Motilal Nehru National Institute of Technology Allahabad

Course Structure of M.Tech. (Software Engineering)

I - Semester :

Sl. No.	Subject Name	L	T	P	Credits	Distribution of Marks out of 100		
						TA	Mid Sem. Exam.	End Sem. Exam
1.	Topics in Computer Engineering	4			4	20	20	60
2.	Advance Data Structure and System Programming Lab			6	4	20	20	60
3.	Elective – I				4	20	20	60
4.	Elective – II				4	20	20	60
5.	Elective – III				4	20	20	60

Total Credits = 20

II - Semester :

Sl. No.	Subject Name	L	T	P	Credits	Distribution of Marks out of 100		
						TA	Mid Sem. Exam.	End Sem. Exam
1.	Network Programming & Lamp Stack			6	4	20	20	60
2.	Cloud Computing	4			4	20	20	60
3.	Elective – IV	4			4	20	20	60
4.	Elective – V	4			4	20	20	60
5.	Elective – VI	4			4	20	20	60

Total Credits = 20

III – Semester

S. No.	Subject Name	Credits	Eval. (100)
1.	Colloquim	**4**	**Marks**
2.	Thesis/Project	**16**	**Marks**

IV – Semester

S. No.	Subject Name	Credits	Eval. (100)
1.	Thesis/Project	**20**	**Marks**

Note : The distribution of thesis evaluation marks will be as follows :

1. Supervisor(s) evaluation component : 60%
2. Oral Board evaluation component : 40%

List of Electives

M.Tech. (Software Engineering)

Semester – I

1. Software Metrics, Maintenance & Testing
2. Data Mining
3. Distributed Computing
4. Decision Support System
5. Genetic Algorithm & Neural Network
6. Digital Image Processing
7. Advanced Computer Network
8. Optimization Techniques
9. Advanced Data Modeling

Semester II

1. Advanced Algorithms
2. Advance Database
3. Advance Software Engineering
4. Semantic Web
5. Object Oriented Modeling & Design
6. Social Networking
7. Software Oriented Architecture
8. Information Retrieval

Advanced Computer Networks (4L 2P)
Syllabus

Course Description

The area of computer networking is undergoing rapid development; it's important to focus not only on what computer networks are today, but also on *why* and *how* they are designed the way they are. The aim of this course is to provide a sound conceptual foundation to computer networks and its design principles. The focus of the course is on the protocols, algorithms and tools needed to support the development and delivery of advanced network services over networks.

Course Outline (to be covered in 40 lectures)

UNIT-1: Review of Networking Concepts. (10)

MAC layer issues, Ethernet 802.3, ARP, IP addressing and Subnetting, NAT and PAT, Variable Length Subnet Masking, CIDR

UNIT-2: End to End protocols (10)

TCP connection establishment and termination, Sliding window concepts, other issues: wraparound, silly window syndrome, Nagle's algorithm, adaptive retransmission, TCP extensions. Congestion and flow control, Queuing theory, TCP flavors: Tahoe, Reno, New-Reno, TCP-SACK, TCP-RED and TCP-Vegas.Transport protocol for real time (RTP), Quality of service: Integrated Services, Differentiated services

UNIT-3: Routing and Multicast. (10)

Structure of internet: Autonomous systems, Intra-domain routing: OSPF and RIP, Inter-domain routing: BGP. Multicasting: Group Management (IGMP), Internet scale multicasting: Reverse path broadcast, MOSPF, DVMPRP, PIM.

UNIT-4 : Peer to peer and overlay networks. (10)

Concept of overlays, Unstructured Overlays: Gnutella, Concepts of Distributed Hash Table, Structured Overlays: Chord, CAN, Pastry.

Text Books

1. Computer Networks: A Systems Approach, by Peterson and Davie, 5th Ed. Morgan Kauffman, 2011
2. Computer Networking: Top Down Approach, by Kurose and Ross, 6th Ed. Pearson, 2011

Reading List

1. V. Paxson. "End-to-end Internet packet dynamics," in IEEE/ACM Transactions on Networking, Vol 7, No 3, June, 1999.
2. W. Stevens, "TCP Slow Start, Congestion Avoidance, Fast Retransmit, and Fast Recovery Algorithms," RFC2001 .
3. K. Fall and S. Floyd, "Simulation-based comparison of Tahoe, Reno, and SACK TCP," Computer Communication Review, vol. 26, pp. 5--21, July 1996.
4. L. Brakmo and L. Peterson, "TCP Vegas: End-to-End Congestion Avoidance on a Global Internet," IEEE Journal on Selected Areas in Communications, 13(8), October 1995, 1465--1480.
5. Stoica, I., Morris, R., Karger, D., Kaashoek, F., Balakrishnan, H.: Chord: A scalable peer-to-peer lookup service for Internet applications.
6. Rowstron, A., Druschel, P.: Pastry: Scalable, decentralized object location and routing for large-scale peer-to-peer systems.

Distributed Computing (4L)

Syllabus

Course Description

The course covers the fundamental concepts and practical aspects of distributed systems. All major software development activities are distributed in nature. The applications are inherently getting distributed. Thus, there is a need to get an insight into Distributed Computing Environment. Students shall be able to define and identify issues in design of distributed applications. After having undergone the course, the student shall be able to understand the issues related with design and development of distributed applications.

Course Outline (to be covered in 40 lectures)

Unit I: Introduction to Distributed Computing - Fundamentals, Goals, System Models, Network & Internetworking, Architectures, Challenges (4)

Unit II: Distributed Communication Paradigms - Message Passing, Remote Procedure Call, Distributed Shared Memory, Stream Oriented Communication, Multicast Communication (8)

Unit III: Distributed Resource Management - Synchronization, Resource Management, Process Management (8)

Unit IV: Distributed File Management - Consistency & Replication, Fault-Tolerance, Distributed File System, Naming (10)

Unit V: Latest Research Paper Topics (10)

Text Books

1. Distributed Operating System – P.K.Sinha, PHI, 2008
2. High performance Cluster computing, Vol. 1, Rajkumar Buyya, Pearson Education, 2008
3. Distributed Systems – Concepts and Design, George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Addison Wesley, 2011

Genetic Algorithm and Neural Network

Syllabus

Course Description

This course introduces various optimization techniques, chiefly genetic algorithms, to optimize solutions for wide varieties of problems which involve numerical optimization or requires scheduling under constraints. This course also offers a tinge of Artificial Neural Networks and the concepts of pareto optimality.

Course Outline (to be covered in 40 lectures)

1. An overview of Combinatorial Optimization. Introduction to Genetic Algorithms and theoretical foundations of Genetic Algorithms. [10]

2. Genetic Algorithms in Optimization, phenomenon of natural evolution, Simulated Annealing and Non-dominated sorting.[8]

3. Artificial Neural Networks. [7]

4. Industrial and scientific applications of Genetic Algorithms and Evolutionary Computing. [10]

5. Latest Research Paper Topics. [5]

Text Books

1. "Genetic Algorithm in Search, Optimization & Machine Learning", by David E. Goldberg, Pearson Education.

2. Introduction to Evolutionary Computing", by Eiben and Smith, Springer.

3. "An Introduction to Genetic Algorithms", by M. Mitchell, MIT Press.

Digital Image Processing
Syllabus

Objective

Advanced Digital Image Processing investigates algorithms and techniques for a variety of imaging applications. Introduction to Digital Image Processing focuses on basic image processing methods.

Outline

UNIT I:

Introduction: Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system.. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels .Image enhancement in the spatial domain : Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods.

UNIT II:

Image restoration : A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function. Color Image Processing

UNIT III:

Image Compression : Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards.Morphological Image Processing : Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms.

UNIT IV

Image Segmentation : Detection of discontinuous, edge linking and boundary detection, thresholding, region–based segmentation. Object Recognition : Patterns and patterns classes, recognition based on decision–theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching.

UNIT V:

Latest Research Paper Topics: To be decided by subject coordinator

REFERENCES

1. Digital Image Processing using MATLAB, Gonzales/ Woods/ Eddins, 2nd edition, Gatesmark Publishing, ISBN 9780982085400.
2. Fundamentals of Digital Image Processing, A K Jain, Prentice Hall, 1989, ISBN 0-13-336165-9.
3 Digital Image Processing Rafael C. González, Richard Richard Eugene Woods, Steven L.

Data Mining (4L)
Syllabus

Course Description

The course's objective is to learn data exploration, and discovery of knowledge using data mining techniques from different types of data. This also focuses on the using statistical methods for data analysis.

Course Outline (to be covered in 40 lectures)

1. Linear regression; review of linear regression, Cross-validation and model selection.
2. Data mining with one and two variables; Kernel smoothing, splines and others; Nonparametric estimation of density function; Nonparametric estimation of regression curve; Data mining with multi-variables;; Single-index models, Additive models, Other semi-parametric models.
3. Linear parametric methods: linear correlation analysis, linear regression models; Nonlinear parametric methods: logistic models, generalized linear regression models.
4. Nonparametric methods: wavelet methods, spline-smoothing, kernel smoothing.
5. Data preprocessing; Mining frequent patterns; Mining frequent patterns, Association, and correlation; Classification and prediction; cluster Analysis.
6. Application and Trends in Data Mining.

Text *Books*

1. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* , Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer-Verlag, 2001.
2. *Data Mining: Concepts and Techniques*, Jiawei Han and Micheline Kamber, Morgan Kaufmann Publishers, Third Edition, 2011.
3. *Introduction to Data Mining*, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Morgan Kaufmann Publishers, Second Edition.
4. *Data Mining: Practical Machine Learning Tools and Techniques*, Ian H. Witten, Eibe Frank, Mark A. Hall, Morgan Kaufmann Publishers, Third Edition.

Software Metrics, Maintenance & Testing

Syllabus

Course Description

This course introduces the basics of software measurement theory, software metrics and models for measurement in software engineering. It also covers the concepts of quality assurance and ethics required for upholding a quality software. This course also offers a prologue to various types of testing techniques.

Course Outline (to be covered in 40 lectures)

1. Fundamentals of Measurements in Software Engineering, Process & Product Metrics, Software Products Attributes and Process Management. [11]

2. Software Quality, ISO-CMM-CMMi, Product and Process Quality, SQA, Clean Room Process and Six-Sigma Principles. [7]

3. Software maintenance, Updates-Upgrades-Patches-Versions, Error Reporting, Customer Support, Software Reliability-Warranty-Guarantee and Software Documentation. [10]

4. Software Testing Fundamentals, Test Case Design and its Optimization, Different Levels of Testing and Testing Tools. [9]

5. Latest Research Paper Topics. [3]

Text Books

1. *"Metrics and Models in Software Quality Engineering"*, by S. H. Kan, Addison-Wesley Professional.

2. *"The Art of Software Testing"*, by GJ Myers, Wiley.

3. *"Software Engineering: A Practitioner's Approach"*, by Roger S. Pressman, McGraw-Hill Higher Education.

4. *"Software Engineering"*, by Ian Sommerville, Addison-Wesley.

Decision Support Systems (4L)
Syllabus

Course Description

The objectives of the course includes, introduction of decision support systems, their development approaches and utilization of DSS capacities to support different types of decisions. The course focuses on how models, data, and other analytical tools decision makers might use in the reasoned consideration of the options available to them.

Course Outline (to be covered in 40 lectures)

1. Introduction to decision support systems; DSS components; decision making and DSS;
2. DSS software and hardware; developing DSS;
3. DSS models; types of DSS; group DSS; executive information systems;
4. Data mining; artificial intelligence and expert systems;
5. Systems integration and the future of DSS;

Text *Books*

1. Decision Support Systems For Business Intelligence, V.L. Sauter, John Wiley & Sons, 2011.
2. Decision Support & Business Intelligent Systems, Turban and Efrain , Pearson Education.
3. Decision Support & data Warehouse Systems, Mallach, G. Efrem, Tata McGraw-Hill.
4. Decision Support System for effective planning, Theierauff, J Robert, Prentice Hall.

Advanced Database Systems (4L)
Syllabus

Course Description

Database systems used to provide convenient access to disk-resident data through efficient query processing, indexing structures, concurrency control, and recovery. This traditional view of database systems has recently changed due to the emergence of a wide variety of new applications and technologies that include web applications, sensor networks, location-based services, multimedia, and context-aware systems, and new hardware that include map flash storage, map reduce environments, and sensor devices. Students will understand and master relevant concepts and techniques of current databases and processing based on databases. They will understand the potentials, limitations, and risks inherent in assembling, combining, and processing huge amounts of heterogeneous data in globally interconnected environments. They will be able to design such databases and connectivity and relevant methods for combining and enriching data, and work with concrete examples of such data collection/processing.

Course Outline (to be covered in 40 lectures)

1. Modeling data; Recap: ER Model, UML, semantic networks, logic;
2. XML databases; Object relational databases;
3. Temporal databases; Queries and relational operators; Temporal indexes: persistent B-trees;
4. Spatial databases and spatio-temporal databases; Representing space / spatial entities; Queries and relational operators;
   Recap: Spatial indexes: B+ trees, kd trees, R-trees; Spatial Database Management Systems (SDBMS);
5. Spatio-temporal queries; map reduce /cloud; Data management on cloud;
6. Defining and combining heterogeneous databases, schemas and ontologies;

Text *Books*

1. A reading list of research papers relevant to above topics may be given to students.
2. Database System Concepts, Avi Silberschatz, Hank Korth, and S.Sudarshan. 6th Ed. McGraw Hill, 2010.
3. Principles of Data and Knowledge Base Systems, Volume 1, J.D. Ullman, Computer Science Press.
4. Spatial Database Systems: Design, Implementation and Project Management; edited by Albert K. W. Yeung, George Brent Hall.

Optimization Techniques
Syllabus

Objective

This course is intended to provide students with a knowledge that can make them appreciate the use of various research operations tools in decision making in organizations. At the end of the Course participants are expected to demonstrate a working knowledge of the various OR /OM tools in making decisions as well as being able to formulate organizational problems into OR models forseeking optimal solutions.

Outline

UNIT I

Linear Models: Formulation and Examples, Basic Polyhedral Theory- Convexity, Extreme points, Supporting hyperplanesetc, Simplex Algorithm- Algebraic and Geometrical approaches, Artificial variable technique, Duality Theory: Fundamental theorem, Dual simplex method, Primal-dual method, Sensitivity Analysis, Bounded Variable L.P.P. Transportation Problems: Models and Algorithms.

UNIT II

Network Flows: Shortest path Problem, Max-Flow problem and Min-cost Flow problem, Dynamic Programming: Principle of optimality, Discrete and continuous models.

UNIT III

Integer Programming: All integer and mixed integer programming problems, cutting planes and branch and bound algorithms, introduction to the ideas of NP-completeness, travelling salesman and other related problems.

UNIT IV

Non-linear Programming: General constrained mathematical programming problems, Kuhn-Tucker-Lagrangian necessary and sufficient conditions, interior point methods, standard algorithms like feasible direction and gradient projections convergence of the methods, convex programming problems, quadratic programming

Unit-V

Recent Research Topics from Papers

REFERENCES

1- . G.L. Nemhauser and L.A. Wolsey: Integer and Combinational Optimization.
2- HamdyA.Taha Operations Research 8 edition
3- R.P.Sen Operations Research,Algorithms and Application

Advanced Algorithms

Syllabus

Objective

. Students will develop the necessary skills from both a theoretical perspective as well as applying their knowledge on various problem sets. Particularly, the course objectives: Develop mathematical skills for algorithm design, analysis, evaluation and computational cost; Develop the skills to design and implement efficient programming solutions to various problems;

Outline

UNIT 1 Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound. Point location Convex hulls and Voronoi diagrams

UNIT II Advanced Algorithms for Graph and Combinatorial Optimization Problems, Shortest path problems: Single source SP problem, SP tree, Ford's labelling method, labelling and scanning method, efficient scanning orders – topological order for acyclic networks, shortest first search for non-negative networks (Dijkstra), BFS search for general networks, correctness and analysis of the algorithms;

UNIT III Flows in Networks: Basic concepts, maxflow-mincut theorem, Ford and Fulkerson augmenting path method, integral flow theorem, maximum capacity augmentation, Edmond-Karp method, Dinic's method and its analysis, String processing: String searching and Pattern matching,

UNIT IV Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing subset-sum problem etc. simple lower bound results.NP-completeness: Informal concepts of deterministic and nondeterministic algorithms, P and NP, NP-completeness, statement of Cook's theorem, some standard NP-complete problems, approximation algorithms.

UNIT V: Latest Research Paper Topics: To be decided by subject coordinator

References:

1- Introduction to Algorithms, third edition

By Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein

2- Algorithms, 4th Edition by Robert Sedgewick and Kevin Wayne

Semantic Web (4L)
Syllabus

Course Description

This course discusses fundamental concepts of information structure, representation, presentation, as well as information exchange on the World Wide Web. It gives students knowledge of how semantics of the Web information as well as its metadata is formed, structured and represented/presented, and how the Web semantics is acquired and organized so that machines can understand information and assist human being to make better use of the Web information. It gives and understanding of languages for semantic web, specification of a conceptualization, and reasoning with ontologies.

Course Outline (to be covered in 40 lectures)

1. Introduction to Semantic Web Vision; Metadata and XML Schema.
2. RDF, RDF Schema.
3. Introduction to description logics, Reasoning with description logics.
4. Ontology; Ontology building methodologies.
5. Ontology Languages for the Semantic Web, From RDFS to OWL, OWL, Reasoning with OWL.

Text *Books*

1. *A First Step towards the Semantic Web* by Wei Song and Min Zhang, Higher Education Press, 2004.
2. *A Semantic Web Primer*, Gregoris Antoniou & Frank Van Harmlen, The MIT Press, second edition.
3. *The Language of First-Order Logic*, Jon Barwise & John Etchemendy, Cambridge University Press, Third edition.
4. *Practical RDF*, Powers S., O'Reilly Associates, Inc. Sebastopol, CA, USA 2003.
5. *Foundations of Semantic Web Technologies*, Pascal Hitzler, Markus Kroetzsch and Sebastian Rudolph, *Chapman & Hall, 2009.*
6. *The Description Logic Handbook: Theory, Implementation and Applications*, Franz Baader, Diego Calvanese, Deborah McGuinness, Daniele Nardi and Peter Patel-Schneider, Cambridge University Press, 2003.
7. *Explorers Guide to the Semantic Web, Thomas Passin*, Manning, 2004.

Advanced Software Engineering (4L)

Syllabus

Course Description

The course covers the fundamental concepts and practical aspects of software engineering. For assessing the cost and quality of software under development, measurement of various activities becomes a key factor. Also major software development activities are component based and distributed in nature. The applications are inherently getting distributed. Thus, there is a need to get an insight into software quality, reliability and versioning.

Course Outline (to be covered in 40 lectures)

Unit I: Measurements Theory - Fundamentals of measurement, Scope of Software metrics (4)
Unit II: Component Based Development (6)
Unit III: Product & Quality Metrics (6)
Unit IV: Software Quality Assurance (6)
UNIT V: Software Reliability (4)
Unit VI: Distributed Software Design, Nightly/Weekly Builds, Versioning (4)
Unit VII: Latest Research Paper Topics (10)

Text Books

1. Metrics & Models in Software Quality Engineering, S. Kan, Addison-Wesley, 2002
2. Software Engineering: A Practitioner's Approach, Roger S Pressman, Mc-Graw Hill, 2010
3. Component-Based Software Engineering: Putting the Pieces Together, George T. Heineman, William T.Councill, Addison-Wesley Professional, 2001
4. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger, Pearson Education India, 2008

Information Retrieval (4L)
Syllabus

Course Description

The course focuses on the basic concepts and methods of information retrieval including capturing, representing, storing, organizing, and retrieving unstructured or loosely structured information. Students will learn how effective information search and retrieval is interrelated with the organization and description of information to be retrieved. Learning the process of indexing and retrieving text documents. Information retrieval is a critical aspect of Web search engines. This course will examine the design, implementation, and evaluation of information retrieval systems, such as Web search engines, as well as new and emerging technologies to build the next generation of intelligent and personalized search tools and Web information systems.

Course Outline (to be covered in 40 lectures)

1. Introduction to information retrieval, Information Retrieval Models; Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval, Performance metrics.
2. Text Representation Models; Query Operations and Languages.
3. Web Search; Search engines; spidering; metacrawlers; directed spidering; link analysis; Social Networks.
4. Text Categorization; Text Classification; Applications to information filtering and organization.
5. Language-Model Based Retrieval; Using naive Bayes text classification for ad hoc retrieval. Improved smoothing for document retrieval.

Text *Books*

1. *Introduction to Information Retrieval*, Christopher Manning, Prabhakar Raghavan and Hinrich Schutze, Cambridge University Press. 2008.
2. *Search Engines: Information Retrieval in Practice,* W. B. Croft, D. Metzler, and T. Strohman, Pearson Education, 2009.
3. *Modern Information Retrieval*, Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Addison-Wesley Professional; Second edition, 2011.
4. *Mining the Web: Discovering Knowledge from Hypertext Data,* Soumen Chakrabarti, Morgan-Kaufmann Publishers, 2003.
5. *Managing Gigabytes: Compressing and Indexing Documents and Images,* Ian H. Witten, Alistair Moffat, and Timothy C. Bell, Morgan Kaufmann, Second Edition, 2013.

Cloud Computing (4L)

Syllabus

Course Description

Shortening of product development lifecycle coupled with alignment of the user needs in a shared manner paved way for cloud computing. It addresses the issues like scalability, large scale data, high performance computing, automation, response time, rapid prototyping, and rapid time to production. This effectively addresses the ever shortening cycle of obsolescence, heterogeneity and rapid changes in requirements.

Course Outline (to be covered in 40 lectures)

Unit1: Introduction to distributed and cluster computing, Basics of the emerging cloud computing paradigm, Cloud Benefits (10)

Unit 2: Virtualization concepts and types, KVM, VM Scheduling (8)

Unit 3: Disaster Recovery, Scaling (6)

Unit 4: Cloud security, Regulatory and compliance issues, VM Security Issues (6)

Unit 5: Latest Research Paper Topics (10)

Text Books

1. Cloud Computing, Michael Miller, Pearson, 2012
2. Cloud Computing: Implementation, Management, and Security, , John Ritting house and James F.Ransome, CRC Press Taylor and Francis Group, 2009
3. www.linux-kvm.org
4. www.redhat.com/rhecm/rest-rhecm/jcr/repository/.../rh:pdfFile.pdf

Social Network Analysis

Syllabus

Course Description

This course introduces various techniques to analyse social relationships in terms of network theory, consisting of nodes and ties between them. In the opening this course aims to introduce the data storage terminology and file systems that store these networks. Passing through network structure and network mining techniques this course culminates with latest research topics in the field of social network analysis. In this course students will learn about the structure and evolution of networks while drawing knowledge on their organisation, distribution, connection and segmentation.

Course Outline (to be covered in 40 lectures)

1. Network data storage: Big Data, Big Tables, PAXOS and CASANDRA. [10]

2. Introduction to GFS: Google File System basics, File Hierarchy, Design and Performance, IBM's General Parallel File System. [10]

3. Graph Mining. [5]

4. Social Networks & Their Structural Properties, Study of real-world networks like Facebook, Twitter and Google. [10]

5. Latest Research Paper Topics. [5]

Text Books

1. *"Social Network Analysis: Methods and Applications"*, by Stanley Wasserman and Katherine Faust, Cambridge University Press.

2. *"Models and Methods in Social Network Analysis"*, by Peter J. Carrington, John Scott and Stanley Wasserman, Cambridge University Press.

3. *"Understanding Social Networks: Theories, Concepts, and Finding"*, by Charles Kadushin, Oxford University Press.

Service Oriented Architecture (4L)

Syllabus

Course Description

The course covers the fundamental concepts and practical aspects of **Service Oriented Architecture**. The current software development and delivery model is service oriented in nature. The applications are inherently getting distributed and shared by multiple clients. Thus, there is a need to get an insight into service oriented architectures. Students shall be able to define and identify issues in design of service oriented applications. After having undergone the course, the student shall be able to understand the issues related with detailed design aspects and standards of SOA.

Course Outline (to be covered in 40 lectures)

Unit I: SOA & Cloud Computing **:** Fundamentals, Technologies, Benefits, Challenges and basic mechanisms associated with cloud computing, Delivery models - SAS, IAS & PAS, Common Cloud deployment models and cloud characters, Security threats and mechanisms (06)

Unit II: Introduction and fundamental of SOA, Benefits and Goals, SOA Manifesto, SOA and network management architecture, Service as web services, Discovery and publishing of web services, Service roles, Service models, Description of services with WSDL, Messaging with SOAP (08)

Unit III: Exchange patterns of message, Service activity, Coordination, Composition, Types, Activation and registration process, Business activities, Orchestration, Composition of heterogeneous web services Choreography, Addressing, Reliable messaging, Correlation, Policies, Notification and eventing (10)

Unit IV: Security threats and mechanisms, Essential techniques, Patterns, Security architecture for service oriented solutions, Infrastructure, Middleware, Multitenancy concepts (08)

Unit V: Latest Research Paper Topics (08)

Text Books

1. Service Oriented Architecture, Concepts Technology and Design, Thomas Erl, Pearson Education, 2008
2. SOA in Practice: The Art of Distributed System Design, Nicolai M. Josuttis, O'Reilly, 2007

Object-oriented Modeling and Design (4L)
Syllabus

Course Description

The objective of this course is to learn basic OO analysis and design skills through an elaborate case study. To use the UML design diagrams and to apply the appropriate design patterns in application development.

Course Outline (to be covered in 40 lectures)

UNIT I (10)

Introduction to OOAD – What is OOAD? – What is UML? What are the Unified process(UP) phases, Case study – the NextGen POS system, Inception-Use case Modeling, Relating Use cases. Elaboration - Domain Models, Finding conceptual classes and description classes, Associations, Attributes, Domain model refinement – Finding conceptual class hierarchies, Aggregation and Composition, UML activity diagrams and modeling

UNIT II (10)

System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram, Logical architecture refinement, UML class diagrams, UML interaction diagrams

UNIT III (10)

GRASP: Designing objects with responsibilities – Creator, Information expert, Low Coupling, Controller, High Cohesion, Designing for visibility, Applying GoF design patterns – adapter, singleton, factory and observer patterns.

UNIT IV (10)

UML state diagrams and modeling - Operation contracts, Mapping design to code, UML deployment and component diagrams.

Text Book

REFERENCES:

1. Craig Larman,"Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and iterative development", Third Edition, Pearson Education, 2005
2. Mike O'Docherty, "Object-Oriented Analysis & Design: Understanding System Development with UML 2.0", John Wiley & Sons, 2005.
3. James W- Cooper, Addison-Wesley, "Java Design Patterns – A Tutorial", 2000.
4. Micheal Blaha, James Rambaugh, "Object-Oriented Modeling and Design with UML", Second Edition, Prentice Hall of India Private Limited, 2007
5. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides,"Design patterns: Elements of Reusable object-oriented software", Addison-Wesley, 1995.
6. **Object-Oriented Analysis and Design with Applications** - Grady Booch et al, 3rd Edition, Pearson, 2007.

Advanced Data Modeling (4L)
Syllabus

Course Description

The objective of this course is to learn basic fundamental techniques of using various data models in application development. In particular, the focus will be over various ways of developing computer applications with different kinds of data models.

Course Outline (to be covered in 40 lectures)

UNIT I (10)

What is data modeling, The History of Data Modeling , Data Modeling Fundamentals, Entity Relationship Model, Enhanced Entity Relationship Models, UML, Physical Data Models.

UNIT II (10)

Mathematical Foundation of the Relational Model, Keys and Referential Integrity, Functional dependencies and normalization, Relational Algebra, Relational Mappings.

UNIT III (10)

Object Oriented Databases – Introduction, Weakness of RDBMS, Object Oriented Concepts Storing Objects in Relational Databases, Next Generation Database Systems – Object Oriented Data models, OODBMS Perspect – Issues in OODBMS, Advantages and Disadvantages of OODBMS, Object Oriented Database Design, OODBMS Standards and Systems – Object Management Group, Object Database Standard ODMG, Object Relational DBMS, Comparison of ORDBMS and OODBMS.

UNIT IV (10)

XML Fundamentals, XML Schema and DTD document definitions, XSLT transformations and programming, Parsing XML.

Text Books

1. Ramez Elmasri & Shamkant B.Navathe, "Fundamentals of Database Systems", Sixth Edition , Pearson Education , 2010.
2. Peter Rob and Corlos Coronel, "Database Systems – Design, Implementation and Management", Thompson Learning, Course Technology, 5th Edition, 2003.
3. Graeme Simsion & Graham Witt, "Data Modeling Essentials, Third Edition", Morgan Kaufmann
4. David Hunter, Jeff Rafter, Joe Fawcett, and Eric van der Vlist " Beginning XML Fourth Edition, Wrox Publications.
5. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts ", Fifth Edition, McGraw-Hill

Topics in Computer Engineering (4 L)

Syllabus

Course Description

The course covers the fundamental concepts and practical aspects of all the courses credited by a student in various branches of M.Tech offered by Computer Science and Engineering Department. The syllabus includes topic from Data Structures, Data Base Management Systems, Algorithms, Operating System and Computer networks. These topics form the foundation of the students.

Course Outline

Unit I: Topics in Data Structures

Unit II: Topics in Data Base Management Systems

Unit III: Topics in Algorithms

Unit IV: Topics in Operating System

Unit V: Topics in Computer networks

Text Books

1. Data structure using C, AM Tanenbaum, Y Langsam & MJ Augustein, PHI Learning Pvt. Ltd., India.
2. Data Structures : A Programming Approach with C, Dharmender Singh Kushwaha & Arun Kumar Misra, PHI Learning Pvt. Ltd., India, 2012
3. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, Addision Wesley.
4. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, McGraw Hill.
5. Advanced Programming in the UNIX® Environment, W. Richard Stevans, Pearson, 2009
6. Operating System Concepts, Avi Silberschatz, Peter Baer Galvin, Greg Gagne, John Wiley & Sons, Inc., 2012

Advance Data Structure and System Programming Lab (6P)

Syllabus

Objectives

To make student learn and polish his/her basics of programming with emphasis on solving real time problems. Focus is to make the student learn object oriented way of solving problems. The lab will cover programming of important data structures. Further it also covers programming using system call interface to write efficient programs.

Outline

UNIT-1: (a) Programming Data Structures using C++: Array, Stack, Queues, Linked Lists, Trees, Graphs, Searching, Sorting, Binary Trees, AVL trees, Red-Black Trees, B-Trees, Hashing, Dynamic programming, Backtracking, Branch and Bound.

(b) Learning the use of STL (Standard Template Library) to write generic programs.

UNIT-2: Programming of Inter Process Communication (IPC) either by Posix or System V: Fork, Pipe, FIFO, Message Queues, Semaphore, Shared Memory

References

1. Fundamentals of Data Structures in C++, by Elis Horowitz, Sartaz Sahni, Dinesh Mehta, Galgotia
2. Data Structures, Algorithms and Applications in C++, by Sartaz Sahni, Mcgraw Hill
3. UNIX Network Programming, Vol.2 (Inter Process Communication), by Richard Stevens, Pearson
4. Resources on WWW for Linux System Programming.

Cloud Computing (4L)

Syllabus

Course Description

Shortening of product development lifecycle coupled with alignment of the user needs in a shared manner paved way for cloud computing. It addresses the issues like scalability, large scale data, high performance computing, automation, response time, rapid prototyping, and rapid time to production. This effectively addresses the ever shortening cycle of obsolescence, heterogeneity and rapid changes in requirements.

Course Outline (to be covered in 40 lectures)

Unit1: Introduction to distributed and cluster computing, Basics of the emerging cloud computing paradigm, Cloud Benefits (10)

Unit 2: Virtualization concepts and types, KVM, VM Scheduling (8)

Unit 3: Disaster Recovery, Scaling (6)

Unit 4: Cloud security, Regulatory and compliance issues, VM Security Issues (6)

Unit 5: Latest Research Paper Topics (10)

Text Books

1. Cloud Computing, Michael Miller, Pearson, 2012
2. Cloud Computing: Implementation, Management, and Security, , John Ritting house and James F.Ransome, CRC Press Taylor and Francis Group, 2009
3. www.linux-kvm.org
4. www.redhat.com/rhecm/rest-rhecm/jcr/repository/…/rh:pdfFile.pdf

Network Programming and LAMP Stack (6P) Syllabus

Course Description

Network programming module of this lab presents a systematic introduction to the principles and practices of configuring and maintaining computer systems and networks. It offers a top-down approach to investigating the layers and components of network technology and provides an understanding of networked systems.
LAMP stands for Linux, Apache, MySQL, and PHP, which are, respectively, an open source operating system, web server, database, and programming language(s), such as PHP/Perl/Python. The "stack" part means that LAMP is a full service that should cover everything for a personal computer.The course focuses on using all the components of LAMP for application development.

Outline

Module1:
Sockets programming; client/server; peer-to-peer; Internet addressing; TCP sockets; UDP sockets; raw sockets. Finger, DNS, HTTP, and ping clients and servers
Internetwork setup: network topology, wireless internetworking,
Packet Sniffers: Network protocol analyzers, traffic generation.
Introduction to Network Simulation: NS-2, OMNET++
Module 2:
1. HTML/CSS Basics ;
2. PHP ; Introduction, Basics, Data types, Operators, Flow control, Arrays, Array functions, Strings and Regular expressions, Generators, OOP in PHP -- Classes, Objects, Constructors and Destructors, Access Modifiers, Methods, Inheritance, Error and Exceptional Handling , File Handling, PEAR, Security
2. Databases; MySQL ; query, transactions
3. I/O, JSON, XML, SESSIONS; Reading from and Writing to files, parsing XML and JSON data, Creating and Accessing Webservices, Simulating user Login and Logout.
4. Javascript; Syntax Overview, DOM Manipulation, eval, closures, objects, AJAX
5. jQuery; Selectors, DOM Manipulation with jQuery, AJAX with jQuery, Plugins; Other Javascript Frameworks;
6. The ZEND Framework; Other PHP Frameworks;
7. Server Administration, Virtual Host Setup, Eclipse IDE, XAMPP, Linux
8. Web 2.0; Overview of the technologies involved in building today's web applications

Text Books

1. W. R. Stevens, *UNIX Network Programming*, Prentice Hall
2. Beginning PHP5, Apache, and MySQL Web Development,Elizabeth Naramore, Jason Gerner , Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass, Wrox, 2 edition.
3. *PHP for the Web*, Larry Ullman, Peachpit Press, Fourth Edition, 2011
4. Programming PHP, Creating Dynamic Web Pages, Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, O'Reilly Media, 3rd Edition, 2013