

KL UNIVERSITY

Green Fields, Vaddeswaram.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PRE-PhD SUBJECTS

1. Advances in Computing
2. Service Oriented Architecture
3. Cloud Computing
4. Mobile Cloud
5. Data Center Virtualization
6. Cloud Security
7. Software Engineering
8. Software Project Management
9. Software Testing & Quality Assurance
10. Software Reliability
11. Advanced Data Structures
12. Software Architecture
13. Information Retrieval Systems
14. Big Data Analytics
15. Data Warehousing & Data Mining
16. Distributed Databases
17. Data Security & Privacy
18. Computer Networks
19. Distributed Computing
20. Network Security
21. Mobile Computing and Wireless Communication
22. Cryptography and Network Security
23. Wireless Sensor Networks
24. Soft Computing
25. Digital Image Processing
26. Web Security
27. Bio-Informatics
28. Pattern Recognition
29. Parallel Algorithms
30. Artificial Intelligence

ADVANCES IN COMPUTING

Syllabus

UNIT I:

Grid Computing: Data & Computational Grids, Grid Architectures and its relations to various Distributed Technologies. Autonomic Computing, Examples of the Grid Computing Efforts (IBM)

UNIT II:

Cluster Computing 1: Cluster setup & its Administration, Performance Models & Simulations; Networking, Protocols & I/O, Lightweight Messaging systems, Active Messages

UNIT III:

Cluster Computing 2: Distributed shared memory, parallel I/O Clusters, Job and Resource management system, scheduling parallel jobs on clusters

UNIT IV:

Cluster Computing 3: Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing, Example Cluster System – Beowulf, COMPaS and NanOS

UNIT V:

Pervasive Computing : Pervasive Computing concepts & Scenarios, Hardware & Software, Human - machine interface Device connectivity, Java for Pervasive devices, Application examples, Quantum Computing : Introduction to Quantum Computing, Qubits, Quantum Mechanics, Quantum gates, Applications of quantum computing.

REFERENCE BOOKS:

1. J. Joseph & C. Fellenstein, Grid Computing, PEA.
2. Raj Kumar Buyya, High performance cluster computing, PEA.
3. J.Burkhardt et .al, Pervasive computing, PEA.
4. Vishal Sahni, Quantum computing, TMH.
5. Marivesar, Approaching quantum computing, PEA.
6. Nielsen & Chung L, Quantum computing and Quantum Information, Cambridge University Press.
7. A networking approach to Grid Computing , Minoli, Wiley.

Advances in Computing

Model Paper

I. Answer any five from the following:

5x20=100

- 1.Explain the Architecture of Grid Computing.Give Examples.
- 2.Explain in detail about Scheduling parallel jobs on Clusters and Parallel I/O Clusters.
- 3.Briefly Explain about Cluster Computing set up and Administration.
- 4.what is Distributed shared Memory?Give an Example.
- 5.Discuss in detail parallel Programming Scheduling Techniques.
- 6.Explain about the Quantum Computing and its Applications.
- 7.Discuss about the Pervasive Computing Scenarios.
8. Explain the following Terms
 - a). parallel I/O Clusters.
 - b). Light weight Messaging systems and Active Messages.

SERVICE ORIENTED ARCHITECTURE

Syllabus

UNIT-I

Introducing SOA: Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP.

UNIT-II

Web Services and Contemporary SOA: Message exchange patterns- Service activity-coordination-Atomic transactions- Business activities-Orchestration-Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies-Metadata exchange- Security- Notification and eventing. SOA and Service-Oriented: Principles of Service-Oriented-Service-orientation. - Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation.

UNIT-III

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA- Deriving business services- Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT-IV

Service-Oriented Design Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT-V

SOA Service Design: -Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics- WS Coordination.

Text Book:

1. Thomas Erl ,” Service-Oriented Architecture: Concepts, Technology & Design”, Pearson Education Pte Ltd 2008.

Reference Books:

1. Thomas Erl,”SOA Principles Of Service Design”Pearson Exclusives 2007.
2. Tomas Erl and Grady Booch,”SOA Design Patterns”Printice Hall 2008.111
3. Michael Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer, “Applied SOA: Service-Oriented Architecture and Design Strategies”, Wiley, 2010.
4. Douglas K. Barry, “Web Services, Service-Oriented Architectures, and Cloud Computing”, Elsevier, 2003.
5. James Bean, “SOA and Web Services Interface Design: Principles, Techniques, and Standards”, Elsevier, 2010

SERVICE ORIENTED ARCHITECTURE

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1.
 - a). Briefly explain the Evolution of Service Oriented Architecture.
 - b). What are the Common Pitfalls while adopting the Service Oriented Architecture.
2. Explain about Different Services of Service Oriented Architecture.
3. Explain Common principle of service-orientation-Service Layers
4. Define the following Term
 - a). WS-BPEL language basics
 - b). SOA delivery lifecycle phases
5. What is the Anatomy of a service-oriented architecture?
6.
 - a) What are the benefits of a business-centric SOA.
 - b). Explain types of service modeling approaches.
7. Discriminate the WSDL-related XML Schema language basics and SOAP language basics.
8. Explain the different Steps to composing SO Considerations for choosing service layers and SOA standards.

CLOUD COMPUTING

Unit-I

Overview of Computing Paradigm :Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing.

Introduction to Cloud Computing :Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing;Role of Open Standards

Unit-II

Cloud Computing Architecture:Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels,How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services; Service Models (XaaS): Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

Unit-III

Infrastructure as a Service(IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM).

Resource Virtualization: Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service); Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers, Eucalyptus.

Platform as a Service(PaaS):Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Computation, Storage, Examples, Google App Engine, Microsoft Azure, Salesforce.com's Force.com platform.

Unit-IV

Software as a Service(PaaS):Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS.

Service Management in Cloud Computing:Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Unit-V

Cloud Security:Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Reference Books

Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 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, 2010

CLOUD COMPUTING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Illustrate the cloud Architectures and cloud services.
2. List out the implementation of cloud in a business case.
 - (a)Elaborate the cloud computing Technologies.5M
 - (b)Write a note on cloud standards.5M
3. Distinguish between software as a service and Software + services with real time examples.
4. Write a case study of cloud mobile device integration.
5. (a) What is virtualization? Explain different types. 5M
(b) Analyzing the service on migrating to the clouds.5M
6. Illustrate the collaborating on event management and on project management with a neat sketch diagram.
7. Analyzing the storing, sharing files and sharing digital photographs in cloud computing.
8. a) Define Cloud computing, Enlist and explain essential characteristics of cloud computing. 5M
b) Explain the services provided by the Amazon infrastructure cloud from a user perspective 5M

MOBILE CLOUD

Syllabus

Unit-I

Mobile Connectivity Evolution: From Single to Multiple Air Interface Devices, Network Evolution: The Need for Advanced Architectures.

Unit-II

Mobile Clouds: An Introduction, Cooperation and Cognition in Mobile Clouds, Mobile Cloud Classification and Associated Cooperation Approaches.

UNIT-III

Sharing Device Resources in Mobile Clouds, Wireless Communication Technologies, Building Mobile Clouds.

UNIT-IV

Mobile Cloud Formation and Maintenance, Cooperative Principles by Nature, Social Mobile Clouds, Green Mobile Clouds: Making Mobile Devices More Energy Efficient.

UNIT-V

Mobile Clouds Applications, Future Developments of Mobile Clouds.

Text Book:

1. Frank H. P. Fitzek, Marcos D. Katz, Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks, Wiley Publications, ISBN: 978-0-470-97389-9, Jan 2014.

References

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, and Michael Morgano, Android for Programmers: An App-Driven Approach, Prentice Hall, November 3, 2011.

MOBILE CLOUD

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Discriminate the Following.
 - a). Mobile Connectivity Evolution
 - b). Network Evolution
2.
 - a). How to share the device Resources in Mobile Clouds ?
 - b). How to Build Mobile Clouds?
3. Define the Following Terms.
 - a). Social Mobile Clouds
 - b). Green Mobile Clouds
4. What are the Future Developments of Mobile Clouds?
5. How the Mobile Devices are Making more Energy Efficient?
6. Classify the Mobile Clouds and their Cooperative approaches.
7. What are different kinds of Mobile Cloud Applications?
8.
 - a) Explain about the Wireless Communication Technologies.
 - b) What is the Need for Advanced Architectures.

DATA CENTRE VIRTUALIZATION

Syllabus

Unit I

Data Center Challenges: How server, desktop, network Virtualization and cloud computing reduce data centre footprint, environmental impact and power requirements by driving server consolidation; **Evolution of Data Centres:** The evolution of computing infrastructures and architectures from stand alone servers to rack optimized blade servers and unified computing systems (UCS).

Unit II

Enterprise-level Virtualization: Provision, monitoring and management of a virtual datacenter and multiple enterprise-level virtual servers and virtual machines through software management interfaces; **Networking and Storage in Enterprise Virtualized Environments:** Connectivity to storage area and IP networks from within virtualized environments using industry standard protocols.

Unit III

Virtual Machines & Access Control: Virtual machine deployment, modification, management, monitoring and migration methodologies.

Unit IV

Resource Monitoring: Physical and virtual machine memory, CPU management and abstraction techniques using a hypervisor.

Unit V

Virtual Machine Data Protection: Backup and recovery of virtual machines using data recovery techniques; **Scalability:** Scalability features within Enterprise virtualized environments using advanced management applications that enable clustering, distributed network switches for clustering, network and storage expansion; **High Availability :** Virtualization high availability and redundancy techniques.

Reference Books:

1. Mickey Iqbal 2010, IT Virtualization Best Practices: A Lean, Green Virtualized Data Center Approach, MC Press [ISBN: 978-1583473542]
2. Mike Laverick, VMware vSphere 4 Implementation [ISBN: 978-0071664523]
3. Jason W. McCarty, Scott Lowe, Matthew K. Johnson, VMware vSphere 4 Administration Instant Reference [ISBN: 978-0470520727]
4. Brian Perry, Chris Huss, Jeantet Fields, VCP VMware Certified Professional on vSphere 4 Study Guide [ISBN: 978-0470569610]
5. Brian Perry, Chris Huss, Jeantet Fields, VCP VMware Certified Professional on vSphere 4 Study Guide [ISBN: 978-0470569610]
6. Jason Kappel, Anthony Velte, Toby Velte, Microsoft Virtualization with Hyper-V: Manage Your Datacenter with Hyper-V, Virtual PC, Virtual Server, and Application Virtualization [ISBN: 978-0071614030]

DATA CENTER VIRTUALIZATION

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Define the following terms
 - a). Grid Computing
 - b).Autonomic Computing and Cluster Computing.
2. Explain about Resource Management system . How to schedule the parallel jobs on clusters?
- 3a).What are the various kinds of parallel programming scheduling techniques
 - b). Briefly describe the dynamic Load balancing
4. Explain the following terms
 - a). Load sharing
 - b).Fault tolerance manager.
5. Explain about Distributed shared memory and parallel I/O Clusters .Give an Example for Cluster System.
6. Explain the Lightweight Messaging systems and Active Messages
7. Explain in detail about How to set up Administer the Cluster.
8. Describe the Performance Models & Simulations , Networking.

CLOUD SECURITY

Syllabus

Unit-I

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud;

Cryptographic Systems: Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

Unit-II

Multi-tenancy Issues: Isolation of users/VMs from each other. How the cloud provider can provide this;

Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery;

Unit-III

Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).

Unit-IV

Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.

Technologies for Virtualization-Based Security Enhancement: IBM security virtual server protection, virtualization-based sandboxing;

Unit-V

Storage Security: HIDPS, log management, Data Loss Prevention. Location of the Perimeter.

Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test. local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

Reference Books:

1. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]
2. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]
3. John Rittinghouse, James Ransome, Cloud Computing [ISBN: 1439806802]
4. J.R. ("Vic") Winkler, Securing the Cloud [ISBN: 1597495921]

CLOUD SECURITY

Model Paper

Time: 3 hours

Max. Marks: 100

**Answer Any Five of the Following Questions
Each Question Carries 20 Marks.**

1. Discuss about different security concepts in cloud computing.
2. Explain about Symmetric Cryptography and public key cryptography.
3. Write a short notes on Virtualization System Vulnerabilities
4. Explain about virtualization system security issues
5. Discuss about X.509 Certificates and Open SSL.
6. Describe different Virtualization System Vulnerabilities
7. Explain different technologies for Virtualization-Based Security Enhancement
8. a) how standards deal with cloud services and virtualization

b) Explain compliance for the cloud provider vs Compliance for the customer

SOFTWARE ENGINEERING

Syllabus

Unit – I

Software and Software Engineering: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths. Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process. Agile development: Agility, agile process, extreme programming and other agile process models.

Unit – II

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods.

Unit – III

Design concepts: Design process, Design concepts, design model. Architecture Design: Software architecture, architectural styles, architectural design, assessing alternative architectural designs, architectural mappings using data flow. Component-level design: Designing class based components, conducting component level design.

Unit – IV

User interface design: The golden rules, user interface analysis and design, interface analysis, interface design steps. Quality concepts: software quality, software quality dilemma, achieving software quality. Software quality assurance: Elements of software quality assurance, sqa tasks, goals. Formal approaches.

Unit – V

Software testing strategies: A strategic approach to software testing, strategic issues, test strategies for conventional software, validation testing, system testing.

Text book:

1. Roger S.Pressman ,”Software Engineering – A Practitioner’s Approach 7th Edition 2010, Mc Graw Hill.

Reference Book:

1) Ian Sommerville, ‘Software Engineering’, Sixth Edition, 2001, Pearson Education.

SOFTWARE ENGINEERING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a. Explain Evolutionary Process models
b. Differentiate Component based model and formal method model
2. Discuss Lean software development and agile software models
3. a. What are the various approaches for requirements modelling? Explain
b. Explain the Architectural design in detail.
4. a. What are the basic principles involved in designing class based components?
b. What are the models for interface analysis and design? Explain
5. a. What is the difference between content architecture and web App architecture? Discuss
b. Explain the statistical Software Quality Assurance.
6. a. Explain Basis path testing with an example
b. What are the various methods in testing object oriented software? Discuss
7. a. Explain Clean room software engineering approach.
b. Explain version management and change management in software configuration.
8. a. What are different metrics for architectural design? Explain.
b. Discuss the elements of Software Process improvement (SPI) framework

SOFTWARE PROJECT MANAGEMENT

Syllabus

Unit-1 Introduction to software project management

Project Stakeholders, Project Management Knowledge Areas, Project Management Tools and Techniques, Program and Project Portfolio Management, the Role of the Project Manager, the Project Management Profession, Project Phases and the Project Life Cycle.

Unit-2 software project Time and Cost management

Time management: The Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule, Using Software to Assist in Project Time Management. Cost management: The Importance of Project Cost Management, Basic Principles of Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Determining the Budget, Controlling Costs.

Unit-3 Human Resources Management

The Importance of Human Resource Management, Keys to Managing People, Developing the Human Resource Plan, Acquiring the Project Team, Developing the Project Team, Managing the Project Team, Using Software to Assist in Human Resource Management.

Unit-4 Risk Management

Planning Risk Management, Common Sources of Risk on Information Technology Projects, Identifying Risks, Performing Qualitative Risk Analysis, Performing Quantitative Risk Analysis, Planning Risk Responses, Monitoring and Controlling Risks, Using Software to Assist in Project Risk Management.

Unit-5 procurement Management

Strategic Planning and Project Selection, Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases.

Textbook:

1. "INFORMATION TECHNOLOGY PROJECT MANAGEMENT", Kathy Schwalbe, 6th edition, Cengage Learning, 2011.

SOFTWARE PROJECT MANAGEMENT

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

- 1a. Explain the relationship between project management and software product development. How do they differ and how do they relate each other?
- b. List 4 of the nine knowledge areas. For each of the 4 areas, list 5 possible issues and some of the strategies that could be used to resolve them.
- 2) a. Explain about Time management processes and Activities
b. Critical Path Method (CPM) network diagram for the project. Identify the activities on the critical path
- 3) a. What is HR Management and Key and Keys to managing People.
b. Illustrate different theories present in HR management and explain with examples
- 4) a. Discuss common sources of Risks in Information Technology and Identify different of types of Risks.
- 5) a. Define the following terms
 - i) Procurement Management;
 - ii) Out- Sourcing;b. Describe what is included in a” statement of work”.
- 6) Applying your knowledge of the Traditional Project Life cycle, discuss
 - i)The tasks expected to be undertaken with each phase
 - ii)The major outputs/deliverables of each phase.
- 7) a. Explain the Project Risk Management Process .
b. Explain and Explore the Risk Break down Structure.
- 8) Explain about Critical chain scheduling with an example.

SOFTWARE TESTING AND QUALITY ASSURANCE

Syllabus

Unit I

Introduction, Basics of Software Testing, Testing Principles, Goals, Testing Life Cycle, Phases of Testing, Defects, Defect Life Cycle, Defect Report, Test Plan(IEEE format), Importance of testing in software production cycle.

Unit II

Introduction, Need of black box testing, Black box testing Concept, Requirement Analysis, Test case design criteria, Testing Methods, requirement based testing, Positive & negative testing, Boundary value analysis, Equivalence Partitioning class, state based or graph based, cause effect graph based, error guessing, documentation testing & domain testing, design of test cases. Black-Box testing.

Unit III

Introduction, Need of white box testing, Testing types, Test adequacy criteria, static testing by humans, Structure - logic coverage criteria, Basis path testing, Graph metrics, Loop Testing, Data flow testing, Mutation Testing, Design of test cases. Testing of Object oriented systems, Challenges in White box testing.

Unit IV

Test organization, Structure of testing, Measurement tools, testing metrics: Type of metric – Project, Progress, Productivity, Metric plan, Goal Question metric model, Measurement in small & large system. Other Software Testing: GUI testing, Validation testing, Regression testing, Scenario testing, Specification based testing, Adhoc testing, Sanity testing, Smoke testing, Random Testing.

Unit V

Software quality, Quality attribute, Quality Assurance, Quality control & assurance, Methods of quality management, Cost of quality, Quality management, Quality factor, Quality management & project management.

Text books:

1. Software Testing, Second Edition By: Ron Patton, Pearson Education ISBN-13: 978-0-672-32798-8
2. Software Testing Principles and Tools By M.G. Limaye TMG Hill Publication, ISBN 13:978-0-07-013990-9

References:

1. Metric and Model in Software Quality Engineering, By Stephen H Kan, Pearson Education ISBN 81-297-0175-8
2. Effective methods for software testing by William Perry , Willey Publication, ISBN 81-265-0893-0
3. Foundation of software testing by Dorothy Graham, Erik Van Veenendaal. CENGAGE learning , ISBN 978-81-315-0218-1

SOFTWARE TESTING AND QUALITY ASSURANCE

Model

Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

- 1).What is testing? What are its advantages? Also discuss significance of Unit testing and Integration testing with examples.
- 2).Differentiate between White-box and Black-box testing techniques with their relative merits and demerits in detail.
- 3).Describe the following briefly:
 - (a) Mutation Testing
 - (b) Symbolic Testing
 - (c) Features of Test cases.
 - (d) Stress Testing
- 4.) What are Software metrics? How these are useful in testing? Also discuss source code metrics with their relative advantages and disadvantages.
- 5).Explain the following:
 - (a) Software quality metrics
 - (b) Test data generators
 - (c) Incremental testing
- 6).Define Software reliability. How is it associated with testing? Also discuss software reliability metrics.
- 7).What is software quality? How is it related with testing? Also explain software quality models briefly.
- 8).Write short note on the following:
 - (a) SEI-CMM
 - (b) Software safety and Hazards Analysis.

SOFTWARE RELIABILITY

Syllabus

UNIT - 1 INTRODUCTION TO RELIABILITY ENGINEERING

Reliability — Repairable and Non Repairable systems — Maintainability and Availability — Designing for higher reliability — Redundancy — MTBF — MTTF MDT - MTTR— k out of n Systems.

UNIT - 2 SOFTWARE RELIABILITY

Software reliability - Software reliability Vs Hardware reliability – Failures and Faults - Classification of Failures – Counting – System Configuration – Components and Operational Models – Concurrent Systems – Sequential Systems – Standby Redundant systems.

UNIT - 3 SOFTWARE RELIABILITY APPROACHES

Fault Avoidance — Passive Fault detection — Active Fault Detection — Fault Tolerance - Fault Recovery - Fault Treatment.

UNIT - 4 SOFTWARE RELIABILITY MODELING

Introduction to Software Reliability Modeling – Parameter Determination and Estimation - Model Selection – Markovian Models – Finite and Infinite failure category Models – Comparison of Models – Calendar Time Modeling.

UNIT - 5 SPECIAL TOPICS IN SOFTWARE RELIABILITY

Management Techniques for reliability - Organization and Staffing — Programming Languages and Reliability — Computer Architecture and Reliability — Proving Program correctness & Reliability Design - Reliability Testing – Reliability Economics.

TEXT BOOKS

1. John D. Musa, “ Software Reliability”, McGraHill, 1985
2. Glenford J. Myers, “Software Reliability “, Wiley Interscience Publication, 1976

REFERENCE BOOKS

1. Patric D. T.O connor,” Practical Reliability Engineering” , 4th Edition, John Wesley & sons , 2003.
2. Anderson and PA Lee : “ Fault tolerance principles and Practice “, PHI ,1981
3. Pradhan D K (Ed.): “ Fault tolerant computing – Theory and Techniques”, Vol1 and Vol 2 , Prentice hall, 1986.
4. E.Balagurusamy ,” Reliability Engineering”, Tata McGrawHill, 1994.

SOFTWARE RELIABILITY
Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. What is the need for reliable software? Explain software reliability engineering concepts.
2. Write short notes on:
 - (a) Software reliability.
 - (b) Hardware reliability.
3. (a) Determine the developed software failure intensity objectives.
(b) Explain engineering strategies to meet the developed software failure intensity Objectives.
4. (a) What are the assumptions and data requirements of Weibull model?
(b) Explain software reliability predication in early phases of the life cycle.
5. Explain the following
 - (a) Static program complexity.
 - (b) Dynamic program complexity.
6. (a) How to estimate reliability with inaccurate operational profiles?
(b) What are the difficulties in estimating the operational profile?
7. (a) List and explain SRE activities in the software product life cycle.
(b) Write the importance and benefits of SRE.
8. Write detail notes on neural networks for software reliability.

ADVANCED DATA STRUCTURES

Syllabus

UNIT-I

Introduction: Algorithms, algorithms as a technology, Analyzing algorithms , Designing algorithms, Asymptotic notations, standard notations, common functions, Recurrences – substitution method, master method. **Sorting and order statistics:** Merge sort, Quick sort, Heap sort, sorting in linear time, Median and order statistics.

UNIT-II

Data structures: Elementary Data Structures – Linked lists, Stacks, Queues, Hash Tables – Direct address tables, Hash tables, Hash functions, Open addressing, Search Trees – Binary search trees, Red-Black Trees. **Advanced Data Structures:** B – Trees, Binomial Heaps, Fibonacci Heaps, Data Structures for Disjoint Sets

UNIT-III

Graph Algorithms: Elementary graph algorithms – Representation of graphs, BFS, DFS, Topological Sort, Strongly connected components, Minimum Spanning Trees – The algorithms of Kruskal and Prim's. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single source shortest paths in DAG's, Dijkstra's algorithm, All-Pair Shortest paths – Shortest paths and Matrix multiplication, Floyd-Warshall algorithm. Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum Bipartite matching.

UNIT-IV

Advanced Design and Analysis Techniques: Greedy Algorithms – An activity – selection Problem, Elements of greedy strategy, Huffman codes. Dynamic Programming: Matrix Chain multiplication, Elements of dynamic programming, Optimal Binary Search Trees.

UNIT-V

String Matching: The naïve string matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm. **NP-Completeness:** Polynomial time, Verification, NP-Completeness and reducibility, NP-Completeness proofs, NP-Complete problems.

Textbooks:

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson,R.L.Rivest, and C.Stein,PHI Pvt.Ltd./ Pearson Education

Reference Books:

1. Algorithm Design: Foundations,Analysis and Internet examples, M.T.Goodrich and R.Tomassia,John wiley and sons.
2. Fundamentals of Computer Algorithms,Ellis Horowitz,Satraj Sahni and S.Rajasekharam,Galgotia publications pvt. Ltd.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.
5. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

ADVANCED DATA STRUCTURES MODEL PAPER

I. Answer any Five from the following
5*20=100M

1. Explain the following in detail
 - a. Heap Sort
 - b. Sorting in Linear time
2. Explain Advanced Data Structures with example.
3. Briefly describe Hash table and Hash functions.
4. Evaluate the following algorithms with suitable examples.
 - a. Dijkstra's algorithm
 - b. Floyd-Warshall algorithm
5. What is Dynamic Programming? Explain the elements of Dynamic Programming.
6. Explain Knuth-Morris-Pratt algorithm in detail.
7. What is NP-Completeness? Explain the NP- Complete Problems.
8. Explain the following in detail.
 - a. Greedy Algorithm
 - b. Huffman Codes.

SOFTWARE ARCHITECTURE

Syllabus

Unit-I – Understanding Software Architecture

Definitions of Software Architecture-Architecture define Structure, Architecture Specifies Component Communication, Architecture Address's Non-functional Requirements; Architecture is an Abstraction, Architecture Views. Architectures and Technologies.

Unit-II-Architectural Styles

Architectural styles, Pipes and Filters, Data Abstraction and Object Oriented Organization, Event – Based Implicit Invocation, Layered Systems, Repositories, Interpreters ,Process Control ,Other familiar Architectures, Heterogeneous Architecture.

Unit-III-Software Quality Attributes

Quality Attributes, Performance, Scalability, Scalability for the ICDE Application, Modifiability, Modifiability for the ICDE Application Security, Security for the ICDE Application Availability, Integration, Other Quality Attributes.

Unit-IV-Architectural Design Guidance

Guidance for user interface architectures-Designs spaces and rules, A design space for user interface architectures, Design rules for user interface architecture, The qualified Design Space.

Unit-V-Software Agents

Agents in the ICDE Environment, Abstraction Revisited, An Example Agent technology, Architectural Implication-Concurrency, Scalability, Mobility, Agent Technologies.

Text Books:

1. Mary Shaw and David Garlan, Software Architecture- Perspectives on an Emerging Discipline, Prentice-Hall of India, 2004.
2. Ian Gorton, Essential Software Architecture Springer International Edition -2006

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Reference Book:

1. Richard N. Taylor, Nenad Medvidovic, Eric Dashofy, "Software Architecture: Foundations, Theory, and Practice", Wiley, 2009.
2. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2/e, Pearson Education, 2003.

SOFTWARE ARCHITECTURE

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

- 1 (a) Describe the following Architectural styles:
(i) Layered systems (ii) Process control (iii) Interpreters (iv) Event based Implicit Invocation.
b) Describe the Database Integration in Shared Information Systems
2. (a) Explain about the quality attributes with examples
(b) Discuss Security in ICDE Application
- 3 (a) Illustrate Data Abstraction and Object oriented event with an example.
(b) Explain layered systems and heterogeneous architecture
- 4 (a) Explain and explore for user interface architectures-Designs spaces and rules.
(b) Illustrate different attributes of software quality with examples
- 5 Analyze the functional and non functional requirements of software architecture.
- 6 (a) Why event based implicit invocation is required .
(b) Write about different heterogeneous architectures.
- 7 (a) Mention the design rules of architecture with a general case study
(b) Is security is required for the designing of software quality
- 8 Explain the features of software agents with examples.

INFORMATION RETRIEVAL SYSTEMS

Syllabus

Unit I : Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

Unit II: Inverted Files: Introduction, Structures used in Inverted Files, Building an Inverted file using a sorted array, Modifications to the Basic Techniques. Signature Files : Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

Unit III: New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. Lexical Analysis and Stoplists: Introduction, Lexical Analysis, Stoplists.

Unit IV: Stemming Algorithms: Introduction, Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files. Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

Unit V: String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knuth-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

REFERENCE BOOKS

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA, 2007.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.
3. Information Retrieval: Algorithms and Heuristics , Grossman, Ophir Frieder, 2/e, Springer, 2004.
4. Information Retrieval Data Structures and Algorithms , Frakes, Ricardo Baeza-Yates, PEA
5. Information Storage and Retrieval, Robert Korfhage, John Wiley & Sons.
6. Introduction to Information Retrieval, Manning, Raghavan, Cambridge University Press.

INFORMATION RETRIEVAL SYSTEMS

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) Define Information Retrieval System. Explain the objectives and functional overview of the Information Retrieval System.
b) Can Information Retrieval System be related to a database Management System? Justify your answer with relevant examples.
2. a) Discuss the various Information Retrieval System capabilities in detail.
3. a) Distinguishing between cataloging and indexing.
b) Give the Objectives of Indexing
4. Explain in detail the various data structures used in Information Retrieval systems with suitable examples
5. a) Explain how a thesaurus will be generated.
b) Discuss about Merging of existing Thesauri.
6. Explain the various user String Searching techniques with suitable examples.
7. Explain the following
a) Inverted Files b) Signature Files c) PAT Trees and arrays
8. Write about
a) Selective dissemination of information search
b) Searching the internet
c) Information Visualization technologies

BIG DATA ANALYTICS

Syllabus

Unit-1:

Big Data, Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value, Data Warehouse, Re-Engineering the Data Warehouse, Workload Management in the Data Warehouse, New Technology Approaches.

Unit-2: Integration of Big Data and Data Warehouse, Data Driven Architecture, Information Management and Lifecycle, Big Data Analytics, Visualization and Data Scientist, Implementing The "Big Data" Data. Choices in Setting up R for Business Analytics, R Interfaces, Manipulating Data, Exploring Data, Building Regression Models, Clustering and Data Segmentation, Forecasting and Time Series Models.

Unit-3: Writing Hadoop Map Reduce Programs, Integrating R and Hadoop, Using Hadoop Streaming with R, Learning Data Analytics with R and Hadoop, Understanding Big Data Analysis with Machine Learning. Big Data, Web Data, A Cross-Section of Big Data Sources and the Value They Hold, Taming Big Data, The Evolution of Analytic Scalability.

Unit-4: The Evolution of Analytic Processes, The Evolution of Analytic, Processes The Evolution of Analytic Tools and Methods. Legacy Data, Hypothesis Testing, Prediction, Software, Complexity, Business problems suited to big data analytics.

Unit-5: High Performance Appliances for Big Data Management, Using Graph analytics, The New Information Management Paradigm, Big Data's Implication for Businesses, Big Data Implications for Information Management, Splunk's Basic Operations on Big Data.

Textbooks:

1. Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann.
2. A.Ohri, "R for Business Analytics", Springer, 2012.

References:

1. Big Data Analytics with R and Hadoop by Vignesh Prajapati
2. Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1st Edition, by J Berman, published by Morgan Kaufmann
3. "Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph" By David Loshin, Morgan Kaufmann
4. Big Data Imperatives: Enterprise 'big Data' Warehouse, 'BI' Implementations and Analytics by Soumendra Mohanty, Apress
5. Big Data Analytics Using Splunk By Peter Zadrozny , Raghu Kodali, Apress 2013
6. Franks, Bill, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley, 1st Edition, 2012.
7. Big Data Application Architecture Q&A: a Problem - Solution Approach Nitin Sawant, Himanshu Shah
8. Big Data Now: Current Perspectives from O'Reilly Radar By O'Reilly Radar Team

BIG DATA ANALYTICS

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) What is Big data. Explain the Big data processing Architectures.
b) Differentiate between Big data and data Warehouse?
2. (a) Define the drivers for Big Data-Velocity, Variety, and Viscosity.
(b) Write at least four Big Data Analytics Applications in detail.
3. (a) Explain Massively Parallel Processing (MPP) Platforms architecture in detail.
(b) Define Unstructured Data Analytics. Elaborate on Context-Sensitive and Domain-Specific Searches?
4. (a) Explain Real-Time Architecture for Conversations in detail.
(b) Elaborate on Orchestration and Synthesis used in Analytics Engines.
5. (a) How Big Data Analytics is Implemented with R? Explain with examples.
6. (a) Explain Map-reduce framework in detail. Draw the architectural diagram for Physical Organization of Compute Nodes.
(b) Define HDFS. Explain HDFS in detail.
7. (a) What is Complexity Theory for Map-Reduce? What is Reducer Size and Replication Rate?
(b) Elaborate on Graph Model and Mapping Schemas. What do you mean by Lower Bounds on Replication Rate?
8. Write Short notes on the following
 - a) Business problems suited to big data analytics
 - b) Graph Analytics
 - c) Splunk's Basic Operations on Big data

DATA WAREHOUSING & DATA MINING

Syllabus

UNIT – I

The compelling need for data warehousing: Escalating need for strategies information, Failures of Past Decision-Supporting System, Operational Versus Decision-Supporting System, Data Warehousing- The only Viable Solution, data Warehouse Defined. The Building Blocks: Defining Features, Data Warehouse and Data Marts, Overview of the Components, Metadata in the Data Warehouse. Planning and Planning Management: Planning your Data Warehousing, The Data Warehouse Project, The project team, Project Management Considerations. Defining the Business Requirement: Dimension Analysis, Information Package- A New Concept, Requirements Gathering Methods, Requirements Definition: Scope and content. Requirements as the Driving force for Data Warehousing: Data Design, The Architectural Plan, Data Storage Specification, and Information Delivery Strategy.

UNIT – II

The Architectural Component: Understanding Data Warehouse Architecture, Distinguishing Characteristics, Architectural framework, Technical Architecture. Infrastructure as the Foundation for Data Warehousing: Infrastructure Support Architecture, Hardware Operational System, Database Software, Collection of Tools. The Significant Role of Metadata: Why Metadata is Important, Metadata Types by Functional Areas, Business Metadata, How to Provide Metadata. Principles of Dimensional Modeling: From Requirement to Data Design, The STAR Schema, STAR Schema keys, Advantages of STAR Schema. Dimensional Modeling: Updates to the Dimensional Tables, Miscellaneous Dimensions, The Snowflake Schema, Aggregate Fact Tables, and Families of STARS. Data Extraction, Transformation, and Loading. OLAP in the Data Warehouse: Demand for Online Analytical Processing, Major Features and Functions, OLAP Models, OLAP Implementation Consideration

UNIT – III

Introduction : Data mining, kinds of data mined, kinds of patterns mined, technologies used: statistics, Machine learning, Database systems and Data Warehousing, Information Retrieval, Major issues in Data Mining: Mining methodology, User Interaction, Efficiency and Scalability, Diversity and database types, Data Mining & society.

UNIT – IV

Data Preprocessing: Overview, Data cleaning, Data Integration, Data Reduction, Data Transformation, Data cleaning: Missing Values, Noisy data, Data cleaning as a process. Data Integration: Entity identification problem, Redundancy and Correlation Analysis, Tuple duplication, Data value conflict detection and Resolution. Data Reduction: Overview, wavelet transforms, Principle components Analysis, Attribute subset selection, Regression and log-linear models, Histograms, clustering, sampling, Data cube Aggregation. Data Transformation and Data Discretization by Binning, Discretization by Histogram Analysis, Discretization by cluster, Decision Tree and correlation Analysis, concept Hierarchy generation for Nominal data.

UNIT – V

Mining Frequent Patterns, Association and Correlations: Basic Concepts, Frequent itemset Mining methods: Apriori Algorithm, Generate Association rules from Frequent itemsets, Improving the efficiency of Apriori, A pattern-growth approach for mining frequent itemsets, using frequent itemset using Vertical data format, Mining closed and max. patterns. Pattern Evaluation Methods, Advanced Pattern Mining: A Road map, Pattern mining in Multilevel, Multidimensional space, Constraint Based Frequent Mining, Classification: Basic Concepts, Decision Tree induction, Bayes Classification Method, Rule based Classification, Model evaluation & selection, techniques to improve classification accuracy. Classification Advanced Methods: Bayesian Belief networks, Classification by Back Propagation, Support Vector Method, Classification using frequent Patterns, lazy learners, other classification methods. Cluster Analysis: Basic Concepts & Methods, Cluster Analysis, partitioning methods, Hierarchical Methods, Density based Methods, Grid based Methods, Evaluation of Clustering. Advanced Cluster Analysis: Probabilistic Model based Clustering, Clustering High Dimensional Data, Clustering Graph & Network data, Clustering & Constraints.

Textbooks:

1. Data warehousing fundamentals, first edition, paulraj ponniah, Wiley.
2. Data Mining Concept & Techniques, Jiawei Han|Micheline Kamber|Jian Pei, 3rd Edition, M K Publishers.

Reference Books:

1. Data Warehousing in the real world, low price edition, Sam Anahory, Dennis Murray, Pearson Education.
2. Data warehousing Tool kit
3. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management by Gordon S. Linoff and Michael J. Berry (Apr 12, 2011).
4. Data Mining: A Tutorial Based Primer by Richard Roiger and Michael Geatz (Oct 6, 2002).

DATA WAREHOUSING & DATA MINING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Briefly discuss.
 - (a). Discretization
 - (b) Advantages of ROLAP and MOLAP
 - (c). Slicing operations
2. (a) What is data mining? Briefly describe the components of a data mining system.
(b) What are the major issues in Data Mining? Briefly describe important Applications of Data mining?
3. (a) Write the differences between operational database and data warehouse.
(b) Briefly describe 3-tier Data warehouse architecture
4. (a) Discuss in detail about the Data Preprocessing Techniques
(b) Propose an algorithm in pseudo-code for automatic generation of a concept hierarchy for categorical data based on the number of distinct values of attributes in the given schema.
5. (a) Discuss the essential features of a typical data mining query language like DMQL.
(b) Explain i) FP Growth Algorithm ii) Apriori Algorithm
6. (a). Discuss about Back propagation algorithm for neural network-based classification of data.
(b). Explain the Concept of SVM and Algorithm for classification of linear and non-linear data
7. (a) Write about different types data in cluster analysis. Explain briefly Density based Clustering Method.
(b) Explain the major Concepts in Semantic Web mining
8. Write Short Notes on the Following
 - (a). GUI based DMQL
 - (b) Genetic Algorithms
 - (c) Web Mining Vs semantic web mining
 - (d) Hierarchical Clustering Methods

DISTRIBUTED DATABASES

Syllabus

UNIT I

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Complicating Factors, Problem Areas Distributed DBMS Architecture DBMS Standardization, Architectural Models for Distributed DBMSs, Distributed DBMS Architecture, Global Directory Issues

UNIT II

Distributed Database Design: Alternative Design Strategies, Distribution Design Issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data Security, Semantic Integrity Control.

UNIT III

Overview of Query Processing: Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Characterization of Query Processing, Layers of Query Processing Query Decomposition and Data Localization: Query Decomposition, Localization of Distributed Data Optimization of Distributed Queries Query Optimization, Centralized Query Optimization, Join Ordering in Fragment Queries, Distributed Query Optimization Algorithms

UNIT IV

Introduction to Transaction Management: Definition of a Transaction, Properties of Transactions, Types of Transactions, Architecture Revisited Distributed Concurrency Control Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp based Concurrency Control algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management, Relaxed Concurrency Control

UNIT V

Distributed DBMS Reliability: Reliability Concepts and Measures, Failures and Fault Tolerance in Distributed Systems, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Dealing with site failures, Network Partitioning, Architectural Considerations Parallel Database Systems Database Servers, Parallel Architectures, Parallel DBMS Techniques, Parallel Execution Problems

Textbook:

1. Principles of Distributed Database Systems, Second Edition, M.Tamer Ozsu, Patrick Valduriez, Pearson Education, 1999.

Reference Book:

1. Distributed Database Management Systems: A Practical Approach] Saeed K. Rahimi ,Frank S. Haug , Wiely,2010

DISTRIBUTED DATABASE

MODEL PAPER

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. (a) what is a Distributed database system?
(b) Explain the promises of DDBSs ?
2. (a) What is normalization? Explain all normal form with example.
(b) Describe following operation in context of relation algebra
 - (1) Selection
 - (2) Intersection
3. (a) Explain the Client server architecture for Distributed DBMS with figure.
(b) Explain peer-to-peer distributed systems.
4. (a) Explain top-down and bottom-up design strategies.
(b) What is allocation? List the information requirements during allocation.
5. (a) What is query processing in a relational database? Explain in detail with an example.
How does it differ from distributed query processing?
(b) Explain Layers of Query Processing.
6. (a) Describe the Transaction ?
(b) Explain various types of transaction in detail.
7. (a) Explain Parallel Database System Architectures ?
(b) Explain about Load Balancing in Parallel Database System Architectures.
8. (a) Describe Object Management in detail.
(b) Explain Database interoperability.

DATA SECURITY & PRIVACY

Unit I

Introduction to Databases Security Problems in Databases Security Controls, Security Models – 1: Introduction Access Matrix Model Take-Grant Model! Acl cn Model PN Model Hartsor and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases - Security Models – 2: Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion.

Unit II

Security Mechanisms: Introduction User Identification/Authentication Memory, Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria - Security Software Design: Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design.

Unit III

Statistical Database Protection & Intrusion Detection Systems: Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison. Introduction IDES System RETISS System ASES System Discovery.

Unit IV

Enterprise Security Architecture - Security as a Process-Security Data- Enterprise Security as a Data Management Problem- Tools for Data Management- David Isenberg and the “Stupid Network”-Extensible Markup Language- The XML Security Services Signaling Layer-XML and Security Standards- The Security Pattern Catalog Revisited-XML-Enabled Security Data-HGP: A Case Study in Data Management. Business Cases and Security: Building Business Cases for Security.

Unit V

Security – Encryption – Digital Signatures – Authorization – Authenticated RPC - Integrity - Consistency - Database Tuning - Optimization and Research Issues. Case Studies Security – Encryption – Digital Signatures – Authorization – Authenticated RPC - Integrity - Consistency - Database Tuning - Optimization and Research Issues. Case Studies.

References:

1. Database Security by Castano, Silvana; Fugini, Maria Grazia; Martella, Giancarlo, Pearson Edition, 1994
2. Database Security and Auditing: Protecting Data Integrity and Accessibility 1st Edition, Hassan Afyouni Thomos Edition, 2006
3. Philip M. Lewis, Arthur Bernstein and Michael Kifer, “Databases and Transaction Processing: An Application-Oriented Approach”, Addison-Wesley, 2002.
4. R. Elmasri and S.B. Navathe, “Fundamentals of Database Systems”, 3rd Edition, Addison Wesley, 2004.
5. Abraham Silberschatz, Henry. F. Korth and S.Sudharsan, “Database System Concepts”, 4th Edition, Tata McGraw Hill, 2004.
6. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3rd Edition, TMH, 2003.

COMPUTER NETWORKS

SYLLABUS

UNIT I

Introduction: OSI, TCP/IP and other networks models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN. Physical Layer : Transmission media copper, twisted pair wireless, switching and encoding asynchronous communications; Narrow band, broad band ISDN and ATM.

UNIT-II

Network Layer: Virtual circuit and Datagram subnets-Routing algorithm shortest path routing, Flooding,

Hierarchical routing, Broad cast, Multi cast, distance vector routing.

UNIT-III

Dynamic routing – Broadcast routing. Rotary for mobility. Congestion, Control Algorithms – General

Principles – of Congestion prevention policies. Internet working: The Network layer in the internet and in the ATM Networks.

UNIT-IV

Transport Layer: Transport Services, Connection management, TCP and UDP protocols; ATM AAL

Layer Protocol.

UNIT – V

Application Layer – Network Security, Domain name system, SNMP, Electronic Mail; the World WEB, Multi Media.

TEXT BOOKS :

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH.

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

COMPUTER NETWORKS

Model Paper

Time: 3 hours

Max. Marks: 100

**Answer Any Five of the Following Questions
Each Question Carries 20 Marks.**

- 1a. Explain with a neat sketch, the functions of the protocols used in each layer of the OSI model and illustrate how communication is taking place between two end systems.
- 1b. Explain two types of guided media and two types of unguided media transfer in networks.
- 2a. Differentiate between adaptive and non- adaptive routing algorithms.
- 2 b. How does link state routing take care of the problem of wrapping of sequence numbers, crashing of routers and corruption of sequence number?
3. Discuss briefly about different network layer protocols
- 4(a). Why does UDP exist? Would it not have been enough to just let user processes send raw IP packets? Justify answer.
- (b) Explain briefly about all the fields in TCP segment header?
5. A TCP machine is sending windows of 65535 bytes over a 1-Gbps channel that has a 10-millisecond one-way delay. What is the maximum throughput achievable? What is the line efficiency?
6. a. Discuss in detail about karn and Jacobson algorithm in transport layer?
b. Explain about RSA algorithm
7. Discuss in detail about Public Key Infrastructure
8. Briefly discuss about Domain name system & SNMP.

DISTRIBUTED COMPUTING

Syllabus

Unit I: Introduction to distributed programming: Anatomy of a Distributed Application, Requirements for Developing Distributed Applications, What Does Java Provide?

Introduction to sockets programming: Sockets and Streams, URLs, URL Connections, and Content Handlers, The Class Loader.

Unit II: Distributing Objects: Why Distribute Objects, What's So Tough About Distributing Objects?, Features of Distributed Object Systems, Distributed Object Schemes for Java, CORBA, Java RMI, RMI vs. CORBA Threads: Thread and Runnable, Making a Thread, Managing Threads at Runtime, Networked Threads

Unit III: Security: Security Issues and Concerns, The java.security Package, Identities and Access Control, Keys: Public, Private, and Secret, Digital Signatures, Data Encryption, Choosing a Cryptographic Algorithm. Message-Passing Systems: Messages Defined, Why Do We Need Messages?, Message Processing, Fixed Protocols, Adaptable Protocols, Message Passing with Java Events, Using Remote Objects Databases: An Overview of JDBC, Remote Database Applications, Multi-Database Applications.

Unit IV: RMI: The Basic Structure of RMI, The Architecture Diagram Revisited, Implementing the Basic Objects, The Rest of the Server, The Client Application The RMI Registry: Why Use a Naming Service? The RMI Registry, The RMI Registry Is an RMI Server, Examining the Registry, Limitations of the RMI Registry, Security Issues Naming Services: Basic Design, Terminology, and Requirements, Requirements for Our Naming Service, Federation and

Threading, The Context Interface, The Value Objects, ContextImpl, Switching Between Naming Services, The Java Naming and Directory Interface (JNDI) The RMI Runtime: Reviewing the Mechanics of a Remote Method Call, Distributed Garbage Collection, RMI's Logging Facilities, Other JVM Parameters

Unit V: Service Oriented Architecture: Introduction, Defining a Service, Defining SOA, Identifying Service Candidates, Identifying Different Kinds of Services, Modeling Services, Making a Service Composable, Supporting Your SOA Efforts, Selecting a Pilot Project, Establishing Governance. Introduction to Web Services: Introduction, Using Publicly Available Web Services to Test Against, Installing Metro, Installing Oracle WebLogic, Creating and Deploying the Simplest Web Service, Creating and Deploying a Service to WebLogic, Setting Up a Maven 2 Service and Client Project, Understanding WSDL, Using References in

NetBeans to Generate Web Service Clients, Monitoring SOAP Traffic with Metro, Monitoring SOAP,Traffic with TCPMon.

REFERENCE BOOKS:

1. Java Distributed Computing, Jim Farley, O'Reilly.
2. Java RMI Designing and Building, The Basics of RMI Applications, William Grosso, O'Reilly.
3. Java SOA Cookbook SOA Implementation Recipes, Tips, Techniques, Eben Hewitt, O'Reilly, 2009.
4. Service Oriented Architecture With Java, Malhar Barai, Vincenzo Caselli, Binildas A. Christudas, Packt Publishing, 2008.
5. Distributed Programming with Java, Qusay H. Mahmoud, Manning Publisher 2000.
6. Java in Distributed Systems, Concurrency, Distribution and Persistence, Marko Boger, 2001.
7. Developing Distributed and E-commerce Applications, Darrel Ince, 2/e, Wesly, 2004.
8. Java Message Service (O'Reilly Java Series), Richard Monson-Haefel, David Chappell.
9. Sun SL 301 Distributed Programming with Java.
10. Java Tutorial, <http://java.sun.com/docs/books/tutorial/index.html>.

DISTRIBUTED COMPUTING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. A) Identify various types of resources that can usefully be shared in computer networks. Give examples of their sharing as it occurs in distributed systems.

B) Discuss briefly key challenges that one needs to address in the design and development of distributed applications.

2. A) Discuss peer-to-peer architectural model for construction of distributed systems.

B) Identify main types of security threats that might occur in the Internet with an example.

3. A) Discuss difference between TCP/IP and UDP protocols for Socket-based communication.

B) Write a multithreaded Java program

4. A) Write a simple CORBA program that demonstrates the invocation of remote object services.

B) Write a simple RMI program that demonstrates the invocation of remote object services.

5. A) Discuss important operating systems services that are essential for supporting the development of concurrent and scalable distributed systems.

B) Discuss architecture of Layered operating system. Comment on how well it supports the development of extensible operating systems.

6. A) Discuss techniques for achieving high-performance in distributed file systems.

B) Discuss model architecture of distributed file system and its components.

7. A) Discuss asymmetric (public/private key pair-based) cryptography technique and how it can be used in supporting security in distributed systems.

B) Discuss secure socket layer (SSL) architecture and its components.

8. A) Discuss the role of naming services in distributed systems. List two navigation schemes that can be used for name resolution in domain name systems.

B) Discuss operation of a typical domain name server (DNS) with suitable example.

NETWORK SECURITY

Syllabus

Unit I:

Introduction to Network Security: Attacks, services, Security. A model of Inter network Security, Steganography, One time PADS. Basic and ESOTERIC Cryptographic Protocols: Key Exchange, Authentication, Formal Analysis of Authentication and key Exchange Protocols, Multiple & Public Key Cryptography, Secret Splitting & Sharing Secure elections, Secure multiparty, Communication, Digital Cash.

Unit II:

Crypto Graphic Algorithms (Block Cipher): RC2, GOST, CAST, BLOW FISH, SAFEER, RC5, NEWDES, CRAB, Theory of Block Cipher design. Key Management: Key lengths, Generating Keys, Transferring, Verification, Updating, Storing, Backup, Compromised, Lifetime of, Destroying Keys, Public key Management.

Unit III:

Digital Signature Algorithms: Digital Signature, DSA, DSA variants, Gost, Discrete Lagorithm, One – Schnorr – Shamir digital Signatures, Esign, Cellular Automata. Mails: Electronic Mail & IO Security good Privacy, SIMIME, IP Security Architecture, Authentication Header, Encapsulating Security, Pay load Key Management Issues.

Unit IV:

Security: Web Security Web Security requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Unit V:

Viruses and Threats: Intruders, Viruses, Worms and Firewalls Intruders, Viruses and Related Threats, Firewall Design Principles, Trusted Systems.

REFERENCE BOOKS:

1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.
4. Cryptography and Information Security, V.K. Pachghare, PHI.
5. Cryptography and Network Security, Forouzan, TMH, 2007.
6. Cryptography and Network Security, 2/e, Kahate , TMH.
7. Modern Cryptography, Wenbo Mao, PEA

NETWORK SECURITY

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1.
 - a) What is a digital signature?
 - b) What is denial service attack?
 - c) What is ECB mode?
 - d) What is the procedure for key generation using RSA?
 - e) What is the purpose and the use of a KDC?
 - f) What is non-repudiation?
 - g) What is session key?

2.
 - a) Describe the Diffie - Hellman key exchange algorithm and explain it with an example.
 - b) Alice and Bob want to establish a secret key using the Diffie – Hellman key exchange protocol using $n = 11$, $g = 5$, $x = 2$ and $y = 3$. Find the values A and B and the secret key

3. Describe the data encryption algorithm. Explain briefly about symmetric key management

4.
 - a) What are the key requirements of message digests?
 - b) Describe the secure hash algorithm.

5. Discuss the message formats of Kerberos V4 in detail.

6.
 - a) What is password based encryption? What are the problems associated with it?
 - b) Explain briefly about SET Protocol

7. Discuss SSL in detail?

8. Describe Pretty Good Privacy.

WIRELESS COMMUNICATIONS AND MOBILE COMPUTING

Syllabus

UNIT -I:

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel

Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring .

UNIT –II:

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation

Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from perfect

conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley- Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeli

UNIT –III:

Introduction to Mobile Computing Architecture: Mobile Computing – Dialog Control – Networks –Middleware and Gateways – Application and Services – Developing Mobile Computing Applications –Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled.

Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G: Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card –GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS –GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data

Services in GPRS – Applications for GPRS – Limitations of GPRS – Spread Spectrum technology –Is-95 – CDMA Versus GSM – Wireless Data – Third Generation Networks – Applications on 3G

UNIT –IV:

Wireless Application Protocol (WAP) and Wireless LAN: WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture –Mobility in wireless LAN
Intelligent Networks and Interworking : Introduction – Fundamentals of Call processing –Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – soft switch – Programmable Networks – Technologies and Interfaces for IN. **Client Programming, Palm OS, Symbian OS, Win CE Architecture:** Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture **J2ME:** JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues – Multimedia – Record Management System – Communication in MIDP – Security considerations in MIDP –Optional Packages

UNIT –V:

Voice Over Internet Protocol and Convergence: Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparison between H.323 and SIP – Real Time protocols –Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP **Security Issues in Mobile Computing:** Introduction – Information Security – Security Techniques and Algorithms – Security Protocols – Public Key Infrastructure – Trust – Security Models – Security

TEXT BOOKS:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
5. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education

REFERENCE BOOKS:

1. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE.
2. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communication – Upen Dalal, Oxford Univ. Press.
5. Wireless Communications and Networking – Vijay K. Gary, Elsevier.
6. The CDMA 2000 System for Mobile Communications – Vieri Vaughni, Alexander Damn Jaonvic – Pearson
7. Adalestein : Fundamentals of Mobile & Parvasive Computing, 2008, TMH

WIRELESS COMMUNICATIONS AND MOBILE COMPUTING
Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions
Each Question Carries 20 Marks.

1. Explain briefly Adjacent Channel interference, Coverage & Capacity in Cellular Systems.
2. Explain briefly Channel planning for Wireless Systems, Adjacent Channel interference.
3. Discuss about different Outdoor Propagation Models.
4. Discuss about different Indoor Propagation Models.
5. Compare & Contrast GSM, GPS, GPRS, CDMA and 3G technologies.
6. Explain briefly about Java Card, GSM Architecture and GPRS Network Architecture.
7. Discuss about WAP, J2ME technologies how they differ.
8. Explain briefly about SIP and Mobile VoIP

CRYPTOGRAPHY AND NETWORK SECURITY

Syllabus

UNIT –I:

Understanding Computer Network Security: Securing the Computer Network Forms of Protection, Security Standards. **Security Threats to Computer Networks:** Sources of Security Threats, Security Threat Motives, Security Threat Management, Security Threat Correlation, Security Threat Awareness. **Computer Network Vulnerabilities:** Sources of Vulnerabilities, Vulnerability Assessment. **Cyber Crimes and Hackers:** Cyber Crimes, Hackers, Dealing with the Rising Tide of Cyber Crimes. **Hostile Scripts:** Introduction to the Common Gateway Interface (CGI), CGI Scripts in a Three-Way Handshake, Server–CGI Interface, CGI Script Security Issues, Web Script Security Issues, Dealing with the Script Security Problems, Scripting Languages. **Security Assessment, Analysis, and Assurance:** System Security Policy, Building a Security Policy, Security Requirements Specification, Threat Identification, Threat Analysis, Vulnerability Identification and Assessment, Security Certification, Security Monitoring and Auditing, Products and Services.

UNIT –II:

Disaster Management: Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery. **Access Control and Authorization:** Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization. **Authentication:** Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods, Developing an Authentication Policy.

UNIT –III:

Firewalls: Types of Firewalls, Configuration and Implementation of a Firewall, The Demilitarized Zone (DMZ), Improving Security Through the Firewall, Firewall Forensics, Firewall Services and Limitations. **System Intrusion Detection and Prevention:** Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Other Types of Intrusion Detection Systems, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools.

UNIT –IV:

Computer and Network Forensics: Computer Forensics, Network Forensics, Forensics Tools. **Virus and Content Filtering:** Scanning, Filtering, and Blocking, Virus Filtering, Content Filtering, Spam. **Computer Network Security Protocols:** Application Level Security, Security in the Transport Layer, Security in the Network Layer, Security in the Link Layer and over LANS. **Security in Wireless Networks and Devices:** Cellular Wireless Communication Network Infrastructure, Wireless LAN (WLAN) or Wireless Fidelity (Wi-Fi), Standards for Wireless Networks, Security in Wireless Networks. **Security in Sensor Networks:** The Growth of Sensor Networks, Design Factors in Sensor Networks, Security in

Sensor Networks, Security Mechanisms and Best Practices for Sensor, Trends in Sensor Network Security Research.

UNIT –V:

Security Beyond Computer Networks: Information Assurance: Collective Security Initiatives and Best Practices. **Network Perimeter Security:** General Framework, Packet Filters, circuit Gateways, Application Gateways, Trusted Systems and Bastion Hosts, Firewall Configurations, Network Address Translations, Setting Up Firewalls. **The Art of Anti Malicious Software:** Viruses, Worms, Virus Defence, Trojan Horses, Hoaxes, Peer-to-Peer Security, Web Security, Distributed Denial of Service Attacks. **The Art of Intrusion Detection:** Basic Ideas of Intrusion Detection, Network-Based Detections and Host-Based Detections, Signature Detections, Statistical Analysis, Behavioural Data Forensics, Honeypots.

Textbooks:

1. Computer Network Security- Theory and Practice by Jie Wang, 2009 edition, Higher Education Press, Beijing and Springer-Verlag.
2. A Guide to Computer Network Security by Joseph Migga Kizza, 2009 Edition, Springer-Verlag London Limited.

References:

1. Network Security Essentials- Applications and Standards by William Stallings, 4th edition.
2. Modern Cryptography: Theory and Practice by Wenbo Mao Hewlett-Packard Company, 1st edition, Prentice Hall PTR.
3. Network Security: Private Communication in a Public World by Charlie Kaufman, Radia Perlman, Mike Speciner, 2nd edition.
4. Cryptography and Network Security: Principles and Practice by William Stallings, 6th edition.

CRYPTOGRAPHY AND NETWORK SECURITY

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. A) Explain about substitution and **transposition techniques** with two examples for each.

B) What is the need for triple **DES**? Write the disadvantages of double DES and explain **triple DES**.
2. a) Explain how the elliptic curves are useful for **cryptography**?
b) In a public key system using **RSA**, you intercept the cipher text $C=10$ sent to a user whose public key is $e=5$, $n=35$. What is the plain text? Explain the above problem with an algorithm description.
3. a) Describe briefly about **X.509 authentication** procedures. And also list out the drawbacks of X.509 version 2.
b) Write about the basic uses of MAC and list out the applications
4. a) Compare & Contrast SSL and TLS
b) Write about the basic uses of MAC and list out the applications
5. Discuss briefly about SET Protocol
6. Discuss briefly about Public Key Infrastructure
7. Discuss briefly about Malicious software, viruses and Firewalls
8. a) Describe the Diffie - Hellman key exchange algorithm and explain it with an example.

b) Alice and Bob want to establish a secret key using the Diffie – Hellman key Exchange protocol using $n = 11$, $g = 5$, $x = 2$ and $y = 3$. Find the values A and B and the secret key

WIRELESS SENSOR NETWORKS

SYLLABUS

UNIT I

Basics of Wireless Sensors and Applications, The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications

UNIT II

Data Retrieval in Sensor Networks, Classification of WSNs, MAC Layer, Routing Layer, High-Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs Sensor Network Platforms and Tools, Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms.

UNIT IV

Operating System: TinyOS, Imperative Language: nesC, Dataflow Style Language: TinyGALS, Node-Level Simulators, ns-2 and its Sensor Network Extension, TOSSIM.-

UNIT V

Sensor Network Databases : Challenges ,Query Interfaces, High level Database Organization, In-Network Aggregation, Data-centric Storage, Temporal Data.

TEXT BOOKS:

1. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science Imprint, Morgan Kauffman Publishers, 2005, rp2009.

REFERENCES:

1. Adhoc Wireless Networks: Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004
2. Wireless Sensor Networks: Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach Book, CRC Press, Taylor & Francis Group, 2010
3. Wireless Ad hoc Mobile Wireless Networks: Principles, Protocols and Applications, Subir Kumar Sarkar et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Wireless Sensor Networks: Signal Processing and Communications Perspectives, Ananthram Swami et al., Wiley India, 2007, rp2009.

WIRELESS SENSOR NETWORKS

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

- 1a. Briefly explain the differences between Wireless sensor networks, Mobile Ad hoc networks and Wireless mesh networks.
 - b. Discuss about the design issues, energy consumption and Clustering of Sensors in WSN.
2. How NS 2 will help to simulate WSN protocols justify.
3. Discuss about Tiny OS, Imperative Language: nesC.
4. Discuss about the challenges in Sensor Network Programming.
5. Briefly explain about TOSSIM.
6. Discuss about Query Interfaces, High level Database Organization.
7. Discuss about In-Network Aggregation, Data-centric Storage and Temporal Data.
8. Discuss about Sensor Network Platforms and Tools, Sensor Network Hardware.

SOFT COMPUTING

Syllabus

UNIT-I:

Introduction to Neuro-Fuzzy and soft computing: computing constituents and conventions, characteristics. **Fuzzy set theory:** basic definitions and terminology, set-theoretic operations, Mf formulation and parameterization. **Fuzzy rules and reasoning:** extension principles and fuzzy relations, fuzzy if-then rules, fuzzy reasoning. Fuzzy inference systems: mamdani fuzzy models, sugeno fuzzy models, Tsukamoto fuzzy models, other considerations.

UNIT-II

Regression and optimization: least-squares methods for system identification. Introduction, basics of matrix manipulation and calculus, least-square estimator, geometric interpretation of LSE, recursive least squares estimator, recursive LSE for time varying systems, statistical properties and maximum likelihood estimator, LSE for nonlinear models. **Derivative-based optimization:** introduction, descent methods, the method of steepest descent, newtons methods, step-size determination, conjugate gradient methods, analysis of quadratic case, non linear least square problems, incorporation of stochastic mechanisms. **Derivative-free optimization:** introduction, genetic algorithms, simulated annealing, random search, downhill simple search.

UNIT-III

Neural Networks: Adaptive networks, supervised learning neural networks, unsupervised learning and other neural networks. neuro-fuzzy modeling: ANFIS, **Coactive Neuro-Fuzzy Modeling:** Towards Generalized ANFIS. **Advanced Neuro-Fuzzy modeling:** classification and regression trees, data clustering algorithms, rule based structure identification.

UNIT-IV

Neuro Fuzzy control: ANFIS: introduction, architecture, hybrid learning algorithm, learning methods that cross fertilize ANFIS and RBFN, ANFIS as a universal approximation. Simulation examples: example 1. Modeling a two-input sinc function, Example 2. Modeling a three input non-linear function, example 3. On-line identification in control systems, example 4. Predicting chaotic time series. coactive neuro-fuzzy modeling: Towards Generalized **ANFIS:** introduction, framework, neuron functions for adaptive networks, neuro-fuzzy spectrum, analysis of adaptive learning capability.

NEURO-FUZZY CONTROL-I

Introduction, framework, control systems and neuro-fuzzy control, expert control, inverse learning, specialized learning, back-propagation through time and real-time recurrent learning.

NEURO-FUZZY CONTROL-II

Introduction, Reinforcement learning control, Gradient-free optimization, Gain Scheduling, Feedback Linearization and Sliding Control.

UNIT-V

GENETIC ALGORITHMS: A Genetic Introduction to Genetic Algorithms: What are Genetic Algorithms, Robustness of Traditional Optimization and search methods, goals of Optimization, How genetic algorithms different from traditional methods, A Simple Genetic Algorithm, Genetic Algorithms at work.

Genetic Algorithms Revisited: Mathematical Foundations Computer implementation of a genetic algorithm.

Advanced Operations and Techniques in Genetic Search: Introduction to Genetics based Machine Learning, Applications of Genetics based Machine Learning.

Text Books:

1. Neuro-Fuzzy And Soft Computing BY “J-S.R.Jang, Ct. Sun, E.Mizutani” Prentic-Hall Of India Private Limited Publications.
2. Genetic Algorithms BY “David E. Goldberg” Pearson Education.

REFERENCES:

1. Neural Networks and Learning Machines By “Simon Haykin”3rd Edition, Phi Publication.
2. Fuzzy Sets and Fuzzy Logic By “George J. Klir|Bo|Yuan” In Phi Publications.

SOFT COMPUTING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) What is Soft Computing? Compare and contrast hard computing with soft computing?
b) What do you mean by Fuzzy Sets and Membership Functions? Explain With an Example.
2. a) Explain Extension principle on Fuzzy sets with continuous and discrete universes with examples?
b) Explain the role of Fuzzy IF-THEN Rules and Fuzzy-Reasoning Rules in Fuzzy Inference Systems?
3. What do you mean by Fuzzy Inference System. Briefly explain different kinds of Fuzzy Models.
4. Explain different kinds of least square methods for System Identification.
5. a) Explain Back Propagation for Feed forward networks with example.
b) Compare and Contrast OFF-Line learning with an ON-Line learning Rules.
6. Demonstrate the Architecture of ANFIS.
7. a) Explain the following
 - i) Feed Back control systems
 - ii) Neuro-fuzzy control systems.
b) What do you mean by Gain Scheduling? Explain with an example?
8. a) Discuss the role of Genetic Algorithms in research development. Demonstrate how genetic algorithms different from traditional methods.

b) Explain advanced operations and techniques in genetic search?

DIGITAL IMAGE PROCESSING

Syllabus

UNIT I:

Introduction: Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Visual Perception, Image sensing & Acquisition, Image Sampling & Quantization, Some Basic Relationships between Pixels.

UNIT II:

Image Enhancement in the Spatial Domain: Some basic Gray level Transformations, Histogram Processing, Enhancement using Arithmetic/Logic Operations, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement methods.

UNIT III:

Image Enhancement in the Frequency Domain: Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphism Filtering, Implementation.

UNIT IV:

Image Restoration: Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum, Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and MultiResolution Processing : MultiResolution Expansions, Wavelet Transforms in One dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.

UNIT V:

Image Compression: Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods; "Digital Image Processing ' Addison Wesley Pubs(Second Edition),2007.

Reference Books :

1. Milan Sonka, Vaclav Hlavac, Roger Boyle Image Processing. Analysis, and Machine Vision(Second Edition,2003).

2. A.K.Jain, 'Fundamentals of Digital Image Processing' PHI,'1999.

DIGITAL IMAGE PROCESSING

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) Explain the fundamental steps in Digital Image Processing.
b) Differentiate between the Image Sampling & Quantization.
2. (a) Give an Algorithm for FFT.
(b) Give an Algorithm for WFT.
3. (a) How do you Acquire an image? Explain in detail.
(b) Define and explain image sliding and image stretching.
4. (a) Define and explain low pass filters in brief.
(b) Define and edge. Explain various edge enhancement filters.
5. (a) Explain spatial filtering.
(b) Explain in detail “Homomorphism filter”.
6. (a) Explain compression at the time of Image Transmission.
(b) Explain about standardization in image compression.
7. (a) Explain split and merge technique for segmentation.
(b) Define and explain Thresholding.
(c) Explain segmentation by PIXEL based methods.
8. Write Short notes on the following
 - a) Image Classification
 - b) Erosion and Dilation of images.
 - c) Skeletanization.

WEB SECURITY

Syllabus

UNIT I

Introduction: The Web Security Landscape, Architecture of the World Wide Web, Cryptography basics, Cryptography and the web, Understanding SSL and TLS, Digital Identification: Passwords, Biometrics and Digital Signatures.

UNIT II

Digital Certificates, CAs and PKI, Web's war on privacy, privacy protecting techniques, privacy protecting technologies

UNIT III

Web Server Security: Physical security for servers, Host security for servers, securing web applications.

UNIT IV

Web Server Security: Deploying SSL server certificates, securing your web service, computer crime Security for content providers: Controlling access to web content, Client-side digital certificates, code signing and Microsoft's Authenticode .

UNIT V

Security for content providers: Pornography, Filtering software, Censorship, privacy policies, legislation, P3P, Digital Payments, Intellectual property and actionable content.

Textbook

1. Web Security, Privacy and Commerce, Simson Garfinkel, Gene Spafford, 2nd Edition, O'REILLY, 2002. Pvt. Ltd.

WEB SECURITY

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Explain in detail about the Web Security Problem.
2. (a) Discuss about Symmetric Key Algorithms.
(b) Write a note on Message Digest Functions.
3. Discuss about the components of the World Wide Web architecture.
4. Explain about “Why Code Signing?”
5. (a) Discuss about Pornography Filtering.
(b) Explain about PICS and its applications.
6. Explain about the working of Cryptographic Systems and Protocols.
7. (a) Describe the Public Key infrastructure.
(b) Discuss about the usage of Public Keys for Identification.
8. Write Short notes on:
 - (a) Log Files
 - (b) Web Bugs.

BIO-INFORMATICS

Syllabus

UNIT I:

INTRODUCTION: The Central Dogma, The Killer Application, Parallel Universes – Watson's Definition – Top Down Versus Bottom up – Information Flow , Convergence Databases , Data Management , Data Life Cycle , Database Technology , Interfaces Implementation.

UNIT II:

NETWORKS: Networks , Geographical Scope , Communication Models , Transmissions Technology , Protocols ,Bandwidth , Topology , Hardware , Contents , Security , Ownership Implementation , Management. **SEARCH ENGINES:** The search process , Search Engine Technology , Searching and Information Theory , Computational methods , Search Engines and Knowledge Management.

UNIT III:

DATA VISUALIZATION: Data Visualization , sequence visualization , structure visualization , user Interface , Animation Versus simulation , General Purpose Technologies. **STATISTICS:** Statistical concepts , Microarrays , Imperfect Data , Randomness Variability, Approximation , Interface Noise , Assumptions , Sampling and Distributions , Hypothesis Testing , Quantifying Randomness , Data Analysis , Tool selection statistics of Alignment

UNIT IV:

DATA MINING: Clustering and Classification , Data Mining , Methods , Selection and Sampling , Preprocessing and Cleaning , Transformation and Reduction , Data Mining Methods , Evaluation , Visualization , Designing new queries , Pattern Recognition and Discovery , Machine Learning , Text Mining , Tools.

PATTERN MATCHING: Pairwise sequence alignment , Local versus global alignment Multiple sequence alignment ,Computational methods , Dot Matrix analysis , Substitution matrices , Dynamic Programming , Word methods , Bayesian methods , Multiple sequence alignment , Dynamic Programming , Progressive strategies , Iterative strategies , Tools Nucleotide Pattern Matching , Polypeptide pattern matching , Utilities , Sequence Databases.

UNIT - V:

MODELING AND SIMULATION: Drug Discovery , components , process , Perspectives, Numeric considerations , Algorithms , Hardware Issues , Protein structure , AbInitio Methods,Heuristic methods , Systems Biology , Tools , Collaboration and Communications, standards , Issues , Security , Intellectual property.

REFERENCE BOOKS

1. Bio Informatics Computing, Bryan Bergeron, PHI, 2003.
2. Introduction to Bio Informatics, Attwood, Smith, Longman, 1999. CSE / Pre PhD R1032
3. Bio-Informatics, D Srinivasa Rao, Biotech.
4. Bio Informatics Computing, Bergeron, PHI
5. Bio Informatics, Managing scientific Data, Lacroix, Terence Critchlow, Elsevier
6. Bio Informatics Methods and Applications, Rastogi, Mendiratta, Rastogi, PHI

PATTERN RECOGNITION

Syllabus

UNIT I :

Introduction: Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model.

UNIT II:

Decisions and Distance Functions: Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications.

Probability - Probability of events: Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples.

STATISTICAL UNIT - III:

DECISION MAKING - Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving-one-out-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns.

Non Parametric Decision Making: Introduction, histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminant functions, Minimum squared error discriminant functions, choosing a decision making techniques.

UNIT IV:

Clustering and Partitioning: Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single-linkage, complete linkage and average-linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.

Pattern Preprocessing and Feature selection: Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.

UNIT V:

Syntactic Pattern Recognition and Application of Pattern Recognition: Concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scan, Finger prints, etc.,

REFERENCES BOOKS:

1. Pattern recognition and Image Analysis, Gose. Johnsonbaugh Jost, PHI.
2. Pattern Recognition Principle, Tou. Rafael. Gonzalez, Pea.
3. Pattern Classification, Richard Duda, Hart., David Stork, Wiley.

PATTERN RECOGNITION

Model paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) What are the applications and fundamental problems in pattern recognition system design ?
b) Discuss the automatic pattern recognition systems with examples?
2. a) Differentiate between Linear and Generalized decision functions.
b) Compare and contrast Pattern space and weight space.
3. Explain the probability of events with examples?
4. a) List the applications of pattern recognition.
b) Discuss the importance of feature extraction for the classification of images.
5. a) What are the various types of distribution commonly employed in statistical decision making?
b) State and prove Baye's theorem as applied to pattern recognition.
6. Explain the following
 - a) Adaptive discriminate functions
 - b) Minimum squared error discriminate functions
7. Discuss the Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scan, Finger prints?
8. Explain the following
 - a) Agglomerative clustering algorithm b) Forg's algorithm
 - c) Isodata algorithm d) K-means's algorithm

PARALLEL ALGORITHMS

Syllabus

UNIT I:

Introduction: Computational demand in various application areas, advent of parallel processing, terminology pipelining, Data parallelism and control parallelism-Amdahl's law. Basic parallel random access Machine Algorithms-definitions of P, NP and NP-Hard, NP-complete classes of sequential algorithms-NC –class for parallel algorithms.

UNIT II:

Organizational features of Processor Arrays, Multi processors and multicomputers. Mapping and scheduling aspects of algorithms. Mapping into meshes and hyper cubes-Load balancing-List scheduling algorithm Coffman-graham scheduling algorithm for parallel processors.

UNIT III:

Elementary Parallel algorithms on SIMD and MIMD machines, Analysis of these algorithms. Matrix Multiplication algorithms on SIMD and MIMD models.

Fast Fourier Transform algorithms. Implementation on Hyper cube architectures. Solving linear file - system of equations, parallelizing aspects of sequential methods back substitution and Tri diagonal.

UNIT IV:

Parallel sorting methods---Odd-even transposition Sorting on processor arrays. Bionomic – merge sort on shuffle –exchange ID –Array processor, 2D-Mesh processor and Hypercube Processor Array. Parallel Quick-sort on Multi processors. Hyper Quick sort on hypercube multi computers. Parallel search operations. Ellis algorithm and Manber and Ladner's Algorithms for dictionary operations.

UNIT V:

Parallel algorithms for Graph searching— All Pairs shortest paths and minimum cost spanning tree.

Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and, Alpha-beta Search methods.

REFERENCE BOOKS:

1. Parallel computing theory and practice, MICHAEL J. QUINN
2. Programming Parallel Algorithms, Guy E. Blelloch, Communications of the ACM
3. Algorithms for Parallel processing, Michael T Heath, Abhiram Ranade, Schreiber(Ed), Springer.
4. Handbook of Parallel Computing Models, algorithms and applications, Samgithevar Rajasekharan, John Reif(Ed), Taylor and Francis group.
5. Parallel Processing and Parallel Algorithms: Theory and Computation, Seyed H. Roosta, Springer

PARALLEL ALGORITHMS

Model Paper

Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. a) What is advent of parallel processing. Explain the Computational demand in various application areas.
b) Differentiate between Data parallelism and control parallelism.
- 2.(a) Differentiate between MIMD and SPMD Models.
(b) Write the various Parallel Programming Models in detail.
- 3 a) Discuss about Multi processors and multi computers?
b) Explain Load balancing and Coffman-graham scheduling algorithm for parallel processors.
4. a) Differentiate between Parallel Quick-sort on Multi processors and Hyper Quick sort on hypercube multi computers.
b) Explain Ellis , Manber and Ladner's algorithms for dictionary operations.
5. Explain the parallel algorithms for graph searching.
6. Discuss the elementary parallel algorithms and matrix multiplication algorithms on SIMD & MIMD models.
7. 4.(a) Explain the Bus, Star, Ring, Mesh, Tree topologies.
(b) What is Perfect Shuffle Network.
- 8 Write Short Notes on the following
 - a) Hypercube inter connection Networks
 - b) Minsky's Conjecture for performance analysis
 - c) MPI Paradigm

ARTIFICIAL INTELLIGENCE

Syllabus

Unit-1

Introduction to Artificial Intelligence: AI Problems, The underlying Assumption, AI Techniques, Level of the Model Problems, Problem spaces & Search: Defining the Problem as a state space search, Production System, Problem Characteristics, Production System Characteristics.

Unit-2

Heuristic Search Techniques: Generate and Test, Hill Climbing, Best first Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Unit-3

Knowledge Representation Issues: Representation and Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation, The Frame Problem
Predicate Logic: Representing simple facts in logic, Computable Functions and Predicates, Resolution, Natural Deduction.

Unit-4

Representing Knowledge using rules : Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge

Unit-5

Common Sense: Qualitative Physics, Common Sense Ontologies, Memory Organization
Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Knowledge Acquisition

Text Book:

Elaine Rich & Kevin Knight, "Artificial Intelligence", 2nd Edition, (Tata McGraw Hill Edition)

Reference Books:

Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003

ARTIFICIAL INTELLIGENCE

Model Paper

I Time: 3 hours

Max. Marks: 100

Answer Any Five of the Following Questions

Each Question Carries 20 Marks.

1. Briefly explain the following:

- a) State Space Representation of AI Problem
- b) Procedural vs Declarative Knowledge

2. a) Explain about State Space Representation of Water Jug Problem

- b) Explain Problem Characteristics with examples

3. a) Explain Best First Search Algorithm with an Example

- b) Apply AI Techniques D the solution of the following Cryptarithmic Problem

CROSS

ROADS

4. a) Explain how a wff in predicate calculus can be converted into Clauses

- b) Explain with an example Unification & Resolution in Predicate Logic

5 a) Show how semantic nets and Frames can be captured in Logic with appropriate Examples

- b) Write the CD Representation of the Sentence John fertilized fields with a Special Tool

6 a) Explain The Dependency back tracking in Truth Maintenance System with an example

- b) What is a Certainty factor and explain how certainty factors are related to Rule Based Systems of the Sentence

7 a) Write a neat diagram the structure of a Rule Based Expert System and Explain its Components

- b) Explain Syntactic Processing and Augmented Transition Nets

8 Write Short on

- a) Natural Deduction b) Forward versus Backward Reasoning c) Expert System Shells