	P		
1	401	Web Technology	50	3	1	0		4
2	402 (M1) 402 (M2)	Artificial Intelligence Wireless Technology & Mobile Computing	25 25	2 2	1 1	0 0		2 2
Total of theory								
B. Practical								
3	403 (M1) 403 (M2)	Web Technology Lab Artificial Intelligence Lab	25 25	0 0	0 0	2 2		2 2
4	404	Tour	50	0	0	4		4
5	405	Project	100	0	0	8		8

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Semester - I
Theory

Paper 101: Design and Analysis of Algorithm

Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis; Graph Algorithms: Shortest paths, Flow networks; NP-completeness; Approximation algorithms; Randomized algorithms; Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations), Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).

References:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press/McGraw-Hill, 2001.
2. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
3. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
4. Udi Manber, Algorithms -- A Creative Approach, Addison-Wesley, Reading, MA, 1989.
5. Mark de Berg, Mark van Kreveld, Mark Overmars and Otfried Shwarzkopf (Cheong), Computational Geometry: Algorithms and Applications, Third edition, Springer-Verlag, 2008.
6. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
7. Vijay V Vazirani, Approximation Algorithms, Springer-Verlag, 2001.
8. Dorit S Hochbaum (editor), Approximation Algorithms for NP-Hard Problems, PWS Publishing Co, 1997.

Paper 102: Advanced Computer Architecture

Overview of von Neumann architecture: Instruction set architecture; The Arithmetic and Logic Unit, The Control Unit, Memory and I/O devices and their interfacing to the CPU; Measuring and reporting performance; CISC and RISC processors.

Pipelining: Basic concepts of pipelining, data hazards, control hazards, and structural hazards; Techniques for overcoming or reducing the effects of various hazards.

Hierarchical Memory Technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

Instruction-level parallelism: Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP; Superscalar, super-pipelined and VLIW processor architectures;

Vector and Array Processors Principles: Instruction types, Compound, Vector loops, Chaining, Array processor structure and algorithms, Case studies of contemporary microprocessors.

Multiprocessor Architecture: Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture, Cluster computers.

References:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.

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3. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.

Paper 103: Computer Networks

Overview of data communication and Networking:
Introduction; Data communications: components, direction of data flow (simplex, half duplex, full duplex); Networks, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical layer:
Overview of data (analog & digital), Data and Signals; Digital Transmission; Analog Transmission

Data link layer:
Error Detection and Correction; Data Link Control; Multiple Access; Virtual-Circuit Networks: Frame Relay and ATM

Network layer:
lnternetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, classful address, subnetting; Routing :techniques, static vs. dynamic routing, routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and muiticast routing protocols.

Transport layer:
Process to process delivery; UDP; TCP; Congestion control algorithms; Quality of services.

Application layer:
DNS; SMTP, SNMP, FTP, HTIP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewalls.

References:
1. William Stallings, Data and Computer Communication, Prentice Hall of India.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill.
3. AndrewS. Tanenbaum, Computer Networks, Prentice Hall.

Paper 104 (Module 1): Computer Graphics

Unit I

Introduction to computer graphics & graphics systems
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion:
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit II

2D transformation & viewing
Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear;
Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping,
clipping circles , polygons & ellipse.

3D transformation & viewing

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3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Unit III

Curves
Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal-geometry.

Color & shading models
Light & color model; interpolative shading model; Texture;

Text Books:
1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
4. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
5. Mukherjee Arup, Introduction to Computer Graphics

Paper 104 (Module 2): Image Processing

Unit I

Introduction: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.
Digital Image Formation :
A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Unit II

Mathematical Preliminaries :
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Unit III

Image Enhancement :
Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Unit IV

Image Segmentation :
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation,

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Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books:

1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis,Chanda & Majumder,PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

Semester - I
Practical

Paper 105: Network Lab

Problems and assignment based on Paper CS/MSC/103

Paper 106: Computer Graphics Lab

- Point plotting, line & regular figure algorithms
- Raster scan line, circle and ellipse drawing algorithms
- Clipping algorithms for points, lines & polygons
- 2-D transformations
- Filling algorithms.
- Curve drawing

Semester - II
Theory

Paper 201: Advanced Database Management System

Introduction : Concept & Overview of DBMS, Concepts of Different Database Models, Database Languages, Functions of Database Administrator, Database Users, Three Schema architecture of DBMS.

Relational Databases: Integrity Constraints revisited: Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes. Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.

Parallel and Distributed Databases: Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

Advanced Transaction Processing: Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery.

Deductive Databases:Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and

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Object Reference, Architecture of Object Oriented and Object Relational Databases. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.

References

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, McGraw-Hill.
2. Raghu Ramakrishnan, Database Management Systems, WCB/McGraw-Hill.
3. Bipin Desai, An Introduction to Database Systems, Galgotia.
4. J. D. Ullman, Principles of Database Systems, Galgotia.
5. R. Elmasri and S. Navathe, Fundamentals of Database Systems8, Addison-Wesley.
6. Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases. Addison-Wesley.

Paper 202(Module 1): Theoretical Computer Science

Introduction:

Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata:

Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

Context-free languages and pushdown automata:

Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Phase Structure Language:

Turing machines, The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recllrsive) languages and their closure properties, variants ofTuring machines, nondeterministicTMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability:

Church-Turing thesis, universaiTuring machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.

References:

1. K.L.P Mishra & N. Chandrasekharan- "Theory of Computer Science", PHI
2. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
3. Ash & Ash- "Discrete Mathematics",TMH
4. Martin-Introduction
5. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
6. Kain, "Theory of Automata & Formal Language", McGraw Hill.
7: Kohavi ZVI, "Switching & Finite Automata", 2nd Edn., Tata McGraw Hill.
8. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa
9. "Introduction to Formal Languages", Tata McGraw Hill, 1983.

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Paper 202(Module 2): Software Engineering

Unit I

The Product : Software, Software Myths,
The process : Software engineering : A Layered Technology, Software Process Models, The linear sequential Model, The prototyping Model,The RAD Model, Evolutionary Software Process Models.

Unit II

Software project planning : Project planning objectives, Software scope, Decomposition Techniques, Estimation models, The Make/Buy Decision.
Risk analysis and Management : Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation, monitoring, and management, Safety risks and hazards,
Project scheduling and technique : Basic concept, Defining a task set for the software project, Defining a task Network, Scheduling, Earned value analysis.

Unit III

Software Quality Assurance : Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, Mistake Proofing for Software, Introduction to ISO standard.

Unit IV

Software Testing Technique : Software testing fundamentals, Test case design, White-box Testing, Basis path testing, Control structure testing, Black-box testing, Testing for specialized environments, architectures and application.

Unit V

Object-Oriented Analysis :
Introduction to UML Diagrams, Use Case Diagrams, Class Diagrams, Collaboration Diagrams, Implementation Diagrams.

Books:
1. R. G. Pressman – Software Engineering, TMH
2. Rajib Mall - Software Engineering Fundamentals
3. Ghezzi, Software Engineering, PHI
4.Pankaj Jalote – An Integrated Approach to Software Engineering, NAROSA.
5.Object Oriented & Classical Software Engineering(Fifth Edition), SCHACH,TMH
6.Vans Vlet, Software Engineering, SPD
7.Uma, Essentials of Software Engineering, Jaico
8.Sommerville, Ian – Software Engineering, Pearson Education
9.Benmenachen, Software Quality, Vikas

Paper 203(Module 1): Object Oriented Design

Unit I

Introduction
Why object orientation, History and development of Object Oriented Programming language, concepts of object oriented programming language.

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Object oriented analysis
Usecase diagram; Major and minor elements, Object, Class.

Unit II

Object oriented design
Relationships among objects, aggregation, links, relationships among classes- association, aggregation, using, instantiation, meta-class, grouping constructs.

Unit III

Basic concepts of object oriented programming using Java
Object, class, message passing, encapsulation, polymorphism, aggregation, threading, applet programming, difference between OOP and other conventional programming-advantages and disadvantages.

Unit IV

Fundamentals of Object Oriented design in UML
Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, statechart diagram, activity diagram, implementation diagram, UML extensibility- model constraints and comments, Note, Stereotype.

Text Books :
1. Ali Bahrami, - "Object –Oriented System Development" - Mc Graw Hill.
2. Rambaugh, James Michael, Blaha - "Object Oriented Modelling and Design" - Prentice Hall India/ Pearson Education
3. Bruce, Foundations of Object Oriented Languages, PHI
4. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" - TMH
5. Priestley – " Practical Object Oriented Design using UML" - TMH
6. Jana, C++ & Object Oriented Programming, PHI
7. Alhir, learning UML, SPD/O'Reily
Reference Books:
1. Page Jones, Meiler - "Fundamentals of object oriented design in UML"
2. Roff: UML: A Beginner's Guide TMH
3. Rajaram: Object Oriented Programming and C++, New Age International
4. Mahapatra: Introduction to System Dynamic Modelling, Universities Press
5. Muller : Instant UML, Shroff Publishers / Wrox
6. Srimathi, Object Oriented Analysis & Design Using UML, Scitech
7. Alhir : UML in a Nutshell, Shroff Publishers / O'reilly
8. Olshevsky : Revolutionary guide to Object Oriented Programming using C++, Shrof/ Wrox

Paper 203(Module 2): Object Oriented Programming with Java

Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic String handling concepts.
String & String Buffer class.
Command line arguments.
Basics of I/O operations.
Reusability properties – Super class & subclass. use of abstract classes & methods, interfaces. Creation of packages, importing packages.

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Exception handling – Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.
Multithreading - Basics of multithreading, creation of multiple threads, thread synchronization, deadlocks for threads, suspending & resuming threads.
Applet Programming – Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets.
Concepts of AWT and Swing.

Textbooks/References:
1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
3. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
4. Ivor Horton's Beginning Java 2 SDK – Wrox
5. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Paper 204(Module 1): Introduction to Programming

Introduction to Computers, Data representation, Conversion of data. Memory organization, Different secondary storage devices and Magnetic media devices.
Data Representation: Representation of Characters in Computers, Representation of Integers, Representation of Fractions, Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error Detecting Codes
Basic concepts of Programming, Machine code, Assembly Language (Introduction), Problem analysis, program constructions – flowcharts, algorithms, pseudo codes, data structures – stacks, queues, linked lists etc., approaches to programming – top-down, bottom-up approach, divide & conquer, modular programming.

Paper 204(Module 2): C Programming

Preliminaries, Constants & Variables, Arithmetic Expressions, Input Output statements, Control Statements, Do-Statements, C-Preprocessor, Do-While statement, if-else statement, Array, Pointer. Elementary Format Specifications, Logical Statements & Decision Tables, Function & Subroutines, handling of arrays, matrices, handling of character strings

Textbooks/References:
1. Yashavant P. Kanetkar, Let Us C, BPB Publications.
2. Balagurusamy, Programming in ANSI C, Mcgraw Hill Education.
3. B. W. Kernighan & D. M. Ritchie, C Programming Language

Semester - II
Practical

Paper 205: Advanced DBMS Lab

Structured Query Language
1. Creating Database

   Creating a Database
   Creating a Table
   Specifying Relational Data Types
   Specifying Constraints
   Creating Indexes

2. Table and Record Handling

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INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

3. Retrieving Data from a Database

The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
Using Aggregate Functions
Combining Tables Using JOINS
Subqueries

4. Database Management

Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Paper 206: JAVA Lab

Problems and assignment based on Paper CS/MSC/203 (Module 2)

Semester - III
Theory

Paper 301: Advanced Operating System

Evolution of Operating Systems, Structural overview, Concept of process and Process synchronization, Process Management and Scheduling, Hardware requirements: protection, context switching, privileged mode; Threads and their Management; Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Dynamic Resource Allocation, Design of IO systems, File Management, Memory Management: paging, virtual memory management, Distributed and Multiprocessor Systems, Case Studies.

References

1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India.
3. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, Tata McGraw-Hill.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing.
5. Gary J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley.
6. Maurice Bach, Design of the Unix Operating Systems, Prentice-Hall of India.
7. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, O'Reilly and Associates.

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Paper 302: Parallel Computing

UNIT 1
Introduction, Parallel Programming Paradigms, Parallel Architecture, Open MP, PRAM, Models of Parallel Computation, Complexity, Memory Consistency, [Lecture Hour: 12]

UNIT 2
Parallel Program Design, Shared Memory & Message Passing, MPI, Algorithmic Techniques
[Lecture Hour: 10]

UNIT 3
CUDA
[Lecture Hour: 10]

UNIT 4
Algorithms, Merging & Sorting, Lower Bounds Lock Free Synchronization, Load Stealing, Graph Algorithms [Lecture Hour: 8]

Paper 303: Elective

303/I: Soft Computing

Artificial Neural Network

Basic concept of Soft Computing;
Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Models Of Neural Network Architecture, Algorithm & Application of - McCulloh-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Backpropagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1,ART2.

Fuzzy Sets & Logic

Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; Fuzzy controllers; Defuzzification methods; FAM;

Genetic Algorithm

Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multiobjective & Multimodal optimization in GA; Application—Travelling Salesman Problem, Graph Coloring problem

Rough set

Basic concept; Applications of rough set in hybridized environment

Hybrid Systems

Hybrid systems, GA based BPNN (Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A;

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303/II: Real Time System

Introduction: Real-time systems, Properties, Misconceptions, Real-Time tasks, Scheduling results. Hard and soft real time systems; handling real time; specification and modeling; design methods; real time operating systems; validation and verification;

Uniprocessor Real-Time System: Task Scheduling, Resource access control protocols, Overload handling, Energy-aware scheduling, Feedback control scheduling.

Multiprocessor Real-Time System: Task Scheduling, Fault-tolerance, Resource reclaiming. Distributed Real-Time System: Global scheduling - transfer, information, and location policies.

Real-time Networks: Real-time channel, Packet scheduling, Real-Time MAC protocols.

Real-time OS and Applications: Case studies of RTOS and Cyber-Physical System applications.

Other Issues: Architecture and software engineering issues, Case studies.

303/III: Embedded System

Introduction to Embedded Systems - definitions and constraints; hardware and processor requirements; special purpose processors; input-output design and I/O communication protocols; design space exploration for constraint satisfaction; co-design approach; example system design; Formal approach to specification; specification languages; specification refinement and design; design validation; Real Time operating system issues with respect to embedded system applications; time constraints and performance analysis.

303/IV: Bioinformatics

UNIT 1 [Lecture Hour: 4]

Introduction and Bioinformatics Resources: Knowledge of various databases and bioinformatics tools available at these resources, the major content of the databases, Literature databases:

- Nucleic acid sequence databases: GenBank, EMBL, DDBJ
- Protein sequence databases: SWISS-PROT, TrEMBL, PIR, PDB
- Genome Databases at NCBI, EBI, TIGR, SANGER
- Other Databases of Patterns/Motifs/System Biology (Gene and protein network database and resources)

UNIT 2 [Lecture Hour: 8]

Sequence analysis:

- Various file formats for bio-molecular sequences: genbank, fasta, gcg, msf, nbrf-pir etc.
- Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues.
- Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM series.
- Sequence-based Database Searches: what are sequence-based database searches, BLAST and FASTA algorithms, various versions of basic BLAST and FASTA.

UNIT 3 [Lecture Hour: 16]

Pairwise and Multiple sequence alignments: basic concepts of sequence alignment, Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments, Progressive and hierarchical algorithms for MSA. Use of pairwise alignments and Multiple sequence alignment for analysis of Nucleic acid and protein sequences and interpretation of results.

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UNIT 4 [Lecture Hour: 8]

Phylogeny: Phylogenetic analysis, Definition and description of phylogenetic trees and various types of trees, Method of construction of Phylogenetic trees [distance based method (UPGMA, NJ), Maximum Parsimony and Maximum Likelihood method]

UNIT 5 [Lecture Hour: 4]

Current Advancements in Bioinformatics: Introduction to System Biology, Structural Biology, Structural bioinformatics, Chemoinformatics, Immunoinformatics etc.

303/V: Data Compression

Introduction

Compression Techniques, Lossless and Lossy Compression; Measures of Performance; Modeling and Coding;

Mathematical Preliminaries for Lossless Compression

Introduction to Information Theory ; Average Information ; Models ; Physical , Probability, Markov, Composite Source Models ; Coding ; Uniquely Decodable Codes, Prefix Codes; The Kraft-McMillan Inequality ;

Lossless Compression

Huffman coding, Adaptive Huffman coding, Arithmetic coding, Dictionary based compression techniques – LZ77, LZ78, LZW etc.

Context-Based Compression

Introduction, Prediction with Partial Match (ppm); The Burrows-Wheeler Transform ; Move-to-Front Coding ; Dynamic Markov Compression

Lossy Graphics Compression

Lossy Compression, JPEG Compression, Discrete Cosine Transform, Quantization, Coding, The Zig-Zag Sequence;

Wavelet-Based Compression

Introduction; Wavelets; Multiresolution Analysis and the Scaling Function; Implementation Using Filters; Scaling and Wavelet Coefficients; Families of Wavelets; Image Compression; Embedded Zerotree Coder; Set Partitioning in Hierarchical Trees; JPEG 2000

303/VI: Pattern Recognition

Introduction to pattern recognition, mathematical preliminaries, and application to OCR, speech recognition, fingerprints, signatures etc.

Classification: Bayes decision rule, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries.Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.

Clustering: Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, MST, medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm.

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Feature Extraction: PCA, Kernel PCA.

Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy.

References:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
2. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

303/VII: Cryptography & Network Security

Introduction:

Introduction to security attacks, services and mechanism, introduction to Gyptography.

Conventional Encryption:

Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.

Modern Stream Ciphers:

Modern Block Ciphers :

Block ciphers principals, Shannon's theory of confusion and diffusion, fiesta I structure, data encryption standard{ DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation

Introduction to Information Hiding:

Technical Steganography, Linguistic Steganography, Copy Right Enforcement, Wisdom from Cryptography Principles of Steganography, Security of Steganography System, Information Hiding in Noisy Data, Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text.

Watermarking and Copyright Protection:

Basic Watermarking, Watermarking Applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking system.

References:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy .
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schiener, "Applied Cryptography"

303/VIII: Natural Language Processing

Introduction: Speech and Natural Language Processing; Brief Review of Regular Expressions and Automata;

Finite State Transducers; Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition .

Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Natural

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Language Generation; Techniques of Machine Translation; Indian language case studies;

References:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Prentice-Hall.
2. Chris Manning and Hinrich Schuetze, Foundations of Statistical Natural Language Processing,MIT Press.

303/IX: Cloud Computing

Unit I

Introduction to Cloud Computing : Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Unit II

Introduction to Cloud Technologies : Study of Hypervisors, Compare SOAP and REST, Webservices, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services
Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization
Multitenant software: Multi-entity support, Multi-schema approach, Multi tenance using cloud data stores, Data access control for enterprise applications

Unit III

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo.
Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model

Unit IV

Cloud security : security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control Identity management, Access control, Autonomic Security
Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit V

Issues in cloud computing: Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.

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Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Cloud computing platforms: Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform.

Books :

1. Mastering Cloud Computing, Rajkumar Buyya,Christian Vecchiola, Selvi
2.Cloud Computing Bible by Barrie Sosinsky, Wiley India
3. Enterprise Cloud Computing by Gautam Shroff,Cambridge
4. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
5. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill

Paper 304 (Module 1): DBMS

Introduction:

Concept & Overview of DBMS, Data Models, Database Languages, Database Administ rator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model:

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features .

Relational Model:

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

SQL and Integrity Constraints:

Concept of DOL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and trigge rs.

Relational Database Design:

Functional Dependency, Different anomalies in designing a Database. Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form,3NF, Normalization using multi-valued dependencies, 4NF, SNF

Internals of RDBMS:

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures:

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single- Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

References :

1. Henry F. Korth and Silberschatz Abraham , "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3.Ramakrishnan : Database Management System, McGraw-Hill

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4.Gray Jim and Reuter Address, "Transaction Processing : Concepts and Tec hniques", Moragan Kauffman Publishers.
5.Jain: Advanced Database Management System CyberTech
6.Date C. J., "Introduction to Database Management",Vo l. I, II, Ill, Addison Wesley.
7.Ullman JD ., "Principles of Database Systems", Galgottia Publication.
8. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi

Paper 304 (Module 2): Internetworking

Computer Networks & the Internet:
What is Network, Network Structure, Network Reference Models, Protocols, Concept of Internet, Introduction to services offered by internet

Interconnecting LAN segments:
Hubs, Bridges, Switches, Routers

Network access & physical media:
Traditional Ethernet, Concept of Wireless LAN, Bluetooth & Wi-Fi
Physical media: twisted pair, co-axial, fibre optic cable. Wireless media.

IP Addressing:
classful addressing, Subnetting and super-netting, Masking, classless addressing

Internet services:

WWW, SMTP, FTP, Telnet etc.

Wireless Networking

Paper 305: Advanced Operating System Lab

Problems and assignment based on Paper CS/MSC/301

Paper 306 (Module 1): Seminar

Students will present a seminar on a topic given by the faculty members of the department.

Paper 306 (Module 2): Grand Viva

A viva voce will be conducted over all topics which are covered in different semesters. 50% of the teachers will make the board.

Semester - IV
Theory

Paper 401: Web Technology

Basic design and implementation of websites,
Different navigation and organizational strategies
Client side technologies; Introduction to JavaScript and JQuery
Introduction to .Net Framework, ASP.Net and its component model, Application Life Cycle, Page Life Cycle and Events

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Server side technologies, Back end data management Security issues, Emerging technologies

Paper 402 (Module 1): Artificial Intelligence

Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toe problem, Problem Space & search. Heuristic Search Techniques, Knowledge representation issues.Representing knowledge using rules. Symbolic reasoning under uncertainty. Statistical reasoning. Weak slot & filler structures. Strong slot & filler structures. Game planning – Minimax search procedure, adding alpha beta cut-off's, iterative deepening, Planning. Natural language processing, Understanding. Learning – induction & explanation based learning. Basic knowledge of programming language like Prolog & Lisp.

References

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall.
2. Nils J. Nilsson, Artificial Intelligence: A New Sythesis, Morgan-Kaufmann.

Paper 402 (Module 2): Wireless Technology & Mobile Computing

Evolution of mobile radio communication fundamentals. Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model.

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS- SS), frequency hopped spread spectrum(FH-SS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multi-path channels, fundamentals of equalization, equalizer in communication receiver, survey of equalization techniques, linear equalizer, linear equalizer, non-linear equalizations, diversity techniques, RAKE receiver.

Characteristics of speech signals, quantisation techniques, vocoders, linear predictive coders, time division multiple access, space division multiple access, and frequency division multiple access . Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems .

Introduction to Mobile Computing, novel applications, limitations, and architecture. GSM : Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SOMA, FDMA, TDMA, COMA.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications,
routing and various routing algorithms, security in MANETs.

Protocols and Tools: Wireless Application Protocoi-WAP. (Introduction, protocol architecture, and

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treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

References:

1. T.S. Rappaport, "Wireless Communication-Principles and practice",
Pearson Reference Books:
2.Willium C. Y. Lee, "Mobile communication Design and fundamentals"
3. D. R. Kamila Fehar, "Wireless digital communication"
4. Jochen Schiller,"Mobile Communications",Addison-Wesley
5. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley.

Semester - IV
Practical

Paper 403 (Module 1): Web Technology Lab

Introduction to Visual Studio IDE, Working with Views and Windows, Adding Folders and Files to Website, Projects and Solutions .

Event handling: Event Arguments Application and Session Events, Page and Control Events, Event Handling Using Controls, Default Events.

Server Side : Server Object, Request Object, Response Object, Methods of the Server Controls

Client Side: Client Side Scripts, Client Side Source Code, Basic Controls. Validators.

Database access: Controls and methods,

ADO.Net Ad Rotators

Error handling

Introduction to AJAX.

Paper 403 (Module 2): Artificial Intelligence Lab

Problems and assignment based on Paper CS/MSC/402 (Module 1)

Paper 404: Tour

A departmental tour of not less than 3 days and not more than one week will be conducted with the students. Students should submit a report on that tour which will be examined by a board of examiners to be nominated by the B.O.S.

Paper 405: Project

A separate project will be assigned to each student under the supervision of internal faculty members. The students will prepare a project report in consultation with the supervisor allotted by the department committee which will be presented before a board of examiners to be nominated by the B.O.S.

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