

M. Tech – Network Communications & Security

CS	GRAPH THEORY & QUEUEING THEORY	3	1	0	4
1.	Review of Basic Concepts of Graphs : Trees Properties – Pendant Vertices – Distances and Centres – Rooted and Binary Trees – Spanning Trees – Fundamental Circuits – Finding all Spanning Trees in a Weighed Graph – Cutsets – Properties – Connectivity and Separability.				9 3 0
2.	Matrix Representation of Graphs : Incidence Matrix – Submatrices – Circuit Matrix – Fundamental Circuit Matrix – An application to switching Network – Cutset Matrix – Path Matrix – Adjacency Matrix - Directed Graphs - Connectedness - Euler Digraphs - Trees with Directed Edges – Adjacency Matrix of a Digraph.				9 3 0
3.	Enumeration : Counting Labeled and Unlabeled Trees - Polya’s Counting Theorem - Graph Enumeration with Polya’s Theorem – Contact Networks - Analysis and Synthesis - Sequential Switching - Graphs in Coding Theory. 9 3 0				
4.	Algorithms : Computer Representation of a Graph – Input-Output Algorithms for I) Connectedness & Components ii) A Spanning Tree iii) A Set of Fundamental Circuits iv) Cut0vertices & Separability v) Directed Circuits vi) Shortest Path from a Specified Vertex to Another Specified Vertex vii) Shortest Path between all the Pairs of Vertices viii) Depth - First Search on a Graph - Planarity Testing - Graph-theoretic Computer Languages.				9 3 0
5.	Elements of a Queuing Model : Role of Exponential Distribution – Pure Birth and Death Models – Generalised Poisson’s Queuing Models – Specialised Poisson Queues – Single Server and Multiple Server – Models – Pollaczek Khintchine Formula – Other Queuing Models.				9 3 0
Total 60 hrs					

Text Books :

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, (1986).
2. Hamdy A. Taha, "Operations Research – An Introduction", Prentice Hall of India, Sixth Edition, 2000.

EC	WIRELESS NETWORK COMMUNICATIONS	3	0	0	3
1.	Introduction to Wireless Mobile Communications : History and Evolution of Mobile Radio Systems. Types of Mobile Wireless Services/Systems - Cellular, WLL, Paging, Satellite Systems, Standards, Future Trends in Personal Wireless Systems. Satellite Applications : INTELSAT, Series, INSAT, VSAT, Remotesensing, Mobile Satellite Service : GSM, GPS, INMARSAT, Satellite Navigation System, Direct to Home Services(DTH), Special Services, E-mail, Video Conferencing and Internet Connectivity.				12 0 0
2.	Cellular Concept and System Design Fundamentals : Cellular Concept and Frequency Reuse, Multiple Access Schemes, Channel Assignment and Handoff, Interference and System Capacity, Trunking and Erlang Capacity Calculations.				12 0 0
3.	Mobile Radio Propagation : Radio Wave Propagation Issues in Personal Wireless Systems, Propagation Models, Multi-path Fading and Base Band Impulse Respond Models, Parameters of Mobile Multi-path Channels, Antenna Systems in Mobile Radio.				12 0 0
4.	Modulation and Signal Processing : Analog and Digital Modulation Techniques, Performance of Various Modulation Techniques-Spectral Efficiency, Error - Rate, Power Amplification, Equalizing Rake Receiver Concepts, Diversity and Space-time Processing, Speech Coding and Channel Coding.				12 0 0
5.	System Examples and Design Issues : Multiple Access Techniques - FDMA,TDMA and CDMA Systems, Operational Systems, Wireless Networking, Design Issues in Personal Wireless Systems.				12 0 0
Total 60 hrs					

References :

1. K.Feher, "Wireless Digital Communications", Prentice Hall of India, New Delhi, 1995
2. T.S. Rappaport, "Wireless Digital Communications - Principles and Practice", Prentice Hall, NJ, 1996.

3. W.C.Y. Lee, "Mobile Communications Engineering - Theory and Applications", 2nd Edition, McGraw Hill, New York.1998.
4. Schiller, "Mobile Communications", Pearson Education Asia Ltd., 2000.
5. Bruce .R Elbert, "The Satellite Communication Applications – Hand Book", Artech House Boston, 1997.

CS	SOFTWARE ENGINEERING METHODOLOGIES	3	0	0	3
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1. **Introduction :** Software Engineering Process Paradigms - Project Management - Process and Project Metrics – software Estimation - Empirical Estimation Models - Planning - Risk Analysis - Software Project Scheduling. **12 0 0**
2. **Requirements Analysis :** Prototyping - Specification - Analysis Modeling. **12 0 0**
3. **Software Design :** Software Design - Abstraction - Modularity - Software Architecture - Effective Modular Design - Cohesion and Coupling - Architectural Design and Procedural Design - Data Flow Oriented Design. **12 0 0**
4. **User Interface Design and Real Time Systems :** User Interface Design - Human Factors - Human Computer Interaction - Human - Computer Interface Design - Interface Design - Interface Standards. Programming Languages and Coding - Language Classes – Code Documentation - Code Efficiency - Software Configuration Management. **12 0 0**
5. **Software Quality and Testing :** Software Quality Assurance - Quality Metrics - Software Reliability - Software Testing - Path Testing – Control Structures Testing - Black Box Testing - Integration, Validation and System Testing - Software Maintenance - Reverse Engineering and Re-engineering. CASE Tools - Projects Management, Tools - Analysis and Design Tools - Programming Tools - Integration and Testing Tool - Case Studies. **12 0 0**

Total 60 hrs

References :

1. Roger Pressman .S, "Software Engineering - A Practitioner's Approach", (4th Edition), McGraw Hill, 1997.
2. I. Sommerville, "Software Engineering", 5th Edition, Addison Wesley, 1996.
3. Pfleeger, "Software Engineering", Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India, 1991.

CS	COMPUTER NETWORKS ENGINEERING AND MANAGEMENT	3	1	0	4
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1. **Network Architecture :** Layering & Protocols - OSI & Internet Architecture - Network Topology - Link & Medium Access Protocols - IEEE 802 Standards - Performance Issues - Network Adapters. **9 3 0**
2. **Network Layer :** Circuit Switching - Packet Switching - Internetworking - Bridges - Internet Protocol - Addressing – Routing Protocols. **9 3 0**
3. **End - To - End Protocol :** UDP – TCP – Reliable Delivery Service - Congestion Control – Connection Establishment – Flow Control - Presentation Aspects. **9 3 0**
4. **Applications :** Telnet, FTP - E-mail - DNS - Multimedia Applications - Security.
5. **Network Management :** Monitoring & Control - SNMP, V2, V3, RMON, RMON2. **9 3 0**

Total 60 hrs

References :

1. Peterson Davie, "Computer Networks - A Systems Approach", Morgan Kaufman - Harcourt Asia, 2nd Edition, 2000.
2. William Stallings, "SNMP, SNMPV2, SNMPV3, RMON1 and 2", 3rd Edition, Addison Wesley, 1999.
3. J.F. Kurose & K.W. Ross, "Computer Networking - A top - Down Approach Featuring The Internet", Addison Wesley, 2001.
4. Tanenbaum .A.S, "Computer Networks", Prentice Hall of India, 3rd Edition, 1996.

CS	ADVANCED NETWORKS	4	0	0	4
1.	Circuit Switched Networks : SONET - DWDM - Fibre to the Home - DSL - CATV - ISDN - BISDN.				12 0 0
2.	ATM : Addressing Signaling & Routing - Header Structure - ATM Adaptation layer - Management control.				12 0 0
3.	Internetworking with ATM : LAN - IP over ATM - Multiprotocol over ATM - Frame Relay over ATM.				12 0 0
4.	Wireless Networks : The Wireless Channel - Link Level Design - Channel Access - Network Design - Standards.				12 0 0
5.	Recent Trends : Optical Networks – Cross Connects - LANs - Voice Over IP – Multimedia Networks.				12 0 0
					Total 60 hrs

References:

- Walrand .J Varaiya, "High Performance Communication Network", Morgan Kauffman - Harcourt Asia Pvt. Ltd., 2nd Edition, 2000.
- William Stallings, "ISDN & Broadband ISDN with frame Relay & ATM", PHI 4th Edition, 2000.
- Bates & Donald W. Gregory, "Voice & Data Communications – Handbook", McGraw Hill Edition, 3rd Edition, 2000.

PR	EMERGING ENGINEERING TECHNOLOGIES	3	0	0	3
1.	Engineering Technologies & Systems and Critical Technologies : Overview - Micro and Nanotechnologies, MEMS, MOEMS.				10 0 0
2.	Interdisciplinary Approach : Engineering, Biology & Medical Technologies - Engineering disciplines & Applications - Biological disciplines & Applications - Medical disciplines & Applications.				12 0 0
3.	Genomics : Biotechnologies, DNA, Protein, Tissue Engineering, Bioinformatics.				8 0 0
4.	Cognitive Engineering : Nanotechnologies, Nanotubes, Molecular Manufacturing - Molecular Nanotechnology - I.T. - Artificial Intelligence, Robotics, Informatics, Human - Computer interaction, Neural Networks - Smart Materials - Microfabrication – Sensors.				15 0 0
5.	Role of Emerging Technologies and its Applications : Energy & Environmental - Defence & Aerospace - Construction & Infrastructure - Information & Electronic Industry - Pharmaceuticals & Medicine - Food & Agricultural Sector.				15 0 0
					Total 60 hrs

References :

- Nadim Maluf, "An Introduction to Microelectromechanical Systems Engineering", (Artech House MEMS Library) Artech House; ISBN : 0890065810; (December 1999).
- Sergey Edward Lyshevski, "Nano and Microelectromechanical Systems ; Fundamentals of Nano and Microengineering", CRC Press; ISBN : 0849309166; (September 25, 2000)
- "Report on Critical Technologies – Overview", NDRF Publication, 2002.

EC	CRYPTOGRAPHY AND COMMUNICATION NETWORK SECURITY	3	1	0	4
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1.	Conventional Encryption : Introduction - Conventional Encryption Model - Steganography - Data Encryption Standard - Block Cipher - Encryption Algorithms – Confidentiality - Key Distribution.	9 3 0
2.	Public Key Encryption and Hashing : Principles of Public Key Cryptosystems, RSA Algorithm, Diffie – Hellman Key Exchange – Elliptic Curve Cryptology - Message Authentication and Hash Functions – Hash and Mac Algorithms - Digital Signatures.	9 3 0
3.	IP Security : IP Security Overview - IP Security Architecture - Authentication Header - Security Payload, Security Associations, Key Management.	9 3 0
4.	Web Security : Web Security Requirement - Secure Sockets Layer - Transport Layer Security - Secure Electronic Transaction - Dual Signature.	9 3 0
5.	System Security : Intruders - Viruses - Worms - Firewall Design - Trusted Systems - Anti-virus Techniques – Digital Immue Systems.	9 3 0
		Total 60 hrs

References:

1. William Stallings, "Cryptography and Network Security", 2nd Edition, Prentice Hall of India, New Delhi, 1999.
2. Baldwin .R and Rivest .R, "The RC5. RC5-CBC.TC5-CBC-PAD and RC5-CT5 Algorithms, RFC2040", October, 1996.
3. N. Koblitz, "A Course in Number Theory and Cryptography, 2nd Edition, Springer – Verlag, 1994.
4. B. Schneier, "Applied Cryptography – Protocols, Algorithms and Source Code in C", John Wiley and Sons, 2nd Edition, 1995.

CS	ADVANCED MOBILE COMPUTING	3	1	0	4
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1.	Introduction : Medium Access Control - Telecommunication Systems - Satellite Systems - Broadcast Systems.	9 3 0
2.	Standards : Wireless LAN - IEEE 802.11 - HIPERLAN – Blue Tooth.	9 3 0
3.	Ad-hoc Networks : Characteristics - Performance Issues - Routing in Mobile Hosts.	9 3 0
4.	Network Issues : Mobile IP - DHCP - Mobile Transport Layer - Indirect TCP - Snooping TCP - Mobile TCP - Transmission / Time-out Freezing - Selective Retransmission - Transaction Oriented TCP.	9 3 0
5.	Application Issues : Wireless Application Protocol - Dynamic DNS - File Systems - Synchronization Protocol - Context-aware Applications - Security - Analysis of Existing Wireless Network .	9 3 0
		Total 60 hrs

References :

1. J. Schiller, "Mobile Communications", Addison Wesley, 2000.
2. <http://www.bluetooth.com/>
3. William C.Y. Lee, "Mobile Communication Design Fundamentals", John Wiley, 1993.

EC	CYBER LAWS AND LEGISLATIONS	4	0	0	4
1.	Introduction : The World of Internet, Scope of Cyber Laws, Cyber Jurisprudence, The Essence of Digital Contracts and The System of Digital Signatures.				12 0 0
2.	The Role and Function of Certifying Authorities : The Science of Cryptography, Domain Names and Related Issues, Copy Right in the Digital Media and Patents in the Cyber World.				12 0 0
3.	Privacy and Freedom Issues in the Cyber World : Cyber Crimes and Cyber Laws and Responsibilities of a Cyber Citizen.				12 0 0
4.	Legal Issues and Information Technology Act : Information Technology Act-2000-1 to 6 and Important Sections – CRAT Rules - Legal Issues in Convergence and Convergence Bill.				12 0 0
5.	Cyber Law Issues in E-business Management : Legal Issues in Cyber Advertising, Cyber Banking, Cyber Taxation – Legal Issues in Emerging Technologies – Cyber Wars and Cyber Terrorism – Cyber Law Compliance – The Need of the Hour.				12 0 0
					Total 60 hrs

Reference :

1. Suresh T. Viswanathan, "Bharat's the Indian Cyber Laws with Cyber Glossary". 2002
2. Ralph D. Clifford, "Computer and Cyber Law", 2001.
3. www.cyberlawindia.com
4. Pawan Dugaal, "Cyber Law – The Indian Perspective", Naavi Publication, 2000.

CS	PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS	3	1	0	4
1.	Introduction : Introduction to Performance Evaluation - Metrics - Workload - Problem of Workload Characterization - Representativeness of a Workload Model - Test Workloads - Workload Model Implementation Techniques - Measurement - Hardware - Software Monitors.				9 3 0
2.	Queuing Network Modeling : Overview - Modeling Cycle - Understanding the Objectives of a Study - Workload Characterization – Sensitivity Analysis - Sources of Insight - Fundamental Laws - Queuing Network Model Inputs & Outputs.				9 3 0
3.	Bounds on Performance : Asymptotic Bounds - Using Asymptotic Bounds - Balanced System Bounds - Models with One Job Class - Workload Representation - Solution Techniques.				9 3 0
4.	Memory : System with known Average Multiprogramming Level - Memory Constraints - Swapping - Paging - Disk I/O - Channel in NON - RPS I/O Subsystems - Channel Contention in RPS I/O Subsystems - Additional Path Elements Multipathing - Other Architectural Characteristics - Processors.				9 3 0
5.	Parameterization : Existing Systems - Evolving Systems - Proposed Systems - Simulation - Analysis of Simulation Results - Simulation of General and Extended Queuing Networks - Response Time Distributions - Local Area Networks - Models - Link Performance - Transaction Response, Link Throughput, Multiplexed Link Capacity - Ethernet, Token Ring Performance Analysis.				9 3 0
					Total 60 hrs

References:

1. Edward D. Lazawska, John zahorjan, G. Scott Graham, Kenneth C. Sevcik , "Quantitative System Performance -Computer System Analysis with Queuing Network Models", Prentice Hall Inc ,1984.

2. Domenico Ferrari , Giuseppe Serazzi, Alexandro Zeijher, "Measurement & Tuning of Computer Systems", Prentice Hall Inc,1983.
3. Michael F. Mories and Paul F. Roth, Tools and Techniques", Computer Performance Evaluation, Van Nostrand, New York, 1982.
4. John Freer R., "Computer Communications and Networks", Affiliated East-West Press Pvt. Ltd., 1990.

ELECTIVES

CS	ADVANCED DATABASES	3	0	0	3
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1. **Relational Databases** : Relational Model - Querying - Storage Structures - Query Processing - Normalization. 12 0 0
 2. **Object Oriented Databases** : Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence - Transaction - Concurrency - Recovery - Database Administration. 12 0 0
 3. **Emerging Systems** : Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases - Mobile Databases. 12 0 0
 4. **Current Issues** : Rules - Knowledge Bases - Active and Deductive Databases - Distributed Databases and Parallel Databases. 12 0 0
 5. **Database Design Issues** : Security - Integrity - Consistency - Database Tuning - Optimization and Research Issues. 12 0 0
- Total 60 hrs**

References:

1. Gary W. Hanson and James V. Hanson, "Database Management and Design", Prentice Hall of India Pvt. Ltd., 1999.
2. Alex Benson, Stephen Smith and Kurt Thearling, "Building Data Mining Applications for CRM", Tata McGraw Hill, 2000.
3. R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", Addison Wesley, 2000.
4. N. Tamer Ozsu & Patrick Valduriez, "Principles of Distributed Database Systems", Prentice Hall International Inc., 1999.

CS	SOFTWARE PROJECT MANAGEMENT	3	0	0	3
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1. **Introduction** : Managing a Software Development Project. Concepts, Objects of a Project, Environment of a Software Project, System Development Life Cycle, Tools, Review Process. 12 0 0
 2. **Software Project - Planning & Documentation** : Documentation in Software Program Management, Procedures, Diagramming Techniques, Management; Planning and Monitoring a Software Project, Project Planning. 12 0 0
 3. **Software Project – Management Tools & Packages** : Management Tools, Software Project Definitions, Project Management Packages, Project Control; Software Project Definition, Classification, Project Sizes and Methodologies, Feasibility, Requirements and Start-up. 12 0 0
 4. **Programmer Productivity** : Software Planning, Control Tools, Accelerated Design; Proto Typing and Role in Software Project Management; Software Production and Software Project Management. 12 0 0
 5. **Software Project – Installation & Testing** : Software System Installation, Managing Testing Requirements, Test Plans, Alpha and Beta Systems; Emerging Directions in Project Management. 12 0 0
- Total 60 hrs**

References:

1. Bob Hughes & Mike Cotterell, "Software Project Management", McGraw-Hill, 3rd Edition, 2002.
2. Chowdy .S, "Project Management", TMG Hill Publishing Co., New Delhi, 1988.
3. Stephen H. Kan, "Methods and Models in Software Quality Engineering," Addison Wesley, 1995.

CS	OBJECT ORIENTED SYSTEM ANALYSIS & DESIGN	3	0	0	3
1.	Object Oriented Programming Model : Methodology - Object Modeling, Abstraction, Dynamic Function Modeling - Object Oriented Design and Analysis Methods, Object Oriented Languages.				12 0 0
2.	Classes : Class Fundamentals - Member Access - Constructors & Destructors, Relationship between Structure and Classes, Inline Function-arrays of Objects - Pointers to Objects, Object Reference. Base Class Access, Access Control - Inheritance of Multiple Base Classes, Constructors, Destructors & Inheritance, Access Grants, Virtual Base Classes.				12 0 0
3.	Operator & Function Overloading and Virtual Functions : Overview Rules of Operator - Overloading, Restrictions, Declaration Matching, Argument Matching, Address of Overloaded Function, Scope of Overloaded Functions, Inheritance of Overloaded Functions and Operators – Virtual Functions – Pure Virtual Function, Abstract Classes.				12 0 0
4.	File Handling, Templates, Exception Handling : File Handling, Templates - Working with Function Templates and Class Templates. Templates vs Macros, Templates vs Void Pointers, Exception Handling - Overview, Syntax, Type-safe Exception Handling, Unhandled Exceptions, Structured Exception Handling, Exception Handles, SW and Hardware Exceptions, Mixing C & C++ Exceptions, C++ Exceptions, C++ Preprocessor.				12 0 0
5.	Case Studies C++, Java.				12 0 0
					Total 60 hrs

REFERENCES :

1. Rumbaugh, et al, "Object Oriented Modeling and Design", Prentice Hall of India, 1991.
2. Schildt .H, "C++ from the Group Up", Osborne McGraw Hill, 1994.
3. Martin Fowler, Kendall Scott, "UML Distiltech - Applying the Standard Object Modeling Language", Addison Wesley, 1997.
4. Richard C. Lee, William M. Tepfenhard, "UML and C++ - A Practical Guide to Object Oriented Development", Prentice Hall, 1997.
5. Kostuch .D.J, Deibal, H.M., & Deibal, P.J., C++ & Object Oriented Programming for professional C programmers, Prentice Hall, 1995.
6. Eooch, "Object Oriented Analysis and Design with Applications", II edition, Benjamin Cummings, USA, 1994.
7. James Martin & James J. Odell, "Object Oriented Methods - A Foundation", Prentice Hall, 1997.

CP	ADVANCED OPERATING SYSTEMS	3	0	0	3
1.	Introduction : Mainframe Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Hardware Protection – System Components – Handheld Systems – Operating System Services – System Calls – System Programs – System Structure – Visual Machines – System Design and Implementation.				12 0 0
2.	Process Management : Process Concept – Process Scheduling – Operation of Process – Co-operation Processes – Inter-process Communication – Threads – Overview – Multithreading Models – Process Synchronization – The Critical Section Problem – Synchronization Hardware – Semaphores – Classical Problems of Synchronization – Deadlocks – System Model – Deadlock Characterization – Methods of Handling Deadlocks – Deadlock Prevention – Deadlock Detection – Recovery from Deadlock.				12 0 0
3.	CPU Scheduling and Memory Management : CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple – Processor Scheduling – Real-time Scheduling – Algorithm Evaluation – Memory Management – Background – Swapping – Contiguous Memory Allocation – Paging – Segmentation – Segmentation with Paging.				12 0 0
4.	Broadband Network Management : Broadband network s and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN. ATM Network Management-ATM Network references model, Integrated local management Interface. ATM Management Information base, Role of SNMD and ILMIin ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management.				12 0 0
5.	Network Management Applications : Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management.				12 0 0
					Total 60 hrs

References :

1. Mani Subramanian, "Network Management Principles and Practice", Addison Wesley, New York, 2000.
2. Salah Aiidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi.1998
3. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi-1999.

EC	TELECOM NETWORK MANAGEMENT	3	0	0	3
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1. **Fundamentals of Computer Network Technology** : Network Topology, LAN, Network Node Components - Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN – Transmission Technology, Communications Protocols and Standards. **12 0 0**
 2. **OSI Network Management** : OSI Network Management Model - Organizational Model -Information Model, Communication Model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/CMIS. **12 0 0**
 3. **Internet Management(SNMP)** : SNMP - Organizational Model - System Overview, The Information Model, Communication Model - Functional Model, SNMP Proxy Server, Management Information, Protocol Remote Monitoring. **12 0 0**
 4. **Broadband Network Management** : Broadband Networks and Services, ATM Technology - VP, VC, ATM Packet, Integrated Service, ATMLAN Emulation, Virtual LAN. ATM Network Management - ATM Network References Model, Integrated Local Management Interface. ATM Management Information Base, Role of SNMD and ILMlin ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management. **12 0 0**
 5. **Network Management Applications** : Configuration Management, Fault Management, Performance Management, Event Correlation Techniques Security Management, Accounting Management, Report Management, Policy Based Management Service Level Management. **12 0 0**
- Total 60 hrs**

References :

1. Mani Subramanian, "Network Management Principles and practice", Addison Wwesly, New York, 2000.
2. Salah Aiidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi.1998
3. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi-1999.

EC	ADVANCED DIGITAL COMMUNICATION TECHNIQUES	3	0	0	3
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1. **Introduction** : Functional Architecture Coded and Encoded Digital Communication System Architecture, Types of Network and Services, Performance Criterion and Link Budgets. **12 0 0**
2. **Digital Modulations** : PSD, Data Pulse Stream, M-ary Markov Source, Convolutionally Coded Modulation, Continuous Phase Modulation(CPM), Scalar and Vector Communications over Memory Less Channel, Scalar Receiver, BER Performance, Detection Criterion. **12 0 0**
3. **Coherent and Non-coherent Communication With Waveforms** : Optical Receiver in WGN, MF Receiver, Matrix Generation, Colored GN, Whitening Approach, Inphase and Quadrature Phase Modem, Non-coherent Receivers, Random Phase Channel, Optimum and suboptimum MFSK, Performance of Non-coherent Receivers in Random Phase Channel, Optimum Receivers in Rayleigh and Rician Channels, M-ary Symbol Error Probability. **12 0 0**
4. **Band Limited Channels** : Optimum Pulse Shape Design, Optimum Demodulation's of Digital Signals in the presence of ISI and AWGN, Equalization Techniques, Diminishing and Detection - Q Modulation, QAM, QPSK, QBM, CPM, FSK, MSK. **12 0 0**
5. **Coded Digital Communication** : Architecture, Interfacing, Detailing, Synchronization ,Block Coded Digital Communication System, Performance, Types of Binary Block Codes, Shannon Channel Coding Theorem, Linear Block Codes, Convolutional Coded Digital Communication System, Representation of Convolution Codes, Decoding, Problems of Decreasing Errors, Sequencing and Threshold Decoding. **12 0 0**

References :

1. M.K. Simon, S.M. Hinedi and W.C. Lindsey, "Digital Communication Techniques - Signaling and Detection", Prentice Hall of India, New Delhi. 1995.
2. Simon Haykin, "Digital Communications", John Wiley and sons, 1998.
3. Wayne Tomasi, "Advanced Electronic Communication Systems", 4th Edition, Pearson Education Asia, 1998.
4. B.P. Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 1998.

EC	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3
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1. **Discrete Random Signal Processing** : Discrete Random Processes, Expectations, Variance, Co -Variance, Scalar Product, Energy of Discrete Signals Parseval's Theorem, Wiener Khintchine Relation- Power Spectral Density - Periodogram – Sample Auto correlation- Sum Decomposition Theorem, Spectral Factorization Theorem - Discrete Random Signal Processing by Linear Systems - Simulation of White Noise - Low Pass Filtering of White Noise. 12 0 0
2. **Spectrum Estimation** : Non-parametric Methods - Correlation Method - Co-variance Estimator - Performance Analysis of Estimators - Unbiased, Consistent Estimators - Periodogram Estimator -Barlett Spectrum Estimation - Welch Estimation - Model based Approach - AR, MA, ARMA Signal Modeling - Parameter Estimation using Yule - Walker Method. 12 0 0
3. **Linear Estimation and Prediction** : Maximum likelihood Criterion - Efficiency of Estimator -Least Mean Squared Error Criterion - Wiener Filter - Discrete Wiener Hoff Equations - Recursive Estimators - Kalman Filter - Linear Prediction, Prediction Error Whitening Filter, Inverse Filter - Levinson Recursion, Lattice Realization and Levinson Recursion Algorithm for Solving Toeplitz System of Equations. 12 0 0
4. **Adaptive Filters** : FIR Adaptive Filters - Newton's Steepest Descent Method - Adaptive Filter based on Steepest Descent Method - Widrow Hoff LMS Adaptive Algorithm - Adaptive Channel Equalization - Adaptive Echo Canceller – Adaptive Noise Cancellation - RLS Adaptive Filters - Exponentially Weighted RLS - Sliding Window RLS - Simplified IIR LMS Adaptive Filter. 12 0 0
5. **Multirate Digital Signal Processing** : Mathematical Description of change of Sampling Rate - Interpolation and Decimation - Continuous Time Model - Direct Digital Domain Approach - Decimation by an Integer Factor - Interpolation by an Integer Factor – Single and Multistage Realization - Poly Phase Realization - Application to sub band Coding - Wavelet Transform and Filter Bank Implementation of Wavelet Expansion of Signals. 12 0 0

Total 60 hrs

References:

1. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996.
2. Sopocles .J Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990.
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, 1995.

EC	NETWORK ROUTING ALGORITHMS	3	0	0	3
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1. **Circuit Switching Networks** : AT & 's, Dynamic Alternative Routing. 12 0 0
2. **Packet Switching Networks** : Distance Vector Routing, Inter Domain Routing, Link State Routing, Apple Talk Routing & Sna Routing. 12 0 0
3. **High Speed Networks** : Routing in Optical Networks, Routing in ATM Networks, Routing in PLANET Networks & Deflection Routing. 12 0 0
4. **Mobile Networks** : Routing in Cellular Radio Mobile Communication Networks, Packet Radio Routing. 12 0 0
5. **Mobile Ad-hoc Networks(Manet)** : Internet based Mobile Ad-hoc Networking, Communication Strategies, Routing Algorithms Destination Sequenced Distance Vector(DSDV), Dynamic Source Routing (DSR), Ad-hoc On Demand Distance Vector(AODV) & Temporarily Ordered Routing Algorithm (TORA),Quality of Service. 12 0 0

Total 60 hrs

References :

1. M. Steen Strub, "Routing in Communication Networks", Prentice Hall International, New York, 1995.
2. William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall, New York, 1998.
3. IEEE Journal on Selected Areas in Communications, Special Issue on Wireless Ad-hoc Networks, Vol. 17, No. 8, 1999.
4. Scott .M Corson, Joseph P. Macker, Gregory .H Cirincione, IEEE Internet Computing, VI.3, No. 4, ,Jul-Aug, 1999.
5. Alder .M Scheidelerl.Ch. "Annual ACM Symposium on Parallel Algorithms and Architectures", ACM, New York, 1998.

EC	HIGH SPEED SWITCHING ARCHITECTURE	3	0	0	3
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1. **High Speed Network** : Introduction – LAN, WAN, Network Evolution through ISDN to B-isdn - Transfer Mode and Control of B-isdn – SDH Multiplexing Structure – ATM Standard – ATM Adaptation Layers. **12 0 0**
 2. **LAN Switching Technology** : Switching Concepts – Switch Forwarding Techniques – Switch Path Control – LAN Switching = Cut through forwarding – Store and Forward – Virtual LANs.. **12 0 0**
 3. **ATM Switching Architecture** : Switch Models – Blocking Networks – Basic and Enhanced Banyan Networks – Sorting Networks – Merge Sorting – Re-arrangeable Networks – Full and Partial Connection Networks, Non-blocking Networks – Recursive Network Construction – Comparison of Non-blocking Networks, Switches with Deflection Routing – Shuffle Switch – Tandem Banyan. **12 0 0**
 4. **Queues in ATM Switches** : Internal Queuing – Input, Output and Shared Queuing – Multiple Queuing Methods – Combined Input, Output and Shared Queuing – Performance Analysis of Queued Switches. **12 0 0**
 5. **IP Switching** : Addressing Model, IP Switching Types – Flow Driven and Topology Driven Solutions, IP Over ATM Address and Next Hop Resolution – Multicasting – Ipv6 over ATM **12 0 0**
- Total 60 hrs**

References :

1. Achille Pattavina, "Switching Theory – Architectures and Performance in Broadband ATM Networks", John Wiley & Sons Ltd., New York, 1998.
2. Christopher Y Metz., "Switching Protocols & Architectures", McGraw Hill Professional Publishing, New York, 1998.
3. Ranier Handel, Manfred N Huber, Stefan Schrodder, "ATM Networks – Concepts, Protocols, Applications", 3rd Edition, Adisson Wesley, New York, 1999.

EC	SIMULATION OF COMMUNICATION SYSTEMS AND NETWORKS	3	0	0	3
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1. **Modeling of Communication System** : Model of Speech and Picture Signals, Pseudo Noise Sequences, Non-linear Sequences, Analog Channel Model, Noise and Fading, Digital Channel Model - Gilbert Model of Busty Channels, HF, Troposcatter and Satellite Channels, Switched Telephone Channels, Analog and Digital Communication System Models, Light Wave System Models. **12 0 0**
2. **Simulation of Random Variables and Random Process** : Univariate and Multivariate Models, Transformation of Random Variables, Bounds and Approximation, Random Process Models -Markov AND aARMA Sequences, Sampling rate for Simulation, Computer Generation and Testing of Random Numbers. **12 0 0**
3. **Estimation of Performance Measures** : Quality of an Estimator, Estimator for SNR, Probability Density Functions of Analog Communication System, BER of Digital Communication Systems, Monte Carlo method and Importance Sampling Method, Estimation of Power Spectral Density of a Process. **12 0 0**
4. **Communication Networks** : Queuing Models, M/M/I and M/M/I/N Queues, Little Formula, Burkes Theorem, M/G/I Queue, Embedded Markov Chain Analysis of TDM Systems, Polling, Random Access Systems. **12 0 0**

5. **Network of Queues** : Queues in Tandem, Store and Forward Communication Networks, Capacity Allocation, Congestion and Flow Chart, Routing Model, Network Layout and Reliability. 12 0 0

Total 60 hrs

References :

1. M.C. Jeruchim, Philip Balaban and K. Sam Shanmugam, "Simulation of communication Systems", Plenum Press, New York, 1992.
2. A.M. Law and W. David Kelton, "Simulation Modeling and Analysis", McGraw Hill Inc., New York, 1991.
3. J.F. Hayes, "Modelling and Analysis of Computer Communication Networks", Plenum Press, New York, 1984.
4. Jerry Banks and John S. Carson, "Discrete-event System Simulation", Prentice Hall Inc., New Jersey, 1984.

	KNOWLEDGE MANAGEMENT	3	0	0	3
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1. **Introduction** : Knowledge Management (KM) – Overview – Definition and Scope. Knowledge Model : Components - Construction – Benefits from KM – Human Learning – Organisational Learning. 12 0 0
2. **Elements of KM System** : KM and New Product Development – KM Strategy – KM in Professional Service Firms – Strategic Planning for Organisational KMS – Building and Implementing a KMS. 12 0 0
3. **KM System** : Network of Practice – Communities of Practice – Expertise Knowledge Portals, Bringing about Organisational Change – Group Decision Support Systems – KMS Project Review – Organising around Knowledge – Knowledge Architecture. 12 0 0
4. **Knowledge Engineering** : Introduction, Knowledge representation using Frames, Rules and Semantic Nets – Search Algorithms. 12 0 0
5. **Knowledge Base Management** : Interface to Information System – Retrieval – Reasoning – Logic Programming – Natural Language Processing – Applications – Case Studies. 12 0 0

Total 60 hrs

References :

1. Guus Schreiber, et. al, "Knowledge Engineering and Management", University Press(I) Ltd., 2001.
2. Ganesh Natarajan & Sandhya Sekar, " KM – Enabling Business Growth", TMH(CI), 2000.

ME	TOTAL QUALITY MANAGEMENT	3	0	0	3
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1. **Concepts of TQM** : Philosophy of TQM, Customer Focus, Organisation, Top Management Commitment, Teamwork, Quality Philosophies of Deming, Crosby and Muller. 12 0 0
2. **TQM Process** : QC Tools, Problem Solving Methodologies, New Management Tools, Work Habits, Quality Circles, Bench Marking, Strategic Quality Planning. 12 0 0
3. **TQM Systems** : Quality Policy Deployment, Quality Function Deployment, Standardisation, Designing for Quality, Manufacturing for Quality. 12 0 0
4. **Quality System** : Need for ISO 9000 System, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality Costs, Quality Auditing, Case Studies, ISO 9001:2000 Quality Management System (QMS) – Manual – Implementation – IQA Certification Processes. 12 0 0
5. **Implementation of TQM** : Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi Methods, Case Studies. Total Productive Maintenance (TPM) : Philosophy and Implementation – Benchmarking – Type - Applications 12 0 0

Total 60 hrs

References :

1. John Bank, "The Essence of Total Quality Management", PHI, 1993.
2. Rose, J.E, "Total Quality Management", Kogan Page Ltd. 1993.
3. Greg Bounds, Lyle Yorks et al, "Beyond Total Quality Management", McGraw Hill, 1994.
4. Takashi Osada, "The 5S", The Asian Productivity Organisation, 1991.
5. Masaki Imami, "KAIZEN", McGraw Hill, 1986.

6. Seiichi Nakagima, "Introduction to Total Productive Maintenance", Productivity Press (India) Pvt. Ltd., 1993.

RESEARCH METHODOLOGY		3	0	0	3
1.	Concepts and Importance of Research Methodology : Meaning of Research – Objectives – Types and Importance of Research – Research Process for Applied and Basic Research.				12 0 0
2.	Research Design : Need – Concepts related to Research Design – Different Research Designs – Meaning – Importance and Scale Construction Techniques.				12 0 0
3.	Sample Design and Data Collection : Criteria for Selecting a Good Sample Design – Random Sample – Sampling Techniques – Probabilistic and Non-probabilistic Samples – Sample Size – Collection of Data – Primary and Secondary Sources – Selection of Appropriate Methods – Guidelines for Questionnaire Design and Successful Interviewing.				12 0 0
4.	Processing and Analysis of Data : Process Operations – Problems in Processing – Types of Analysis – Measures of Relationship – Factor –Cluster – Discriminate Analysis.				12 0 0
5.	Hypothesis Testing and Research Report : Basic Concepts and Procedure – Report Writing – The Role of Computers in Research – Use of Internet.				12 0 0
					Total 60 hrs

References :

1. Kothari C.R, "Research Methodology – Methods & Techniques", Wishwa Prakashan, A Division of New Age International Pvt. Ltd.
2. Donald R. Cooper and Ramela S. Schindler, "Business Research Methods", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2000.
3. Uma Sekaran, "Research Methods for Business", John Wiley & Sons Inc., New York, 2000.
4. Donald H. McBurney, "Research Methods", Thomson Asia Pvt. Ltd., Singapore.
5. Ranjit Kumar, "Research Methodology", Sage Publications, London, New Delhi, 1999.
6. Chandan J.S, Statistics for Business and Economics", Vikas