Course Curriculum

M.Tech. (Computer Science)
M.Tech. (Information Architecture & Software Engineering)
M.Tech. (Network Management & Information Security)

2018-19

Devi Ahilya Vishwavidyalaya
School of Computer Science & IT
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School of Computer Science & IT, DAVV, Indore
Scheme for M.Tech. : 2018-19

M.Tech.(Computer Science) I

Sub. Code	Subject	L	T	P	C	Inter-nal	Practical/Project	End Sem	Total
CS-6516	Advanced Operating Systems	3	1	4	6	30	20	50	100
CS-5010	Advanced Computer Architecture	3	1	2	5	30	20	50	100
CS-6220	Internet Programming Using Java	3	1	4	6	30	20	50	100
CS-5413	Data Mining and Warehousing	3	1	4	6	30	20	50	100
CS-6221	Advanced Algorithm Design	3	1	4	6	30	20	50	100
CS-6809A	Comprehensive Viva				4				
Total					27				

M.Tech.(Computer Science) II

Sub. Code	Subject Name	L	T	P	C	Internal	Practical /Project	End Sem	Total
CS-6418	Advanced Database Management Systems	3	1	4	6	30	20	50	100
CS-6517	Advanced Compiler Design	3	1	2	5	30	20	50	100
CS-6518	Cloud Computing	3	1	2	5	30	20	50	100
CS-6711	Soft Computing	3	1	4	6	30	20	50	100
CS-6809B	**Comprehensive Viva**				4			100	100

M.Tech. (Network Management& Information Security) I

Sub. Code	Subject	L	T	P	C	Inter-nal	Practical/Project	End Sem	Total
CS-5615	Information Security	3	1	2	5	30	20	50	100
CS-6220	Internet Programming Using Java	3	1	4	6	30	20	50	100
CS-6622	Advanced Computer Network	3	1	2	5	30	20	50	100
CS-6624	Network Management	3	1	4	6	30	20	50	100
	Elective-I								100
CS-6809A	Comprehensive Viva				4				

Elective-I may be opted from any one of the optional subjects specified in list I of Electives for M.Tech. (NM) Sem I. Total credits in every semester should be >=26

List I of Electives for M.Tech.(Network Management) Semester I

Sub. Code	Subject	L	T	P	C	Inter-nal	Practical/Project	End Sem	Total
CS-6516	Advanced Operating Systems	2	1	2	4	30	20	50	100
CS-5413	Data Mining and Warehousing	3	1	2	5	30	20	50	100
CS-6221	Advanced Algorithm Design	3	1	4	6	30	20	50	100

M.Tech. (Network Management& Information Security) II

Sub. Code	Subject Name	L	T	P	C	Internal	Practical/Project	End Sem	Total
CS-6628	Legal Aspects of Information Security	3	1	0	4	40	-	60	100
CS-5618	Network Security	3	1	2	5	30	20	50	100
CS-6623	Mobile & Wireless Systems	3	1	2	5	30	20	50	100
CS-6518	Cloud Computing	3	1	2	5	30	20	50	100
CS-6630	Internet of Things	3	1	4	6	30	20	50	100
CS-6809B	**Comprehensive Viva**				4			100	100

M.Tech. (Information Architecture & Software Engineering) I

Sub. Code	Subject	L	T	P	C	Inter-nal	Practical/ Project	End Sem	Total
CS-7314	Information Architecture	3	1	2	5	30	20	50	100
CS-6315	Advanced Software Engineering	3	1	4	6	30	20	50	100
CS-6316	Information System Design	3	1	2	5	30	20	50	100
CS-6220	Internet Programming Using Java	3	1	4	6	30	20	50	100
	Elective-I								100
CS-6809A	Comprehensive Viva				4				

Elective-I may be opted from any one of the optional subjects specified in list I for M. Tech. (SE&IA) Sem I . Total credits in every semester should be >=26.

List I of Electives for M.Tech.(SE&IA) Semester I

Sub. Code	Subject	L	T	P	C	Inter-nal	Practic al/Proje ct	End Sem	Total
CS-5413	Data Mining and Warehousing	3	1	4	6	30	20	50	100
CS-6221	Advanced Algorithm Design	3	1	4	6	30	20	50	100
CS-6516	Advanced Operating Systems	3	1	4	6	30	20	50	100

M.Tech. (Information Architecture & Software Engineering) II

Sub. Code	Subject Name	L	T	P	C	Internal	Practical /Project	End Sem	Total
CS -6313	Software Testing & Quality Assurance	3	1	2	5	30	20	50	100
CS-6418	Advanced Database Management Systems	3	1	2	5	30	20	50	100
CS-6316	Software Reuse & Customization	3	1	2	5	30	20	50	100
CS-6712	Data Science	3	1	2	5	30	20	50	100
CS-6518	Cloud Computing	3	1	2	5	30	20	50	100
CS-6809B	**Comprehensive Viva**				4			100	100

M. Tech . (CS/NM/SE) – I Semester

CS-6516: Advance Operating System

1. **Review of Operating System Concepts** : Process management, Synchronization, Interprocess Communication techniques, Processor Scheduling, Memory Management, Device Management, File System etc.
   Limitations of centralized and uniprocessor operating systems. Need of advance operating systems, Types of advance operating systems.
2. **Distributed Systems** : Difference between network and distributed operating systems, Design objectives and features of distributed operating systems, Distributed systems architectures, distributed system software, and distributed operating systems.
3. **Resource Management in distributed Computing:**
   (i) Distributed Scheduling, process management, process migration
   (ii) Distributed Shared Memory
   (iii) Distributed File System: File caching, replication management, Naming of resources, name resolution process.
4. **Process management in distributed operating systems** : Process synchronization and IPC, RPC, Clock synchronization, mutual exclusion, deadlock handling, security aspects, case studies.
5. **Multiprocessor systems** : Multiprocessor architecture, multiprocessor Operating systems, process synchronization and IPC, processor scheduling, memory management.
6. **Database Systems' support**: Need of OS support for databases, concurrency control in database systems.

Recommended Books:
 [i] Distributed Operating Systems (Concept and Esign), II Edition, P. K. Sinha, PHI, 1997.
 [ii] Advance Concepts in Operating Systems, Mukesh SInghal, Niranjan G. Shivratri, Mc GRaw Hills, 1994.
 [iii] Modern Operating Systems(III Edition) , Andrew S. Tanenbomb, Pearson.
 [iv] Distributed Systems (Concept and Design), II Edition, GEprge Couloris, Jean Dollimore and Tim Kindberg, Addison-Wesley, 1994.

CS-6622 Advanced Computer Network

Unit 1
Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model; Applications (WWW, Audio/Video Streaming, Video conference, Networked Games, Client/Server); Traffic Characterization (CBR, VBR); Switching Paradigms; Multiplexing; Error Control; Flow Control, SONET, Optical Networks.

Unit 2
Local Area Network Technologies: Wired LANS: Ethernet Protocol, Fast Ethernet, Gigabit Ethernet, Wireless LANs, IEEE 802.11 Project, Bluetooth, Connecting LANs.

Unit 3

Internetworking: Interdomain Routing, Border Gateway Protocol version 4, IPv6, Multicast Routing Protocols, Multi-Protocol Label Switching, Virtual Private Networks, High speed transport protocols, Quality of Service Mechanisms, Improving QoS in Internet.

Unit 4

Distributed Systems: Naming, DNS, DDNS, Paradigms for Communication in Internet, Caching, Issues of Scaling in Internet and Distributed Systems, Caching Techniques for Web, Protocols t o Support Streaming Media, Multimedia Transport Protocols, Content Delivery Networks, Overlay and P2P Networks.

Unit 5

Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DDoS Attack, Mitigation in Internet, Security in MPLS; Introduction to Cellular, Satellite and Ad hoc Networks.

Recommended Books:
Main Reading:
1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed., Morgan Kaufmann
3. Jean Walrand and Pravin Varaiya, High performance Communication Networking, 2nd Ed., Morgan Kaufmann, 1999.
4. Markus Hoffmann and Leland R. Beaumont, Content Networking: Architecture, Protocols, and Practice, Morgan Kaufmann, 2005.

CS-5010 Advanced Computer Architecture

Unit I

Review: Pipeline, Performance, Cache, Virtual Memory ,Review: Moore's Law, Cost.

Unit II

Caches and Memory systems ,Memory Systems continued ,Storage: Disks, Tapes, RAID ,Storage: Benchmarks, Examples

Unit III

Multiprocessors: motivation, classification, apps Multiprocessors: Snooping Protocol, Directory Protocol, Synchronization, Consistency Multiprocessors: Measurements, Crosscutting Issues, Examples, Fallacies & Pitfalls

Unit IV

Instruction Set: Vector, Dynamic Pipeline: Tomasulo, Reorder Buffers, Dynamic Pipeline: Branch prediction, ILP limits, Dynamic Wrap-up: Examples and SMT

Unit V

Static Pipeline : VLIW, static branch prediction, IA-64 ,Static Pipeline Wrap-up:

Textbook: J. L. Hennessy and D. A. Patterson, *Computer Architecture: A Quantitative Approach*
4th Edition, Morgan Kaufmann Publishers

CS-5413 Data Mining & Data Warehousing

UNIT I
Fundamentals of data mining, Data Mining definitions, KDD vs Data Mining, Data Mining Functionalities, From Data Warehousing to Data Mining, DBMS vs DM, Issues and challenges in Data Mining. Data Mining Primitives, Data Mining Query Languages. Data Mining applications-Case studies.

UNIT II
Association rules: Methods to discover association rules. Various algorithms to discover association rules like A Priori Algorithm. Partition, Pincer search, Dynamic Item set Counting Algorithm etc. Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Algorithms, Hierarchical and Categorical clustering, Classification methods, Decision Trees, Neural networks, Genetic Algorithm.

UNIT III
Web Mining, Web content mining, Web Structure mining, Text mining.,Temporal Data Mining, Spatial Data Mining, Data Mining tools.

UNIT IV
Introduction: Data Warehouse, Evolution, Definition, Very large database, Application, Multidimensional Data Model, OLTP vs Data Warehouse, Data Warehouse Architecture. Data Warehouse Server, Data Warehouse Implementation, Metadata, Data Warehouse Backend Process: Data Extraction, Data Cleaning, Data Transformation, Data Reduction, Data loading and refreshing. ETL and Data warehouse, Metadata, Components of metadata.

UNIT V
Warehouse Schema, Schema Design, Database Design, Dimension Tables, Fact Table, Star Schema, Snowflake schema, Fact Constellation, De-normalization, Data Partitioning, Data Warehouse and Data Marts. SQL Extensions, PL/SQL. OLAP, Strengths of OLAP, OLTP vs OLAP, Multi-dimensional Data, Slicing and Dicing, Roll-up and Drill Down, OLAP queries, Successful Warehouse, Data Warehouse Pitfalls, DW and OLAP Research Issues, Data Warehouse Tools.

Text Book(s) :
1. Data Mining Techniques – Arun K Pujari, University Press,4th edition
2. The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley Student Edition, 2nd Edition.

Reference Book(s):
1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Harcourt India. 2nd Edition.
2. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd, 3rd Edition.
3. Data Warehousing in the Real World – SAM ANAHORY & DENNIS MURRAY. Pearson Education,

1st Edition.
4. Data Warehousing Fundamentals – Paulraj Ponnaiah, Wiley Student Edition, 2nd Edition.
5. Data Mining Introductory and advanced topics –Margaret H Dunham, Pearson Education, 3rd Edition.

CS-6221 Advanced Algorithm Design

Unit 1 Order Analysis: Objectives of time analysis of algorithms; Big-oh and Theta notations. Master Theorem and its proof, solution of divide and conquer recurrence relations. Searching, Sorting and Divide and Conquer Strategy: Linear Search, Binary Search

Unit 2: Searching, Sorting and Divide and Conquer Strategy: Merge - sort; Quick - sort with average case analysis. Heaps and heap - sort. Lower bound on comparison - based sorting and Counting sort. Dynamic Programming: methodology and examples (Fibonaci numbers, Knapsack problem and some other simple examples) Dynamic Programming: Longest integer subsequence, Longest common subsequence, Weighted interval scheduling.

Unit 3 Greedy Method: Methodology, examples (lecture Scheduling, process scheduling) and comparison with DP (more examples to come later in graph algorithms) Greedy Method: Knapsack problem and some other simple examples. Graph Algorithms: Basics of graphs and their representations. BFS. DFS. Topological sorting.

Unit 4 Minimum spanning trees (Kruskal and Prim'salgorithms and brief discussions of disjoint set and Fibonacci heap data structures). Shortest Paths (Dijkstra, Bellman - Ford, Floyd - Warshall). Hard problems and approximation algorithms. Problem classes P, NP, NP - hard and NP - complete, deterministic and nondeterministic polynomial - time algorithms, Approximation algorithms for some NP - complete problems

Unit 5 Backtracking, Branch and Bound technique, String Matching, Naive algorithm, KMP algorithm, Parallel Algorithms

Text Book: Cormen, Leiserson, and Rivest. Algorithms, MIT Press 2011

CS-6220 Internet Programming Using Java

UNIT-I
Review of java concepts: Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables, Memory concepts, control statements, looping, Method Call Stack and Activation Record, Argument Promotion and Casting, Scope of declaration and Method Overloading, String Handling: The String constructors, String operators, Character Exaction, String comparison, String Buffer. Arrays: Declaring and Creating Arrays, Enhanced for Statement, Passing Arrays to Method, Multidimensional Arrays, Variable-Length Argument lists, Using Command-line Arguments,

UNIT-II
Inheritance: Extending classes & related things. Packages and Interfaces: Defining a Package, Understanding CLASSPATH, Access Protection, Importing packages, creating own packages

Exception Handling: Introduction, overview of doing it and keywords used, when to use it, Multithreading: What are threads, The java thread model, Thread priorities, Thread life cycle, Thread Synchronization, Applets: Applet basics, Applet Architecture, Applet life cycle methods, Database connectivity: JDBC, The design of JDBC, Typical uses of JDBC,

UNIT-III
Introduction to HTTP, web Server and application Servers, Installation of Application servers, Config files, Web.xml. Java Servlet, Servlet Development Process, Deployment Descriptors, Generic Servlet, Lifecycle of Servlet. Servlet Packages, Classes, Interfaces, and Methods, Handling Forms with Servlet, Various methods of Session Handling, various elements of deployment descriptors,

UNIT-IV
JSP Basics: JSP lifecycle, Directives, scripting elements, standard actions, implicit objects. Connection of JSP and Servlet with different database viz. Oracle, MS-SQL Server, MySQL. java.sql Package. Querying a database, adding records, deleting records, modifying records, types of Statement. Separating Business Logic and Presentation Logic, Building and using JavaBean. Session handling in JSP, Types of errors and exceptions handling..

UNIT-V
MVC Architecture
Introduction to Remote Method Invocation, Introduction to Enterprise Java Bean, Types of EJB, Creating and working with Session Bean,

Text Books:
1. Java 2: The Complete Reference by Herbert Schildt, Tata McGraw- Hill, 8th Edition, 2011.
2. K. Mukhar, "Beginning Java EE 5: From Novice to Professional", Wrox Press.

Reference Books:
1. The Java Programming Language, Ken Arnold , James Gosling , David Holmes, 3rd Edition, Person
   Education, 2000.
2. Head First Java, Kathy Sierra, Bert Bates, O'Reilly Publication, 2nd Edition, 2005
3. M. Hall, L. Brown, "Core Servlets and Java Server Pages", 2nd edition, Pearson Education
4. G. Franciscus, "Struts Recipes", Manning Press
5. C. Bauer, G. King, "Hibernate in Action", Manning Press
6. B. Basham, K. Sierra, B. Bates, "Head First Servlet and JSP", 2nd Edition, O'Reilly Media.

CS-5615 INFORMATION SECURITY

UNIT I
A Definition of Computer Security, The Challenges of Computer Security, **The OSI Security Architecture** . **Security Attacks** (Passive Attacks, Active Attacks).
Security Services (Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Availability Service**). Security Mechanisms, Model for Network Security** (Bell LaPadula, Biba, Clark Wilson, Chinese wall, Role based, Object oriented, Resource allocation monitor models).

UNIT II
Symmetric Encryption Principle (Cryptography, Cryptanalysis, Feistel Cipher structure)
Symmetric Block Encryption Algorithms (Data Encryption Standard, Triple DES, Advanced Encryption Standard). **Stream Ciphers and RC4** (Stream Cipher Structure, The RC4 Algorithm). **Cipher Block Modes of Operation** (Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode,

Counter Mode).

UNIT III

Approaches to Message Authentication (Authentication Using Conventional Encryption, Message Authentication without Message Encryption). **Secure Hash Functions (**Hash Function Requirements, Security of Hash Functions, Simple Hash Functions, The SHA Secure Hash Function). **Message Authentication Codes (** HMAC , MACs Based on Block Ciphers). **Public-Key Cryptography Principles** (Public-Key Encryption Structure, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptography) . **Public-Key Cryptography Algorithms** (The RSA Public-Key Encryption Algorithm, Diffie-Hellman Key Exchange, Other Public-Key Cryptography Algorithms). **Digital Signatures.**

UNIT IV

Secure sockets – IPsec overview – IP security architecture – IPsec-Internet Key Exchanging(IKE) – IKE phases – encoding – Internet security – Threats to privacy – Packet.

sniffing   –   Spoofing - Real Time communication security – Security standards– Kerberos.X.509AuthenticationService**.**

UNIT V

IEEE 802.11 Wireless LAN Overview(The Wi-Fi Alliance, IEEE 802 Protocol Architecture,

IEEE 802.11 Network Components and Architectural Model, IEEE 802.11 Services). **. IEEE 802.11i Wireless LAN Security** (IEEE 802.11i Services, IEEE 802.11i Phases of Operation, Discovery Phase, Authentication Phase, Key Management Phase, Protected Data Transfer Phase, The   IEEE 802.11i Pseudorandom Function). **Wireless Application Protocol Overview**(Operational Overview, Wireless Markup Language, WAP Architecture, Wireless Application Environment, WAP Protocol Architecture**). Wireless Transport Layer Security** (WTLS Sessions and Connections, WTLS Protocol Architecture, Cryptographic Algorithms)**, WAP End-to-End Security**.

References

1. W. Stallings, Cryptography and Network Security Principles and practice, 3/e, Pearson Education Asia, 2003.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private Communication in a public world", Prentice Hall India, 2nd Edition, 2002.
3. Charles P. Pleeger, "Security in Computing", Pearson Education Asia, 5th Edition, 2001.
4. William Stallings, "Network Security Essentials: Applications and standards", Person Education Asia, 2000.
5. W. Mao, Modern Cryptography: Theory & Practice, Pearson Education, 2004

CS-6624 Network Management

Introduction:- Computer Network, Goals and Applications, Data Communications and Network Management Overview : Communications protocols and Standards. Case Histories of Networking and Management, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

Fundamentals of computer network technology: Network Topology, LANs. Network node components Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology. Network Management Standards, Network Management Model, Organization Model, Information Model, Communication Model, ASN.1, Encoding Structure.

SNMPV1 Network Management: Managed network: Case Histories and Examples, The History of SNMP Management. The SNMP Model, The Organization Model, System Overview. The Information Model, The SNMP Communication Model, Functional Model.

SNMP Management: SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information. The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility With SNMPv1.

SNMP Management- RMON: Introduction, RMON SMI and MIB, RMON1.

Broadband Network Management-ATM Networks: Broadband Networks and Services, ATM Technology, ATM Network Management.

Broadband Network Management: Broadband Access Networks and Technologies, HFC Technology, HFC Management, DSL Technology, ADSL Technology, ADSL Management.

Telecommunication Manage ment Network: Introduction, Operations Systems, TMN conceptual Model, TMN Architecture, TMN Management Service Architecture, An integrated view of TMN.

Network Management Tools and Systems: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management. Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions.

Network Management Applications: Configuration management, Fault management, performance management. Event Correlation Techniques, security Management, Accounting management, Report Management, Policy Based Management Service Level Management.

1. Required Text(s)
- Network Management, Principles and Practice, Mani Subrahmanian, Pearson Education.

2. Essential References
- Network management, Morris, Pearson Education.
- Principles of Network System Administration, Mark Burges, Wiley Dreamtech.
- Distributed Network Management, Paul, John Wiley.
- Computer Networks, Andrew S. Tanenbaum, Addison-Wesley, 4th Ed.
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3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)
- Data Communications and Networking, B.A. Forouzan, McGraw-Hill.
- Data and Computer Communications : W.Stallings, , Prentice-Hall, 5th Ed., 1997.
- Computer Networking : James F. Kurore & Keith W. Rose , Pearson Education, Third Edition, 2005.

- Communication Networks : Fundamentals Concepts and Key Architecture : Alberto Leon-Garcia and Indra Widjaja, , Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-0402235-3.
- Data and Network Communication : Michael A. Miller, Delmar Thomson Learning inc. ISBN 0-07668-1100-X.
- Introduction to Computer Networks : Douglas E. Comer , Prentice-Hall.
- Alberto Leon-Garcia and Indra Widjaja, Communication Networks –Fundamentals Concepts and Key Architecture , Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-0402235-3

CS 7314 Information Architecture

Aim This course is designed to help students acquire an understanding of information architecture, principles and concepts of designing effective architecture. The course also offers an easy understanding of The Open Group Architecture Framework.

Unit 1 Introduction to Information Architecture: Principles of information architecture, role of information architect, areas of information architecture, types of architecture, system architecture, enterprise architecture, application architecture, internet architecture, research and practice in information architecture.

Unit 2 Organizing information: Organizing information, organizational challenges, organizing websites and intranets, creating cohesive organization system, organizing WWW, browser navigation features, building context, improving flexibility, types of navigation systems, integrated navigation elements, remote navigation elements, designing elegant navigation systems

Unit 3 Labeling Systems: Labeling systems, not labels, types of labeling systems, creating effective labeling systems, fine-tuning the labeling system, non-representational labeling systems, double challenge, searching website, website understanding how users search, designing the search interface, reference interview, indexing the right stuff, search or not to search.

Unit 4 Research: Getting started, defining goals, learning about the intended audiences, identifying content and function requirements, grouping content, archipelagos of information, architectural page mock-ups, design sketches, web-based prototypes,
Case Study: Henry Ford Health System.

Unit 5 The Open Group Architecture Framework: Introduction to TOGAF 9, TOGAF 9 management overview, TOGAF 9 components, introduction to ADM, ADM phases, ADM deliverables, enterprise continuum, architecture repository, architecture governance, views and view points, architecture building blocks.

Text Book(s)
 1. Information Architecture on the World Wide Web, First Edition, Peter Morville.

Reference Books
 1. TOGAF Version 9 – The Open Group Architecture Framework. Publisher – The Open Group.
 2. TOGAF – Quick start guide for Enterprise Architect, Wolfgang Keller.

CS-4407: Information System Design

Unit-I   **No. of Hrs: 8**
Introduction, Elements of Information System Design, Software Processes, Project planning & Estimation, Risk analysis, Roles and responsibilities in IS Design, Case Study.

Unit-II   **No. of Hrs: 8**
Information System Design Models, A comparative study of Information System design models such as SDLC, Prototyping, Spiral, Iterative, Time-boxing, RAD model, CBD approach, Agile development and RUP model. Requirement engineering process: Requirement analysis, Requirement Specification, Requirement Validation and Requirement Management.

Unit-III   **No. of Hrs: 8**
Information systems design Methodologies - Structured approach and Object-oriented approach, CASE tools. Software Architecture: Why software architecture is important? Architectural styles, architectural decisions, Architectural design and documentation.

Unit-IV   **No. of Hrs: 8**
Fundamentals of Information System Testing, Testing strategies, Levels of Testing, Debugging approaches. Software Change & Evolution, Software Maintenance, Maintenance Process Models Reengineering Process.

Unit-V   **No. of Hrs: 8**
Case studies: Software Reuse, Software Repositories, Service Oriented Software Engineering, Client Server Software Engineering, Aspect Oriented design, Usability engineering, Model Driven Software Engineering.

Text Books:
 1. *Introduction to Information System,* **O'Brain,** Printice Hall, 1997.
 2. *Software Engineering: Concepts & Practices-* **Ugrasen Suman**, *Cengage Learning publications, 2013*.
 3. *Fundamentals of Software Engineering-* **Rajib Mall**, Pearson Education. Third Edition 2012.

Assignments:
1. Students have to select a project to trace the activities of information system design.
2. Chapter wise selected exercises will assigned from Text Book 2 and 3.

M.Tech. (CS/NM/SE) - II Semester
CS 6418 Advanced Database Management System

Unit I
Database: Overview of database design, introduction to Relational model and its queries, review of SQL, review of computer networks.

Unit II

Distributed Databases: features of distributed database, Study of reference architectures for DDBMS, Comparison of Homogeneous and Heterogeneous Databases, fragmentation, distribution transparency for read-only and update applications.

Unit III

Distributed database design: a framework for distributed database design, the design of database fragmentation, the allocation of fragmentation. Overview of Transaction processing and concurrency control.

The management of distributed Transactions: a framework for transaction management, supporting atomicity of distributed transactions, concurrency control for distributed transactions, architectural aspects of distributed transactions. Concurrency control and reliability.

Unit IV

Query processing, query optimization, database security: Security and integrity threats, Defence mechanisms, Statistical database auditing & control. Security issue based on granting/revoking of privileges, Introduction to statistical database security. PL/SQL Security – Locks – Implicit locking, types and levels of locks, explicit locking, Oracles' named Exception Handlers.

Unit V

Introduction to Spatial Databases, Spatial Concepts and Data Models, Spatial Query Languages, Spatial Networks: Query language for graphs, graph algorithms, access methods. Trends in Spatial Databases: Mobile wireless applications, spatio-temporal data.

Recommended Books:

- Date C. J., An Introduction to Database Systems, Addison Wesley Longman (8th Ed), 2003. Silberschatz A., Korth H., and Sudarshan S., Database System Concepts, McGraw - Hill (6th Ed), 2010.
- Stefano Ceri., Giuseppe Pelagatti., Distributed databases principles & systems, McGraw – Hill.
- M. Tamer Ozsu., Patrick Valduriez., Principle Of Distributed Database System, Springer(3rd Ed.)
- Shashi Shekhar and Sanjay Chawla, Spatial Databases: A Tour, Prentice Hall, 2003
  ISBN-10: 0130174807, ISBN-13: 9780130174802
- Philippe Rigaux, Michel Scholl, and Agnes Voisard, Spatial Databases: with Application to GIS, Morgan Kaufmann, 2001, ISBN 1-55860-588-6

CS-6517 Advanced Compiler Design

Unit I

Compiler, Translator, Interpreter, Assembler definition, Types of compiler, Phases of compiler, one pass and multi pass compilers. Analysis of source program. Review of Finite automata, lexical analyzer, Input, buffering, Recognition of tokens, LEX: A lexical analyzer generator, Error handling.

Unit II

Introduction to parsing. Bottom up and Top down parsing techniques- Shift reduce, Operator precedence, Recursive descent and predictive parsers. LL grammars and parsers, error handling in LL parser. LR parsers, Construction of SLR. Canonical LR and LALR parsing tables.

Unit III

Syntax directed definitions and translation: Construction of syntax trees, L~attributed definitions, Intermediate code forms using postfix notation and three address code. Representing TAC using triples and quadruples, Translation of assignment statement. Boolean expression and control structures etc.

Unit IV

Definition of basic block control flow graphs, DAG representation of basic block. Advantages of DAG, Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization.

Unit V

Issues in design of code generator, A simple code generator, Code generation from DAG. Code Optimization.

Text Book:
1. Aho-Ullman, Principles of Compiler Design, Narosa Publishing House.
Reference Book(s):
1. Aho-Ullman, Compilers: Principles Techniques & Tools, Addison Wesley.
2. Dhamdhere, Compiler Construction.

CS-6518 Cloud Computing

COURSE TOPICS:
- Enabling Technologies and System Models for Cloud Computing (2 Lectures)
- Introduction to Cloud Computing including benefits, challenges, and risks(2 Lectures)
- Cloud Computing Models including Infrastructure/Platform/Software as-a-service (4 Lectures)
- Public cloud, private cloud and hybrid clouds(2 Lectures)
- Cloud OS(4 Lectures)
- Cloud Architectures including Federated Clouds(4Lectures)
- Scalability, Performance, QoS (2 Lectures)
- Data centers for Cloud Computing(2 Lexctures)
- Principles of Virtualization platforms(2 Lectures)
- Security and Privacy issues in the Cloud(2 Lectures)
- Energy Efficient and Green Cloud Computing (4Lectures)
- Capacity Planning (4 Lectures)
- Disaster Recovery in Cloud Computing(2 Lecurtres)
- Research Issues in Cloud Computing(2 Lectures)
- Case Study CloudSim Simulator(4 Lectures)
- Case Study Hadoop, HDFS and MapReduce(10 Lectures)

Recommended Books;
- Cloud Computting Bible: Barrie Sosinsky, Wiley India Pvt Ltd.,2010
- *Cloud Computing: Principles and Paradigms,* Editors: Rajkumar Buyya, James Broberg,Andrzej M. Goscinski, *Wile,* 2011

- *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer,* 2012
- *Cloud Security: A Comprehensive Guide to Secure Cloud Computing,* Ronald L. Krutz, Russell Dean Vines*, Wiley-India,* 2011
- Distributed and Cloud Computing, 1st edition, Morgan Kaufmann, 2011.
- *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer,* 2012

CS-6628 Legal Aspects of Information Security

Cyber World: An Overview: The internet and online resources, Security of information, Digital signature.

An Overview of Cyber Law: Introduction about the cyber space , Regulation of cyber space – introducing cyber law, UNCITRAL Model Law on Electronics Commerce 1996

Understanding Cyber Crimes : Defining Crime, Crime in context of Internet –Actus Rea/Mens Rea, Types of crime in Internet, Computing damage in Internet crime.

Indian Penal Law & Cyber Crimes: Fraud, Hacking, Mischief, Tresspass, Defamation, Stalking, Spam.

Case #1: Study various cases relate to Phishing in people's account and write a report.

Obscenity: Internet and Potential of Obscenity, Indian Law on Obscenity & Pornography, Technical and Legal solutions, International efforts, Changes in Indian Law ,Search and Seizure powers,Digital Forgery.

Case #2: Study Section 67,67A,67B,69A,69A and 69B related case study

Freedom of Speech & Human Rights Issues in Internet : Freedom of Expression in Internet, Issues of Censorship ,Hate speech, Sedition, Libel, Subversion, Privacy Issues, International Positions on Free Speech in Internet.

Contract in the InfoTech world

Understanding Electronic Contracts : The Indian Law of Contract, Construction of Electronic Contracts, Issues of Security Issues of Privacy Technical Issues in Cyber Contracts.

Assignment: Write a contact policy b/w Your IT company and Client.

Types of Electronic Contracts : Employment Contracts Consultant Agreements Contractor Agreements Sales, Re-Seller and Distributor Agreements Non-Disclosure Agreements , Software Development & Licensing Agreements Shrink Wrap Contract ,Source Code Escrow Agreements.

Cyber Contracts & Indian Legal Position: Legal Issues in Cyber Contracts, Cyber Contract and IT Act 2000, Indian Law on Shrink Wrap/ Click wrap Contracts Drafting of Cyber Contracts.

E-Commerce & Taxation

E-Commerce - Salient Features : On-line contracts, Mail Box rule, Privity of Contracts, Jurisdiction issues in E-Commerce, Electronic Data Interchange

Security and Evidence in E-Commerce : Dual Key Encryption ,Digital Signatures, Security issues in E-Commerce , Evidence related issues ,UNCITRAL model law of E-Commerce, Indian Legal

Position on E- Commerce, IT Act 2000/Indian Evidence Act/ Draft law on E-Commerce.

Taxation Issues in Cyber Space : Indian Tax System, Transactions in E- Commerce, Taxing Internet Commerce, Indirect Taxes, Tax evasion in Cyber space

International Taxation in E-Commerce : Understanding International Taxation, Fixed place vs. Website, Permanent Establishments, Double Taxation, Role of ISPs, OECD initiatives in International Taxation.

Impact of Technology on Law

Understanding Copy Right in Information Technology: Understanding the technology of Software, Software - Copyrights vs. Patents debate, Authorship and Assignment Issues, Commissioned Work and Work for Hire, Idea/Expression dichotomy, Copyright in Internet.

Legal Issues in Internet and Software Copyright: Jurisdiction Issues and Copyright, Infringement, Remedies of Infringement, Multimedia and Copyright issues, Software Piracy.

Assignment : Write a Content uses copywrite policy for your open source software.

Patents: Understanding Patents, International context of Patents, European Position on Computer related Patents, Legal position of U.S. on Computer related Patents and Indian Position on Computer related Patents.

Trademarks : Understanding Trademarks, Trademark Law in India, Infringement and Passing Off, Trademarks in Internet, Domain name registration, Domain Name Disputes & WIPO.

Practical on Information Security Tools: Nmap,SARA

Databases : Databases in Information Technology, Protection of Databases, Legal Position of Database protection in U.S., European Legal position on Databases, Indian Law on Databases, Sui Generis Extraction Right**.**

Practical on Information Security Tools: CyberCheck 4.0

1. Required Text(s) :
    1. Vivek Sood, Cyber law Simplified ,Tata Mcgraw-HillPublishing(2001).
    2. Chris Reed and john Angel, Cyber law(2007)
    3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)
    4. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd.

2. Essential References:
   1. The Information Technology Act,2000.
   2 .Information Technology Law and practices by Vakulsharma.
   3. Computers, Internet and New Technology Laws (A comprehensive reference work with a special focus on developments in India)" By: Karnika Seth.
   4. Cyber Law & Crimes By: BarkhaBhasin, Rama Mohan Ukkalam.

3. Electronic Materials, Web Sites:
   i)   http://www.cyberlawsindia.net
   ii)   http://www.madaan.com/cyberlaw.html

Network Security (CS-5618)

UNIT 1

Obstacles to Security

Security is inconvenient, Computer Are Powerful and complex, Computer User Are Unsophisticated, Computer Created without a Thought to Security, Current Trend is to Share, Not Project Data Accessible from Anywhere security Isn't, Hardware and Software. The Bad Guys Are Very Sophisticated, Management Sees Security as a Drain on the Bottom Line.

Ten Steps to Building a Secure Organization

Evaluate the Risks and Threats, Beware of Common Misconceptions, Provide Security Training for IT Staff-Now and Forever, Think Employees: Develop a Culture of Security Identify and Utilize Built-In Security Features of the Operating System and

Applications, Monitor System, Hire a Third Party to audit Security, Don't Forget the Basics, Patch

UNIT 2

Internet Security

Internet Protocol Architecture: Communications Architecture Basics, **An Internet Threat Model:** The Dolev-Yoa Adversary Model Layer Threats, **Defending Against Attacks on the Internet:** Layer Session Defences, Session Stratup Defences

Botnet Problem

Botnet Overview, Origin of Botnets, Botnet Topologies and Protocols, **Typical Bot Life, Cycle, The Botnet Business Model, Botnet Defence,** Detecting and Removing Individual Bots, Detecting C&C Traffic, Detecting and Neutralizing C&C Channels,\Locating and identifying the Botmaster **Botmaster Traceback:** Traceback Challenges, Traceback Beyond the internet

UNIT 3

Content Filtering

The Problem with Content Filtering, Categories, Issues and Problems with Content Filtering, Bypass and circumvention, Client –Based Proxies, Open Proxies, HTTP web-Based Proxies(Public and private),Secure Public Web-Based Proxies, Process Killing

Remote Pc Control Applications, Overblocking and Underblocking, Blacklist and Whitelist Determination, Casual Surfing Mistake, Getting the List Updated, Time-of-Day Policy Changing ,Override Authorization Methods, Hide Content in "Noise" or use Steganography, Detect Spywareand malware in the HTTP Payload, Scalability and Usability , Performance Issue, **Technology and Techniques for Content-Filtering control ,**Internet gateway-based Products Unified Threat Appliances

Virtual Private Network,

IPsec,,L2TP,L2TPv3,L2F,PPTP VPN,MPLS,MPVPN,SSH,SSL-VPN,TLS

Authentication Methods

Hashing, HMAC, MD5, SHA-1, Symmetric Encryption, Asymmetric Cryptography
Edge Devices, Password,

UNIT 4

Instant-Massaging Security

The Evolution of Networking Technology, Game Theory and Instant Messaging, Your workforce, Generational Gaps, Transactions, **The Nature of the Threat**

Malicious Threat , Vulnerabilities, Man-in-the-Middle Attacks, Phishing and Social Engineering, Knowledge Is the Commodity, Data and Traffic Analysis, Unintentional Threats, Regulatory Concerns, **Common IM Applications** Consumer Instant Messaging, Enterprise Instant Messaging, Backdoor: Instant Messaging via Other Means(HTML),Mobile Dimension, **Defensive Strategies:** Asset Management, Built-in Security, Content Filtering, Classic Security, Compliance, Data Loss Prevention, Logging, Archival, **Processes,** Instant-Messaging Activation and Provisioning, Application Review, People, Revise ,Audit

Risk Management: The **concept of risk, Expressing and Measuring Risk**

The Risk Management Methology: Context Establishment, Risk Assement, Risk Treatment, Risk Communication, Risk Monitoring and Review, Integrating Risk Management into the System Development Life Cycle, Critique of Risk Management as a Methology, Risk Management Methods

Risk Management Laws and Regulations, Risk Management standards

UNIT 5

Vulnerability Assessment

Why Vulnerability assessment, Penetration Testing Versus Vulnerability Assessment,

Vulnerability Assessment Goal, Mapping the Network, Selecting the Right Scanner

Central Scans versus local Scans, Defence in Depth Strategy, Network Scanning Countermeasures, Vulnerability Disclosure Date, Find Security Hole before They Become Problem, Proactive Security versus Reactive Security, Vulnerability Causes, Conclusion.

Firewall, IDS/IPS, Honeypot

Outcomes:

1. Develop strategies to protect organization information assets from common attacks.
2. Understand how security policies, standards and practices are developed.
3. Identify the major techniques, approaches and tools used to discover network and system vulnerabilities.
4. To be exposed to original research in Network Security.

References:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security", Prentice Hall, 2nd edition, 2002, ISBN-10: 0130460192, ISBN-13:978-0130460196.
2. Charles Pfleeger," Security in Computing", Prentice Hall, 4 th Edition, 2006, ISBN-10: 0132390779, ISBN-13: 978-01323907744.
3. Ulysess Black, "Internet Security Protocols: Protecting IP Traffic", Prentice Hall PTR; 1st edition, 2000, ISBN-10: 0130142492, ISBN-13:978-0130142498.
4. Amir Ranjbar 2007, CCNP ONT Official Exam Certification Guide, Cisco Press [ISBN: 978-1-58720-176-3].
5. Luc De Ghein 2006, MPLS Fundamentals, 1st Ed. Ed., Cisco Press [ISBN: 978-1- 58705-197-5]
6. William Stallings, "Cryptography and Network Security", Pearson Education, 6th Edition, 2013,ISBN 10: 0133354695.

CS-6623 Mobile and Wireless Systems

UNIT I

Overview of the emerging fields of mobile computing; Historical perspectives (mainly from the perspective of radio), Mobile applications, Limitations, Health Concerns, Cordless phone, Land mobile vs. Satellite vs. In-building communications systems, Frequencies for radio transmission. Characteristics of Cellular Systems, Mobility support in cellular telephone networks, Personal Communications Systems/Personal Communications Networks, Wireless Personal Area Network, Wireless Local Area Network and Internet Access. Mobility management, Security, Cellular telephony as a case study in network support: hand-off, mobility, roaming, billing/authorization/authentication.

UNIT II

Mobile communication: Fibre or wire based transmission, Wireless Transmission - Frequencies, Signals, Antennas and Signal Propagation, Modulation Techniques, Multiplexing techniques, Coding techniques.

Cellular structure, Voice Oriented Data Communication - GSM, CDMA, GSM Architecture, Authentication & security, frequency hopping, Speech coding, Data communication with PCs, Wireless web browsing, Testing cellular Systems Speech coding.

UNIT III

Satellite Systems: History, Application, and Basics of Satellite Systems: LEO, MEO, GEO, Routing, Handover, VSAT, installation & Configuration. Cyclic repetition of data, Digital Audio Video Broadcasting, Multimedia object tran-sfer Protocol, Wireless LAN topologies, requirements. Physical layer, MAC sublayer, IEEE802.11.HIPERLAN: Protocol architecture, layers, Information bases and networking, Bluetooth.

UNIT IV

Basics of Discrete Event Simulation, Application and Experimentation, Simulation models. Case Study on Performance Evolution of IEEE 802.11 WLAN configuration using Simulation, MobileIP, goals, assumptions requirements, entities and terminology, IP packet delivery, tunnelling

and encapsulation, Feature and format of IPv6, DHCP, TCP over Wireless. Characteristic of Ad Hoc networks, Applications, need for routing, routing classification, Wireless sensor networks, classification and Fundamentals of MAC protocol for wireless sensor networks.

UNIT V

Economics Benefits of Wireless Networks, Wireless Data Forecast, Charging issues, Role of Government, Infrastructure manufacturer, Enabling Applications Mobile operating System, file system, Process, Task, Thread, ISR and IST, CODA, HTTP versus HTML, WML, XML application for wireless handheld devices. UWB systems Characteristics, Current approaches for security.

Text Book(s):
1. Mobile Communications author Jochen Schiller, publication John Willy & Sons, Ltd.

Reference Book(s):
1. Wireless And Mobile Systems,D. P. Agrawal,Qing-An zeng, Thomson publication.

2. Wireless Networks, P Nicopotidis, Addision –Wesley-An zeng publication

CS-6630 Internet of Things

Unit 1:
Introduction to IoT: Definition, Characteristics, Conceptual framework, Architectural view.
Technology involved - Server-end technology, Hardware and Software components, Development tools & Open source framework, APIs & Device interfacing components, Platforms & Integration tools, Sources of IoT, Advantages and Disadvantages of IoT.
Machine-to-Machine Communication: Definition, How M2M relates to IoT?, M2M architecture.

Unit 2:
Design principles for connected devices: Communication Technologies – Near-field communication, RFID, Bluetooth, Zigbee (ZigBee IP/ZigBee SE 2.0), Wi-Fi, GPRS/GSM cellular Networks-Mobile Internet.
Design principles for web connectivity: Constrained Application Protocol (CoAP), MQTT, XMPP.
Data formats: JSON, XML, TLV, MIME.
Connectivity Models: Request/Response, Publish/Subscribe, Pull/ Push Data, Message cache, Message queue.
Gateway Protocols for Web Connectivity: HTTP, SOAP, REST, RESTful HTTP and WebSockets.

Unit 3:
Data Acquiring: Data generation, Data Acquisition, Data validation, Data categorization for storage, Data Store – definition, Key/value store, Document store, tabular store (Column Family & Big Table), Object store, Graph Stores-Graph Databases
Data Organizing: Definition, DBMS-ACID rules, Distributed database, CAP theorem , Query processing, SQL, NoSQL, ETL, MPP, in-memory databases , columnar database

Unit 4:
Data Processing: Definition, Online tractions and processing (OLTP), Stream processing, Real-Time processing, Event Stream processing, Business process, Business Intelligence, Distributed Business Process, Enterprise Systems, Service Oriented Architecture(SOA).
Data Analytics: Definition, Analytics phases- Descriptive, Predictive, Prescriptive), Online analytical processing (OLAP), Statistical tools for data analysis -descriptive and inferential statistics, random analysis, sampling concept, Sampling distribution techniques, statistical inference, regression analysis.
Machine Learning basics: Supervise and un-supervised techniques,
Big Data analytics - Big data definition, Characteristics, Big data Classifications on the basis of: sources, format, stores, analysis, type, users, rate.
Big data Analytics: Architecture, Hadoop components, Berkley Data Analytics Stack (BDAS) Architecture.
Knowledge Management: Definition, Knowledge Management Reference Architecture.

Unit 5:
Cloud Storage models and communication APIs for IoT, IoT Privacy, Security and Vulnerabilities Issues and Solutions, Prototyping and designing the software for IoT applications, Interoperability in IoT.
Introduction to Arduino Programming: Integration of Sensors and Actuators with Arduino.

TEXT BOOKS:
1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Thing", Wiley
2. Rajkamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, 2017.

REFERENCE BOOKS:
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers , 2014
3. Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, "Interconnecting Smart Objects with IP: The Next Internet"
4. Michael Miller, "The Internet of Things", Pearson Education,2015.
5. Vijay Madisetti , Arshdeep Bahga, " Internet of Things (A Hands-on-Approach)", Universities Press, 2015, ISBN: 9788173719547
6. Tanenbaum, Andrew S, "Computer Networks", Pearson Education Pte. Ltd., Delhi, 4 th Edition
7. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010
8. Charalampos Doukas, "Building Internet of Things with the Arduino"
9. Tom Igoe, "Making Things Talk Using Sensors, Networks, and Arduino to see, hear, and feel your world" (Second Edition)

CS-6313 Software Testing & Quality Assurance

Software Testing : Introduction and background, Big picture of software development process and testing component in every phase of the process

Software testing terms and definitions: Black box & white box testing, static and dynamic testing, unit, integration, system, validation, acceptance, regression testing. Unit test Automation with JUnit

Techniques of black box testing: Preparing tests-to-pass and tests-to-fail, equivalence partitioning, data and state testing, White box testing: formal reviews of the code, programming standards and guidelines, preparing code review checklists, Data & Code coverage techniques

Configuration and Compatibility testing: Isolating configuration bugs, identifying requirements of hardware, software and network, Identifying platform and application versions, backward and forward compatibility, Data sharing compatibility
Foreign Language testing: Translation issues, ASCII, EBCDIC, Hotkeys and shortcuts, extended characters, computation on characters, localisation, compatibility and configurability issues

Documentation testing, Types of documentation testing, preparing checklists before documentation testing, Security testing, Website testing: Web page fundamentals,

Automation Testing: Techniques and methods, Seminar on popular tools like Winrunner and Rational ROBO. Hands on experience on these tools

Test Planning: Test Phases, Resource, manpower requirements, test strategy, test schedule, bug reporting mechanisms, metrics and statistics
Writing and tracking testcases, Introduction to automated bug tracking and testcase management systems

Usability Engineering
Usability: Importance and Impact on SDLC, Generations of User Interfaces, The Usability Engineering Lifecycle, Usability Heuristics, Usability Testing, Usability Assessment Methods beyond Testing, Interface Standards, International User Interfaces.
Capability Maturity Model

CMM: Process, Need for Process Improvement & Standards, Assessment, Improvement and Compliance against Matured Processes, Software Quality tradeoffs, Introduction: CMM Level I to V, Case Studies.

Essential References:
1. Software testing Ron Patton SAMS Publishing
2. CMM Level 5 unleashed'

Recommended Book(s)
1. Effective methods of software testing' Wiley Publishers, William E. Perry

Electronic Materials, Web Sites:
1. CMM Level 5 and Carnegie Mellon University Site reference material on aspects of software quality

CS- 6316: Software Reuse & Customization

Unit-I
Introducing to Software Reuse: What is Software Reuse?, Reuse types, Reuse Approaches, Reuse Technology, Reuse benefits & barriers, Reuse success & failure Factors, Reuse Driven Software Engineering is a business.

Unit-II
Architectural Style: Application and component systems- Application Developers can reuse OOSE model components; Application families allow significant reuse, Application Systems Are Built from Reusable Components, Group Components into Component Systems, Facades Control Access to Component System Internals, Component Systems Export Components Via Facades. Use Case Components, Object Components, Layered Architecture.

Unit-III
Process- Object Oriented Business Engineering, Applying Business Engineering to Define Process and Organization, Application Family engineering, Component System Engineering, Application System Engineering.

Unit-IV
Organizing a Reuse Business: Transition to a Reuse Business, Reengineering   and   Reuse,

Managing the Reuse Business.

Unit-V
  Design Patterns : Object Oriented Principles, Importance of Design Patterns in Reuse, Introduction to Creational Patterns, Structural Patterns, Behavioral Patterns, Miscellaneous Patterns, Implementation of Design Patterns.

Text Book:
  1. Ivar Jacobson, Martin Griss, Patrick Johnson, "*Software Reuse Architecture, Process and Organization for Business Success*", First Edition, Pearson Education, 2000.
  2. Erich Gamma at al., "*Design Patterns: Elements of Reusable Object-Oriented Software*", Addison Wesley, 1999.

Reference Books:
  1. Eric Braude, "*Software Design: From Programming to Architecture*", John Wiley & Sons, 2003.
  2. Bernd Bruegge & A. Dutoit, "*Object Oriented Software Engineering using UML, Design Patterns, and Java*", Pearson Education, 2004.
  3. Ugrasen Suman, "*Software Engineering: Concepts & Practices*", Cengage Learning publications, 2013.

CS-6711 Soft Computing

UNIT 1
Soft Computing: Soft computing, Differences between soft computing and hard computing, Soft Computing constituents. **Fuzzy logic**: Definition, Applications. **Genetic Algorithms:** Definition, Applications,**Neural Networks :** Definition, Applications **, Hybrid Systems** : Definition,Types**.**

UNIT 2
Fuzzy Sets and Fuzzy Logic: Introduction to Classical Sets and Fuzzy Sets. Classical set and Fuzzy sets – Operations and Properties. Fuzzy Relations – Equivalence and Tolerance, Membership Functions, Fuzzification, Membership Value Assignment. Fuzzy to Crisp Conversion, Lambda Cuts for Fuzzy Sets and Fuzzy Relations, Defuzzification Methods, Fuzzy Arithmetic, Fuzzy Logic and Approximate Reasoning, Rule Based Systems and Graphical Techniques of Inference.**Rough Sets:** Rough Sets,Upper and Lower Approximations, Boundary Region, Decision Tables and Decision Algorithms. Properties of Rough Sets.

UNIT 3
Elementary Search techniques:
Uninformed Search Techniques: Breadth First Search, Depth First Search, Depth first Iteravtive Deepining, Bidirectional Search.**Heuristic Search Techniques:** Best First Search, Hill Climbing Search,Branch and Bound Search, A*, AO*, Means-ends Analysis, Constraint Satisfaction**. Genetic Algorithm(GA):** Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), **Multi-objective GA,** steady state GA, Applications of GA, **Stimulated Annealing**

UNIT 4
Artificial Neural Networks
Basics of Neural Networks, Biological Neural Networks, McCulloch Pitt model, Supervised Learning algorithms: Perceptron (Single Layer, Multi layer), Linear separability, Delta learning rule, Back Propagation algorithm, Un-Supervised Learning algorithms: Hebbian Learning, Self Organizing Maps, Learning Vector Quantization.

UNIT 5
Hybrid Systems
Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, GA Based Back propagation Networks, Fuzzy Back Propagation Networks, Fuzzy Associative Memories, ANFIS: Adaptive Neuro-Fuzzy Inference Systems.

References :
1. S.N. Deepa,S.N. Sivanandam,Principles of Soft Computing (Second Edition), Wiley India Pvt. Ltd.,2011.
2. Samir Roy,Udit Chakraborty,Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson India,2013.

CS-6712 Data Science

UNIT I
Structured data Analytics, Data Warehouse, Evolution, Definition, Very large database, Application, Multidimensional Data Model, OLTP vs. Data Warehouse, Data Warehouse Architecture. Metadata, ETL and Data warehouse, Metadata, Components of metadata.

Dimension Tables, Fact Table, Warehouse Schema Design: Star Schema, Snowflake schema, Fact Constellation, Data Marts, PL/SQL. OLAP, Strengths of OLAP, OLTP vs OLAP, Multi-dimensional Data, Slicing and Dicing, Roll-up and Drill Down, Pivot. Data Warehouse Implementation.

UNIT II
Unstructured Data Analytics: Descriptive, diagnostic, predictive and prescriptive data Analytics.

Introduction to R, Vectors, Matrices, Factors, Lists, Data Frames., Basic Graphics

UNIT III
Introduction to Data Cleansing, Missing and Repeated Values, Feature Engineering, Outliers and Errors, Finding Outliers, Cleaning Data with R.

UNIT IV
Machine Learning: Regression, Simple Linear Regression, Multiple Regression, Assessing Performance, Ridge Regression, Feature Selection & Lasso, Nearest Neighbors & Kernel Regression

Machine Learning: Classification, Linear Classifiers & Logistic Regression, Learning Linear Classifiers, Overfitting & Regularization in Logistic Regression, Decision Trees, Handling Missing

Data, Boosting.

UNIT V

R and Hadoop, Overview of Hadoop, Hadoop Streaming, Packages for Parallel Computation with R: Segue, doMC.

Text:

[1] Data Mining Techniques, Arun K Pujari, University Press Second Edition.

[2] R in a Nutshell, Joseph Adler Second Edition O'REILLY.