Gujarat University
Syllabus
M.Tech (Networking and Communications)-I

Subject Name: Design and Analysis of Algorithms

Subject Code: MTNT-111

Objectives:
- To develop proficiency in problem solving and programming.
- To be able to carry out the Analysis of various Algorithms for mainly Time and Space Complexity.
- To get a good understanding of applications of Data Structures.
- To develop a base for advanced study in Computer Science.

Prerequisites:
Any programming language like C or C++

Contents:

1. **Introduction:**
   - The role of Algorithms in Computing, Insertion Sort, Analyzing algorithms, Designing algorithms, Asymptotic notations

2. **Divide and Conquer Technique:**
   - The substitution method for solving recurrences
   - The recursion tree method for solving recurrences
   - The master method for solving recurrences

3. **Heapsort:**
   - Heaps
   - Maintaining the heap property
   - Building a heap
   - The heapsort algorithm
   - Priority queues

4. **Red-Black Trees:**
   - Properties of red – black trees
   - Rotations
   - Insertion
   - Deletion

5. **Dynamic Programming:**
   - Matrix-chain multiplication
   - Longest common subsequences

6.   Greedy Technique:
  o   An activity selection problem
  o   Elements of greedy strategy
  o   Huffman codes

7.   Single –Source Shortest Paths:
  o   The Bellman-Ford algorithm
  o   Single-source shortest paths in directed acyclic graphs
  o   Dijkstra's algorithm

8.   String Matching:
  o   The naïve string matching algorithm
  o   The Rabin Karp algorithm

9.   NP-Completeness and the P & NP Classes:
  o   Introduction
  o   Polynomial Time & Verification
  o   NP-Completeness and Reducibility
  o   The Traveling Salesman Problem

References:

1) Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithm", PHI.
2) Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education.
3) Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis & internet examples", Wiley.
4) A V Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing.
5) Brassard G. amd Bratley P., Allgorithms, Theory and Practices, PHI.
6) Berman Kenneth, Paul Jerome, "Fundamentals of Sequential and Parallel Algorithms", Cengage Learning.
7) Anany V. Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education publication.
8) Knuth D.E., "The Art of Computer Programming", Vol. 1,2 and 3, Addison-Wesley Publishing.
9)   Horowitz E, Sahni S, Rajasekaran S., "Fundamentals of   Computer Algorithms", University Press.

Accomplishments of the student after completing the Course:
- Ability to decide the appropriate data type and data structure for a given problem.
- Ability to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.
- Ability to compare algorithms with respect to time and space complexity

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Subject Name: Distributed Computing & Applications

Subject Code: MTNT-112

Objectives:
- Present the principles of distributed computing
- Create an awareness of the major technical challenges in the area of distributed computing
- Provide an experience in building algorithms and implementing them on clusters and distributed systems

Prerequisites:
Computer Networking, Operating Systems

Contents:

1. **Fundamentals:**
   Introduction, Distributed Computing Models, Software Concepts, Issues in Designing Distributed Systems, Client Server Model, Case Studies

2. **Inter-Process Communication:**
   Message Passing, Group Communication, Case Studies

3. **Remote Procedure Calls:**
   Introduction, RPC Basics, RPC Implementation, RPC Communication, Issues, Overview of RMI, Case Studies

4. **Synchronization:**
   Introduction, Clock Synchronization, Logical Clocks, Global State, Mutual Exclusion, Election Algorithms, Deadlocks in Distributed Systems, Case Studies

5. **Distributed System Management:**
   Introduction, Resource Management, Task Assignment Approach, Load Balancing Approach, Load Sharing Approach, Process Management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

6. **Distributed Shared Memory:**
   Introduction, Basic Concepts of DSM, Hardware DSM, Design Issues in DSM Systems, Issues in Implementing DSM Systems, Heterogeneous and Other DSM, Case Studies.

7. **Distributed File System:**
     Introduction, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching, Replication, Case Studies

8. **Naming:**
     Introduction, Desirable features, Basic Concepts

9. **Applications & Emerging Trends**
     Overview of Distributed Operating Systems, Distributed Database Management Systems, Grid Computing, SOA, Cloud Computing

References:

1) Mahajan S., Shah S., "Distributed Computing", Oxford University Press, India.
2) Kshemkalyani, Ajay, Singhal Mukesh, "Distributed Computing - Principles, Algorithms, and Systems", Cambridge University Press.
3) George Coulouris, Jean Dollimore and Tim Kindberg", Distributed Systems Concepts and Design", Pearson Education.
4) Crichlow, Joel M., "Distributed Systems – Computing Over Network", Prentice Hall India.
5) Steen, Maarten Van, Tanenbaum A.S., "Distributed Systems – Principles and Paradigms", Prentice Hall India.
6) Garg Vijay, "Concurrent and Distributed Computing in Java", IEEE Press, A John Wiley and Sons Inc. Publication.
7) Hagit Attiya, Jennifer Welch, "Distributed Computing – Fundamentals, Simulations and Advanced topics", Wiley India.
8) Liu M.L., "Distributed Computing Principles and Applications", Pearson Education.
9) Reilly David, Reilly Michael, "Java Network Programming and Distributed Computing", Pearson Education.

Accomplishments of the student after completing the Course:

- Appreciate the principles underlying the functioning of distributed computing, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions
- Recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems
- Implementation of Clusters, Grids and Cloud computing environments
- Designing of applications suitable to be executed on Distributed Computing Environment

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Subject Name: Communication & Research Skills

Subject Code: MTNT-113

Objectives:
Communication and Research are essential skills for success in professional career. The major objective of this course is to develop skills in communication and research. For the technocrats it is very important to have proper communication skills in representing their problems and ideas in a simple language, and reporting their research work. Apart from that, on several occasions they require skills in technical writing also. Therefore, the objective of the course is to acquaint the students with the basic concepts and techniques of communication that are useful in developing the skills of communicating effectively, and also for giving basic ideas of research methods and their reporting.

Prerequisites:
None.

Contents:

1. **Concepts of Communications:**
   Definition, Forms of Communication, Objectives of Communication, Characteristics of Communication, Process of Communication, Communication, Roadblocks, Role of Verbal and Non-verbal Symbols in Communication, Barriers to Effective Communication, Overcoming Communication Barriers

2. **Referencing and Writing skills:**
   Business letters: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims and adjustments, Collection letter, Banking correspondence, Agency correspondence, Bad news and persuading letters, Sales letters, Job application letters – Biodata, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars & notices, Types of Business Reports - Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization reports, by individual, Report by committee.

3. **Introduction to Research and Research Design:**
   Nature and scope of research, information based decision making and source of knowledge. The research process; basic approaches and terminologies used in research. Defining research question and framing of hypotheses, preparing a research plan, qualitative and quantitative research designs, Experimentation, Observational studies, Exploring secondary data.

4. **Measurement and Scaling, Data Source and Data Collection**
   Field research, primary data collection from observations, surveys and experimentation, Measurement and scaling, commonly used scales in reliability

and validity of scales, Designing instrument for data collection, testing the instrument, data collection process, Sampling methods and procedures and sample size decisions

5. Data Analysis and Presentation:

Editing and coding of data, tabulation, graphic presentation of data, cross tabulation, Testing of hypotheses, type I and II errors, one tailed and two tailed tests of significance, Parametric and nonparametric tests for Uni-variate and Bi-variate data, Tests of association, Simple linear regression and other non-parametric tests

6. Technical Writing:

Technical Proposal writing: Definition, Purpose, types, characteristics, Elements of structure, style and appearance, evaluation, exercises, Research report writing, Proposal writing, referencing, forms of reports, bibliography, etc., Research paper, Dissertation, and Thesis, Instruction Manuals, Type of instructions, Writing Instructions, Technical Descriptions, Process descriptions, Guidelines for Writing Good Descriptions codes

References:

1) Lesikar, R. V. & Flatley, "Basic Business Communication Skills for Empowering the Internet Generation", TMH.
2) Meenakshi Raman, Sangeeta Sharma , "Technical Communication", Oxford
3) D. K. Bhattacharyya, "Research Methodology", Excel Books.
4) Bowman, J.P. & Branchaw, P.P., "Business Communications: From Process to Product", Dryden Press.
5) M Ashraf Rizvi, "Effective Technical Communication", TMH.
6) E. H. McGrath, "Basic Managerial Skills for all", Prentice Hall India
7) Meera Banerji, "Developing Communication Skills", McMillan India Ltd.
8) Whigham, David, "Business Data Analysis Using Excel", Oxford
9) Thill, J. V. & Bovee, G. L., "Excellence in Business Communication", TMH.
10) Sajitha Jayaprakash, "Technical Writing", Himalaya.
11) Adair, J., "Effective Communication", Pan Mcmillan.
12) Donald R. Cooper, Pamela S. Schindler, "Business Research Methods", TMH.
13) Taylor, Sinha & Ghoshal, "Research Methodology: A Guide for Researchers in Management and Social Sciences", PHI.

Accomplishments of the student after completing the course:

At the end of the work student will be able to communicate reporting their research work.

Subject Name: Information Security

Subject Code: MTNT-114

Objectives:

After completion of this course student will be able to know
- Why it is necessary to secure information
- The different risks to information are
- The steps required to mitigate those risks

Prerequisites:
- Fundamentals of Networking & Data Communications
- Fundamentals of Operating Systems
- Fundamentals of Computers

Contents:

1. Introduction
   Meaning of Security, Security Attacks, Security Defense, Cyber Criminals

2. Cryptography
   Introduction to Cryptography, different types of crypto graphical methods, Secret Key Cryptography, Study of Block Encryption, AES, IDEA and DES algorithms, Modes of Encryption, Study of ECB, CBC, OFB, CFB and CTR modes of encryption, Hashes and Message Digests, Study of utility of hashes, MD2, MD4, MD5, SHA-1, HMAC hashing methods, Public Key Algorithms, Study of RSA, Diffie-Hellman, Digital Signature Standards

3. Application Security
   Secure Programs, Non-malicious program errors, viruses and malicious code, targeted malicious code, controls against program threats

4. System Security
   Methods of Protection, Memory and Address Protection, Control of Access to General Objects, File Protection Mechanisms, User Authentication

5. Trusted Systems
   What is a trusted system? Security Policies, Models of Security, Trusted Operating System Design, Assurance in Trusted Operating Systems

6. Database Security
   Introduction, Security Requirements, Reliability and Integrity, Sensitive Data, Inference, Multilevel Databases, Proposals for Multilevel Security, Data Mining

7. **Network Security**
   Network Concepts, Network Threats, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail

8. **Operations Security**
   Security Planning, Risk Analysis, Organizational Security Policies, Physical Security

9. **Privacy in Computing**
   Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, E-mail Security, Impacts on emerging technology

References:

1) Charles P. Pfleeger, Shari Lawrence Pfleeger , "Security in Computing", Prentice Hall Professional
2) Charlie Kaufman, Radia Perlman, Mike Speciner, Michael Speciner "Network Security: Private Communications in a Public World", PTR Prentice Hall

Accomplishments of the student after completing the Course:
Understand and appreciate the importance of Information Security in today's world.

Subject Name: Computer Communication Networks

Subject Code: MTNT-115

Objectives:
- To introduce the principles of Computer Networks
- To understand the functionality of layers of OSI model and TCP/IP model and interactions between them.
- To gain basic insight of programming for network solutions.

Prerequisites:
C Programming, Linux OS.

Contents:

1. **Foundation :- Building a Network:**
   Applications, Requirements, Network Architecture, Implementing Network Software, Performance

2. **Connecting to a Network:**
   Perspective on Connecting, Encoding, Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Wireless Networks

3. **Internetworking:**
   Switching and Bridging, Basic Internetworking (IP), Routing, Implementation and Performance

4. **Advance Internetworking:**
   Global Internet, Multicast Addresses, MPLS, Mobile IP

5. **End – to – End Protocols:**
   The Transport service, Elements of Transport Protocols, Overview of UDP and TCP

6. **Unix Network Programming:**
   Socket programming

References:

1) Peterson L., Davie B., "Computer Networks – A systems approach", Morgan Kaufmann Publishers.
2) Tanenbaum A.S., "Computer Networks", Prentice Hall India.
3) Forouzan B., "Data Communication and Networking", TMH.
4) Stallings W., "Data & Computer Communications", Pearson Education.
5) Natalia & Victor Olifer, "Computer Networks", Wiley.
6) Garcia A.L, Widjaja I., "Communication Networks", TMH.
7) Kurose J., Ross K., "Computer Networking – A Top Down Approach", Pearson Education.
8) Stevens R., "Unix Network Programming", Pearson Education.

Accomplishments of the student after completing the course:

At the end of the work student will be able to

- Analyze and develop protocol/algorithm to solve real problems.
- Understand the working of each layer of OSI and TCP/IP Model.
- Appreciate the developments in the area of Computer Networks.