COURSE NAME : NETWORK SECURITY AND CRYPTOGRAPHY
COURSE CODE : CS 461
CREDITS : 4
PREQ : COMPUTER NETWORKS
LTP : 4 0 0

LECTURE WITH BREAKUP

BASIC ENCRYPTION AND DECRYPTION (05)
Attackers and Types of threats, challenges for information security, Encryption Techniques, Stream and Block Ciphers, Classical Cryptographic Algorithms

SECURE ENCRYPTION SYSTEMS (05)

SECRET KEY SYSTEMS (03)
The Data encryption Standard (DES), Analyzing and Strengthening of DES, Introduction to TDES and Advance Encryption Standard (AES)

KEY MANAGEMENT PROTOCOLS (04)
Solving Key Distribution Problem, Diffie-Hellman Algorithm, Key Exchange with Public Key Cryptography

PUBLIC KEY ENCRYPTION SYSTEMS (05)

HASH ALGORITHMS (05)
Hash concept, description of Hash Algorithms, Message Digest Algorithms such as MD4 and MD5, Secure Hash Algorithms such as SH1 and SHA2, Other Advances

PUBLIC KEY INFRASTRUCTURE (PKI) (05)

NETWORK SECURITY (06)
Network Security Issues such as Impersonation, Message Confidentiality, Message Integrity, Code Integrity, Denial of Service, Vulnerabilities in TCP/IP Model, Securing Switches and Routers, Firewalls, DMZs, Virtual Private Networks, Network Monitoring and Diagnostic Devices, Virtual LANs, IPSec Secure Communication Mechanism,

WEB SECURITY (04)

BOOK:

REFERENCES:
1. Principles of Cryptography, William Stallings, Pearson Education
4. Firewalls and Internet Security, Bill Cheswick and Steve Bellovin, Addison-Wesley

CS 461H, NETWORK SECURITY AND CRYPTOGRAPHY
Elliptic Curve Cryptography
Zero knowledge proof systems and identity based encryptions
Worms, Trojans, viruses and Rootkits
Defense Mechanisms like antivirus, antispyware
Symmetric Algo: RC5
PKI, CAs in India

COURSE NAME : SYSTEM SOFTWARE
COURSE CODE : CS 462
CREDITS : 04
L T P : 4 0 0
PR-REQ. : Computer Architecture

LECTURE WITH BREAKUP

INTRODUCTION 07
Introduction to various system software’s, Introduction to the m/c architecture to be used for the implementation of various System Software’s- basic architecture, addressing modes, instruction set to be used, common symbols to be used like EQU, DC, DS etc in case of IBM 360 architecture.

ASSEMBLERS 08
Data structures and logic flow for a simple two-pass assembler, Design of a two pass assembler, n-pass assembler, Effect of machine architecture on assembler design Sorting techniques, Searching techniques. Effect of machine architecture on assembler design, sorting techniques, Searching techniques.

MACRO PROCESSORS 07
Data structures and design of a two-pass macro processor, introduction to one pass macro processor, combining macro processor with assembler.

MACRO PROCESSOR PROGRAMMING 05
Concatenation of macro parameters; Generation of labels in macro expansions; Conditional macro expansion; Keyword and positional macro parameters; Nested macro definitions; Nested macro invocations, Macro processing within an assembler, General-purpose macro processors.

LINKERS AND LOADERS 04
Absolute loaders; Program relocation; Program linking; Data structures and logic flow for a relocating and linking loader, Library search to resolve external references

**OVERLAYS, LOADING** 05
Overlay programs; Linkage editors; various loading techniques: Dynamic loading, Bootstrap loaders, Effect of machine architecture on loader design

**COMPILERS** 05
Structure of a Compiler, Various types of Grammars, Various Phases of Compiler.

**PARSING TECHNIQUES** 04
Recursive descent and operator precedence, Simple code generation techniques; Code optimization; Storage allocation; Compilation of Structured variables; Block-structured languages.

**TYPES OF COMPILERS** 03
Multi-pass compilers Interpreters; P-code compilers; Cross Compilers

**BOOK:**
1. System Programming By J J Donovan TMH

**REFERENCES:**
1. System Software by Dhamdhere
2. System Software: An Introduction to Systems Programming by Leland L. Beck
3. System Software : An Introduction to Systems Programming by Beck

**COURSE NAME** : DEPARTMENTAL LAB IV  
**COURSE CODE** : CS 463  
**CREDITS** : 02  
**L T P** : 0 04

Programs and problems based on the courses of Network Security and Cryptography.

**COURSE NAME** : DEPARTMENTAL LAB V  
**COURSE CODE** : CS 464  
**CREDITS** : 02  
**L T P** : 0 04

Programs and problems based on the courses of System Software.

Course Name : CAPSTONE PROJECT-I  
Course Code : CS 498
COURSE NAME : UNIX NETWORK PROGRAMMING
COURSE CODE : CS 469
CREDITS : 4
L T P : 4 0 0

LECTURE WISE BREAKUP

<table>
<thead>
<tr>
<th>NO. OF LECTURES</th>
<th>UNIVERSITY MODEL</th>
</tr>
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<tbody>
<tr>
<td>(4)</td>
<td>Introduction, Basic Definitions, Input and Output, Signals, Process Control, Daemon Processes</td>
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<table>
<thead>
<tr>
<th>NO. OF LECTURES</th>
<th>UNIX FILE SYSTEM AND SHELL INTRODUCTION</th>
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<tbody>
<tr>
<td>(4)</td>
<td>The Shell: Executing commands and command options; Interactive features: job control, history; The UNIX file system; File Utilities (cp, mv, rm, etc.); comm, cmp, diff; Tree walking: find, xargs</td>
</tr>
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<tr>
<th>NO. OF LECTURES</th>
<th>INTER PROCESS COMMUNICATION</th>
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<tbody>
<tr>
<td>(4)</td>
<td>Introduction, Pipes and FIFOs, Message Queues, Read-Write Locks, Record Locking, Semaphores, Shared Memory</td>
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<tr>
<th>NO. OF LECTURES</th>
<th>COMMUNICATION PROTOCOLS</th>
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<tbody>
<tr>
<td>(4)</td>
<td>XNS, SNA, NETBIOS, OSI Protocols, UUCP</td>
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<thead>
<tr>
<th>NO. OF LECTURES</th>
<th>INTRODUCTION TO TCP/IP, THE TRANSPORT LAYER</th>
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<tbody>
<tr>
<td>(4)</td>
<td>TCP, UDP and SCTP, TCP Connection Establishment and Termination, SCTP Association Establishment and Termination, Port Numbers, Buffer Sizes and limitations</td>
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<tr>
<th>NO. OF LECTURES</th>
<th>SOCKETS</th>
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<tbody>
<tr>
<td>(4)</td>
<td>Sockets Introduction, TCP Sockets, UDP Sockets, SCTP Sockets,</td>
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<tr>
<th>NO. OF LECTURES</th>
<th>SOCKETS PARTII</th>
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<tbody>
<tr>
<td>(4)</td>
<td>I/O Multiplexing, Socket Options, Name and Address conversions, TCP, UDP and SCTP Examples. Introduction to Ipv4 and Ipv6 Interoperability, Daemon Processes, Advanced I/O Functions.</td>
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<tr>
<th>NO. OF LECTURES</th>
<th>Signal Driven I/O, Threads, Raw Sockets</th>
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<tr>
<th>NO. OF LECTURES</th>
<th>Remote Login, Remote Command execution, Remote Tape drive access, Remote procedure calls.</th>
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<td>(4)</td>
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</tbody>
</table>

BOOK:
UNIX Network programming by W. Richard Stevens

REFERENCES:
1. UNIX Network programming – The sockets networking API Vol 1 by W. Richard Stevens
2. UNIX Network programming – Interprocess Communications by W. Richard Stevens
3. UNIX Network programming Vol – 1 by W. Richard Stevens
4. Internet working with TCP/IP Vol III by Douglas
5. The protocols by W. Richard Stevens
6. Internet working with TCP/IP Vol I, principles and Architecture by Douglas

**COURSE NAME**: COMPUTER GRAPHICS  
**COURSE CODE**: CS 470  
**CREDITS**: 04  
**L T P**: 4 0 0

**LECTURE WISE BREAKUP**

**Graphics Hardware**: (6)  
Introduction, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems, graphics monitors and workstations and input devices.

**Output primitives**: (4)  
Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.

**Filled area primitives**: (4)  
Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

**2-D geometrical transforms**: (4)  
Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

**2-D viewing**: (6)  
The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland–Hodgeman and Weiler-Atherton polygon clipping algorithm.

**3-D object representation**: (6)  
Polygon surfaces, quadric surfaces, spline representation, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods.

**3-D Geometric transformations**: (6)  
Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D projections.

**Visible surface detection methods**: (4)  
Classification, back-face detection, Hidden surface removal algorithms.

**Illumination Models and Shading**: (5)  
Gouraud Shading, Phong Shading.

**Interactive Computer Graphics techniques**: (5)

**BOOKS**:  
REFERENCES:
5. Computer Graphics, Steven Harrington, TMH.

COURSE NAME : COMPILER DESIGN
COURSE CODE : CS 471
CREDITS : 04
L T P : 4 0 0

LECTURE WISE BREAKUP

COMPILER STRUCTURE
Analysis-synthesis model of compilation, various phases of a compiler, passes of compilers, bootstrapping, tool based approach to compiler construction.

PHASES OF COMPILERS

SYNTAX ANALYSIS AND BASIC PARISING TECHNIQUES
Syntax directed definitions like Inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions. CFGs, derivations and parse trees, ambiguity, associativity, precedence, use of syntax analyzer generators, top down parsing, shift reduce parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR(k) parsing (SLR, LALR, LR), YACC.

AUTOMATIC CONSTRUCTION OF SOME EFFICIENT PARSERS
Canonical collection of LR(0) items, constructing SLR parsing tables, constructing LR parsing table, constructing LALR parsing tables, ambiguous grammars usages, implementation of LR parsing tables, constructing LALR sets of items.

INTERMEDIATE CODE GENERATION
Syntax directed translation schemes and their implementation, Intermediate languages, quadruples and triples, assignment statements, boolean expressions, array references, procedure calls, declarations, case statements.

SEMANTIC ANALYSIS
Type checking, type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

RUN TIME SYSTEM AND OPTIMIZATION
Storage organization, activation tree, activation record, parameter passing, symbol tables, data structures for symbol tables, handling recursive calls, global optimization through flow graph analysis, dynamic storage allocation, local optimization techniques, loop optimization techniques, loop-invariant, peephole optimization.

**ERROR DETECTION AND RECOVERY**

Introduction to errors in all phases of compilers, lexical-phase errors, synthetic phase errors, semantic errors and various recovery methods.

**CODE GENERATION AND INSTRUCTION SELECTION**

Issues, basic blocks and flow graphs, register allocation, code generation, DAG representation of programs, code generation from dags, code generator generators, specifications of machine, Compiler-Compilers, Parser generators, machine independent code generation

**COMPILER HONOURS:**

Study of LEX, Study of YACC, Study of design of various code optimization techniques used in the advanced compilers, Study of parallelism and Garbage collection techniques.

**BOOK:**


**REFERENCES:**


**COURSE NAME** : KNOWLEDGE BASED SYSTEM & ROBOTICS

**COURSE CODE** : CS 472

**CREDITS** : 4

**L T P** : 4 0 0

**LECTURE WISE BREAKUP**

A brief history of expert systems, Expert system concept, Differences with regard to conventional software systems

Applications of Expert Systems, Knowledge Engineering

Inference engine, Knowledge base, Knowledge acquisition components,

Expert system shell

Classification of knowledge, Knowledge representation and reasoning approaches (declarative, procedural, combined)

Hierarchical classification, Scripts, Object-oriented approaches, Hybrid Approaches, Predicate logic, Rule based systems, Forward and Backward chaining,

Semantic nets, Conceptual graphs, Frames

Participants in expert system development, Process of expert system development, Rapid prototyping, Knowledge acquisition methods

(04)
Effective knowledge base implementation approaches, Inference engines (04)  
An introduction of robotics, Need of control programs and the uses of robots in industrial situations, Examples of Pick and Place, Gantry and Arm type Robots in typical set-ups, Robotic arms and End Effectors (04)  
Application of robotics (04)  

**BOOK:**  
1. Knowledge-based systems & AI by: George Luger, Pearson Education  

**REFERENCES:**  
3. Building Large Knowledge-Based Systems by Douglas B. Lenat, R.V. Guha  
5. Computer Vision for Robotic Systems by Fairhunt, PHI  

**COURSE NAME :**  
**SOFT COMPUTING**  
**COURSE CODE:**  
**CS 473**  
**CREDITS:**  
**4**  
**L T P:**  
**4 0 0**  

**LECTURE WISE BREAKUP**  

<table>
<thead>
<tr>
<th>Lecture Topic</th>
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<tbody>
<tr>
<td>Fundamentals of Artificial Neural Networks &amp; Applications,</td>
<td>(04)</td>
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<tr>
<td>Characteristics of ANNs The Biological Prototype, Perceptron, Multilayer NN</td>
<td>(04)</td>
</tr>
<tr>
<td>Learning Methods</td>
<td>(04)</td>
</tr>
<tr>
<td>Backpropagation, Counterpropagation, ART, BAM, Associative memories</td>
<td>(04)</td>
</tr>
<tr>
<td>Introduction to Fuzzy Logic, Fuzzy sets, Fuzzy model, Fuzzy rule generation</td>
<td>(04)</td>
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<tr>
<td>Fuzzy inference systems, Defuzzification</td>
<td>(04)</td>
</tr>
<tr>
<td>Introduction to Neuro Fuzzy Systems, Architecture of a Neuro Fuzzy system and its applications</td>
<td>(04)</td>
</tr>
<tr>
<td>GENETIC ALGORITHM: An overview, Problem solving using GA</td>
<td>(04)</td>
</tr>
<tr>
<td>Implementation of GA and GP</td>
<td>(04)</td>
</tr>
<tr>
<td>Applications of GA &amp; GP, Hybrid systems</td>
<td>(04)</td>
</tr>
</tbody>
</table>

**BOOK:**  
1. Neuro fuzzy and soft computing by Jang, Pearson Education  

**REFERENCES:**  
1. Learning and Soft Computing by Kecman, Pearson Education  
2. Fuzzy Sets and Fuzzy Logic - Klir and Yuan, PHI  
3. Neurocomputing: Theory & Practice by Philip D.Wasserman, VanNostrand Reinhold  
4. Neural Network in computer Intelligence by Fu, TMH  
5. Neural Networks and Fuzzy Systems by Bart Kosko, PHI  
6. An Introduction to Genetic Algorithm -Melaine Mitchell, PHI
COURSE NAME : ADVANCED DATABASE MANAGEMENT
SYSTEMS
COURSE CODE : CS 474
CREDITS : 04
L T P : 4 0 0

LECTURE WISE BREAKUP

REPRESENTING DATA ELEMENTS 4
Data Elements and Fields, Representing Relational Database Elements, Records, Representing Block and Record Addresses, Client-Server Systems, Logical and Structured Addresses, Record Modifications, Index Structures, Indexes on Sequential Files, Secondary Indexes, B-Trees, Hash Tables.

RELATIONAL ALGEBRA 5
Relational Algebra: Basics of Relational Algebra, Set Operations on Relations, Extended Operators of Relational Algebra, Constraints on Relations, Modification of the Database, Views Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus.

NORMALIZATION 4
Database design process, Relational database design, Relation Schema, Anomalies in a database , Functional dependencies, Membership and minimal covers, Normal forms, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued dependencies, Fourth Normal Form, Join dependencies, Fifth Normal Form, Inclusion dependencies , Effect of de-normalization on database performance.

SQL 4
Use Of SQL, DDL Statements, DML Statements, View Definitions, Constraints and Triggers Keys and Foreign Keys, Constraints on Attributes and Tuples, Modification of Constraints Cursors, Dynamic SQL.

CONCURRENCY CONTROL 5

TRANSACTION MANAGEMENT 4
Introduction of Transaction management, Serializability and Recoverability, View Serializability, Resolving Deadlocks, Distributed Databases, Distributed Commit, Distributed Locking.

DISTRIBUTED DATABASE 3
Homogeneous And Heterogeneous Database, Distributed Data Storage, Distributed Transaction, Commit Protocols, Concurrency Control In Distributed Databases.

DATABASE SECURITY: 4
Database security issues, Discretionary access control, Mandatory & role based access control, Database audit.

ADVANCED DATABASE APPLICATION: 5
Evolution of an Information system, Decision making and MIS, MIS as a technique for making programmed decisions, Navigation Database System Architecture Overview, Data Mining, Data warehouse, Types of transaction processing system :OLAP,OLTP,DSS
EMERGING TECHNOLOGIES: 8
Data mining: Data mining concepts, Association rules, Classification, Clustering, Application of data mining. Data warehousing: Characteristics of Data warehouses, Data modelling of data warehouses, Typical functionality of data warehouses, XML & Internet databases, Object relational databases.

BOOK:

REFERENCES:
2. BC Desai, An Introduction to Database Systems, Galgotia Publications
3. An Introduction to database systems, Sixth Edition C. J. Date Addison Wesley
5. Computer Data Base Organization by Martin J. (Latest edition), PHI

COURSE NAME: CLOUD COMPUTING & SERVICES
COURSE CODE: CS 475
CREDITS: 04
LTP: 4 0 0

LECTURE WITH BREAKUP

Introduction to Cloud Computing (05)
Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

Cloud Computing Architecture (10)
Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization A discussion on Hypervisors Storage Virtualization A discussion on SAN, ISCSI, Network Virtualization A discussion on VLAN

Cloud Computing Architecture Amazon Case study (08)
Introduction to Amazon Cloud Computing services, Amazon EC2, Amazon S3, Amazon DB, Queues and Cloud Front, Practical Amazon
Introduction to Distributed Computing
Fallacies of Distributed Computing, Sources of failure in distributed computing, Large Data sets and the handling issues, Moore Law & relationship to storage, CPU speed, etc.

Introduction to MapReduce
Discussion of Google Paper, Discussion of BigTables, GFS, HDFS, MapReduce
Hadoop Framework, Map Reduce – Hadoop Framework examples, Hadoop and related Projects, HBase, Pig, Mahout, etc.

Challenges in Cloud Computing
Security, Privacy, and Trust management issues, Cloud Economics and Business Models, Resource management and scheduling, Interoperability between Clouds, Internetworking between Clouds (InterClouds), Building and Deploying Social Network Applications on Clouds. Portability of applications and data between different cloud providers

Project Presentations

REFERENCES:
6) Somniloquy: Augmenting Network Interfaces to Reduce PC Energy Usage, Yuvraj Agarwal, Steve Hodges, Ranveer Chandra, James Scott, and Paramvir Bahl, Rajesh Gupta, NSDI'09
7) A Scalable, Commodity Data Center Network Architecture, Mohammad Al-Fares, Alexander Loukissa, Amin Vahdat, SIGCOMM'08
8) Xen and the Art of Virtualization, P. Barham, B. Dragovic, K. Fraser, S. Hand, T. Harris, A.Ho, R. Neugebauer, I. Pratt, A. Warfield, SOSP03
9) Interactive WiFi Connectivity For Moving Vehicles, Aruna Balasubramanian, Ratul Mahajan, Arun Venkataramani, Brian Levine, John Zahorjan, MobiCom'08
11) MapReduce: Simplified Data Processing on Large Clusters, Jeffrey Dean and Sanjay
Ghemawat, OSDI'08
12) Dynamo: Amazon's Highly Available Key-value Store, Giuseppe DeCandia, Deniz Hastorun, Madan Jampani, Gunavardhan Kakulapati, Avinash Lakshman, Alex Pilchin, Swaminathan Sivasubramanian, Peter Vosshall and Werner Vogels, SOSP'07
13) DCell: A Scalable and Fault-Tolerant Network Structure for Data Centers, Chuanxiong Guo, Haitao Wu, Kun Tan, Lei Shi, Yongguang Zhang, Songwu Lu, SIGCOMM'08
14) Learning to Share: Narrowband-Friendly Wideband Networks, Hariharan Rahul, Nate Kushman, Dina Katabi, Charles Sodini, and Farinaz Edalat, SIGCOMM'08
15) Dryad: Distributed Data-Parallel Programs from Sequential Building Blocks, Michael Isard, Mihai Budiu, Yuan Yu, Andrew Birrell, and Dennis Fetterly, EuroSys'07
16) Measurement and Analysis of Online Social Networks, Alan Mislove, Massimiliano Marcon, Krishna P. Gummadi, Peter Druschel, Bobby Bhattacharjee, IMC'07
17) Skilled in the Art of Being Idle: Reducing Energy Waste in Networked Systems, Sergiu Nedevschi, Sylvia Ratnasamy, Jaideep Chandrashekar, Bruce Nordman, Nina Taft, NSDI'09
18) Pig Latin: A Not-So-Foreign Language for Data Processing, C. Olston, B. Reed, U. Srivastava, R. Kumar and A. Tomkins, SIGMOD'08
19) User Interactions in Social Networks and their Implications, Christo Wilson, Bryce Boe, Alessandra Sala, Krishna P. N. Puttaswamy and Ben Y. Zhao, EuroSys'09
20) Improving MapReduce Performance in Heterogeneous Environments, Matei Zaharia, Andy Konwinski, Anthony D. Joseph, Randy H. Katz, Ion Stoica, OSDI'08
22) TRUST: A General Framework for Truthful Double Spectrum Auctions, Xia Zhou, Haitao Zheng, INFOCOM'09

COURSE CODE : CS 476
COURSE NAME : DATA MINING & WARE HOUSING
CREDITS : 4
L T P : 4 0 0

DATA WAREHOUSE AND OLAP TECHNOLOGY (10)
Data warehousing Definition and characteristics, need for data warehousing DBMS vs. data warehouse, OLAP
Multidimensional data model, data cubes, Schemas for multidimensional databases, OLAP operations
Data Marts, Metadata, data warehouse architecture

DATA PREPROCESSING (5)
Cleaning, integration and transformation, Data reduction, Data discretization

DATA MINING (10)
Data mining definition, issues in data mining, Data mining primitives and functionalities
Data Mining query language

DATA MINING TECHNIQUES (4)
Concept description and data generalization

ASSOCIATION RULE MINING (4)
Apriori Algorithm, generating frequent item sets, Multi-level and Multidimensional Mining

CLASSIFICATION (4)
decision tree, Bayesian, neural networks, Genetic algorithm, Support vector machines, Fuzzy techniques

CLUSTERING (3)
Cluster Analysis and its Various Techniques for cluster analysis

APPLICATIONS AND TRENDS IN DATA MINING (10)
Mining multimedia databases, Text databases, web mining
Commercial Importance of DW, applications of data mining, data mining, data mining in business process, embedded data mining.

BOOK:
Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber.

REFERENCES:
Data Warehousing, Data Mining and OLAP by Alex Berson and Stephen J. Smith.

COURSE NAME       : IMAGE PROCESSING AND COMPUTER VISION
COURSE CODE        : CS 477
CREDITS                    : 04
L T P                            : 4 0 0

LECTURE WISE BREAKUP

INTRODUCTION AND DIGITAL IMAGE FUNDAMENTALS (6)
Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbors, connectivity, Distance measure between pixels, Imaging Geometry

IMAGE TRANSFORMS (4)
Discrete Fourier Transform, Some properties of the two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT

IMAGE ENHANCEMENT (8)
Point Operations, Histograms, Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Low pass filtering, High pass filtering, Homomorphic filtering, Colour Image Processing

IMAGE RESTORATION (8)
Degradation model, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain

IMAGE COMPRESSION (6)
Coding, Interpixel and Psycho visual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards

IMAGE SEGMENTATION (6)
Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation

**REPRESENTATION AND DESCRIPTION**

(4)

Representations schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology

**INTRODUCTION TO COMPUTER VISION**

(8)

Computation approach to stereopsis, Distance computation from disparity, Correspondence problem.

**BOOKS:**


**REFERENCE:**


---

**COURSE NAME** : WIRELESS SENSOR NETWORKS  
**COURSE CODE** : CS 478  
**CREDIT** : 04  
**L T P** : 4 0 0

**LECTURE WISE BREAKUP NO. OF LECTURES**

**INTRODUCTION TO WIRELESS SENSOR NETWORKS**  
Applications and motivation, network performance objectives, opportunities and challenges in wireless sensor networks, sensor network architectures and applications, sensor network architecture, tiered architectures in sensor networks,

**THE DEVELOPMENT OF WIRELESS SENSOR NETWORKS**  
Early wireless networks, wireless data networks, wireless sensor and related networks, next generation technologies to enable sensor networks, models for programmability in sensor networks, coverage in wireless sensor networks

**THE PHYSICAL LAYER**  
Introduction, some physical layer examples, a practical physical layer for wireless sensor networks, simulations and results, miniaturizing sensor network with MEMS

**THE DATA LINK LAYER**  
Introduction, medium access control techniques, the mediation device, system analysis and simulation, overview of communication protocols for sensor networks, communication architecture and programming abstractions for realtime embedded sensor networks, energy efficient MAC protocols

**THE NETWORK LAYER**  
Introduction, some network design examples, a wireless sensor network design employing a cluster tree architecture, simulations and results, a taxonomy of routing techniques in wireless sensor networks, energy efficient protocols in sensor networks
## DATA AGGREGATION
Introduction, directed diffusion, low energy adaptive clustering hierarchy, tiny aggregation, greedy aggregation

## PRACTICAL IMPLEMENTATION ISSUES
Introduction, the partitioning decision, transducer interfaces, time base accuracy and average power consumption, a practical perspective on wireless sensor networks, a sensor network for biological data acquisition

## POWER MANAGEMENT
Introduction, power sources, loads, voltage converters and regulators, power management strategy, sensor network management, power efficient topologies for wireless sensor networks, dynamic power management in sensor networks

## ANTENNAS AND THE DEFINITION OF RF PERFORMANCE
Introduction, antennas, RF performance definition, location management in WSN, positioning and location tracking in wireless sensor networks, protocols for gathering information, reliability in sensor networks, fault tolerance in sensor networks

## WIRELESS SENSOR NETWORK STANDARDS
Introduction, introduction to industrial sensor networking, the IEEE 802.15.4 low rate WPAN standard, the Zigbee alliance, the IEEE 1451.5 wireless smart transducer interface standard

Architecture and modeling of dynamic wireless sensor networks

### BOOK:

### REFERENCES:
1. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems by Mohammad Ilyas and Imad Mahgoub
2. Wireless Sensor Networks and applications by Yingshu Li, My T. Thai and Weili Wu
3. Wireless sensor networks: signal processing and communication perspectives by Ananthram Swami, Qing Zhao, Yao-Win Hong and Lang Tong
4. Adhoc and sensor networks by C.M. Cordeiro and D.P. Agrawal

### COURSE NAME : ERP
### COURSE CODE : CS 479
### CREDIT : 04
### L T P : 4 0 0

### LECTURE WISE BREAKUP

<table>
<thead>
<tr>
<th>AN INTRODUCTION TO ERP</th>
<th>NO. OF LECTURES</th>
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Basic ERP Concepts, Risks and Benefits of ERP, Justifying ERP Investments, RoadMap for successful ERP Implementation, Importance of ERP, ERP Package Selection issues.

**ERP AND RELATED TECHNOLOGIES** (5)

**ERP FUNCTIONAL MODULES** (7)

**MATERIAL PLANNING AND PRODUCTION PLANNING** (5)
Material Planning and Control, Inventory, Forecasting, Manufacturing, Production Planning, Production Scheduling, Production Control, Sales and Distribution.

**ERP IMPLEMENTATION** (5)
Implementation Challenges, Requirements and process definition, Pre-Post Implementation Activities, ERP implementation life cycle, Data migration, Measuring performance of the ERP system.

**ERP – KEY MANAGERIAL ISSUES** (10)
Concept Selling, IT Infrastructure, Implication of ERP system on Business Organization, Critical Success factors in ERP system, Critical Failure factors in ERP system, ERP Culture Implementation Issues, Resistance to Change, Return on Investment, Future Directions and Trends in ERP, Case Studies of Big Business houses adopting ERP.

**BOOKS:**
1. ERP Demystified by Alexis Leon, TMH.
2. Enterprise Resource Planning by Alexis Leon, TMH.

**REFERENCES:**
Enterprise Resource Planning by Mary Sumner

**COURSE NAME** : WIRELESS & MOBILE NETWORKS
**COURSE CODE** : CS 481
**CREDITS** : 4
**PREQ** : COMPUTER NETWORKS
**LTP** : 4 0 0

**LECTURE WITH BREAKUP**

**NO. OF LECTURES**

**BASICS OF WIRELESS NETWORKS** (06)
Channel Assignments, Interference and System Capacity, Frequency reuse, Radio Propagation, Free space Propagation Model, Propagation modeling, Propagation and Measurements Parameters of Mobile Path Channels

**MULTIPLE ACCESS TECHNIQUES** (03)
FDMA, TDMA, CDMA, SDMA, Spread Spectrum Technologies

Wireless LANs (15)
Wireless LANs Physical & MAC layer, IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues, energy efficient protocols, Case Studies, Encryption and Authentication, Denial of service attacks, Key exchange, WEP, IEEE 802.11i, research challenges in security

Wireless – Mesh Technologies (05)
Introduction to Wi-Mesh, routing in wi-mesh, standards, Secure routing, applications and research challenges.

Wi-Max: (03)
Wi-Max protocol stack and specifications, standards (IEEE 802.16), applications and deployment issues

Special Topics: (08)
Wireless PANs: Bluetooth AND Zigbee
Introduction to Wireless Sensors
Introduction to Vehicular Adhoc Networks

MOBILE NETWORKS (08)
1G, 2G, and 3G wireless systems (AMPS, GSM, GPRS)
Overview of GSM network building blocks, GSM service areas, MSC / VLR service areas, location areas, GSM frequency allocation, Cell planning concepts and process, security in Mobile networks
Project presentations

BOOK:
1. Mobile Communications, Joschen Schiller, Pearson Education

REFERENCES:
2. Mobile and Wireless design essentials, Martyn Mallick, John Wiley
3. Wireless communications & Networks, By William Stallings, PHI
5. Building Microsoft® ASP.NET Applications for Mobile Devices, Andy Wigley and Peter Roxburgh, MS Press
8. IEEE Wireless LAN medium access control (MAC) and physical layer (PHY) specifications Amendment 4: Further higher speed physical layer extension in the 2.4 GHz band. IEEE Standard 802.11g, 2003.

COURSE NAME: NATURAL LANGUAGE PROCESSING
COURSE CODE: CS 480
LECTURE WISE BREAKUP

<table>
<thead>
<tr>
<th>Topic</th>
<th>NO. OF LECTURES</th>
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<tbody>
<tr>
<td>Introduction and overview of NLP, Finite state techniques for NLP,</td>
<td>(05)</td>
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<tr>
<td>A computational framework for Natural Languages</td>
<td></td>
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<tr>
<td>Partial description of English or an Indian language in the framework, Lexicon,</td>
<td>(05)</td>
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<tr>
<td>Algorithms and data structures for implementation of the framework</td>
<td></td>
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<tr>
<td>Error-tolerant lexical processing, Transducers for the design of morphological Analyzers</td>
<td>(05)</td>
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<tr>
<td>POS tagging, Efficient representations for linguistic resources</td>
<td>(05)</td>
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<td>Machine-readable dictionaries and lexical databases</td>
<td>(05)</td>
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<tr>
<td>Recursive Transition Networks - theory and its implementation</td>
<td>(05)</td>
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<tr>
<td>Augmented Transition Networks - theory and its implementation</td>
<td>(05)</td>
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<tr>
<td>Augmenting context-free grammars with features, Ambiguity in NLP</td>
<td>(05)</td>
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<tr>
<td>Statistical/Corpus-based NLP, Connectionist NLP</td>
<td>(05)</td>
</tr>
<tr>
<td>Applications like Machine translation, Database interface</td>
<td>(05)</td>
</tr>
</tbody>
</table>

BOOK:
1. Natural Language understanding by James Allen, Pearson Education

REFERENCES:
1. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall
3. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education
4. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley

COURSE NAME : NETWORK TECHNOLOGY
COURSE CODE : CS 482
CREDIT : 04
L T P : 4 0 0

LECTURE WISE BREAKUP

<table>
<thead>
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<th>Topic</th>
<th>NO. OF LECTURES</th>
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<tbody>
<tr>
<td>INTRODUCTION</td>
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</tr>
<tr>
<td>LAN ACCESS TECHNIQUES</td>
<td>5</td>
</tr>
</tbody>
</table>
LAN TECHNOLOGIES
Ethernet: Overview of Ethernet (IEEE 802.3), Standard Ethernet, Fast Ethernet, Switched Ethernet, Gigabit Ethernet, Ten Gigabit Ethernet
Token Passing LANs: Token Bus (IEEE 802.4), Token Ring (IEEE 802.5), FDDI, RPR
ATM LANs: ATM LAN Architecture, LAN Emulation (LANE), Client Server Model, LANE Operation, Frame Format
Storage area networks

NETWORK INTERCONNECTIONS
Internetworking Concepts, Repeaters, Hubs, Bridges, Routers, Switches, Gateways, Virtual LANs

WAN TECHNOLOGIES
Frame Relay: Introduction, Frame Relay Operation, Frame Relay Layers
ATM: Introduction, ATM Architecture, ATM Cell Structure, Switching, ATM Layers, ATM Service Categories

WIRELESS TECHNOLOGIES
Wireless links and network characteristics, wireless LANs, PANs, MANs and WANs

MULTIMEDIA NETWORK TECHNOLOGIES
Streaming stored audio and video, best effort service, protocols for realtime interactive applications, content distribution networks, scheduling and policing mechanisms, integrated services and differentiated services, RSVP.

BOOKS:

REFERENCES: