# Scheme of Teaching and Examination for M.Tech. Computer Network Engineering
(autonomous scheme: 2015-2016)

## I Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Credits (L/T/P/S)</th>
<th>C.I.A.</th>
<th>SEE</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CNE101</td>
<td>Wireless Networks</td>
<td>4+1+0+0</td>
<td>50</td>
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<tr>
<td>2</td>
<td>CNE102</td>
<td>Cryptography and Network Security</td>
<td>4+0+1+0</td>
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<td>4</td>
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<td>Elective-I</td>
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<tr>
<td>5</td>
<td>CNE12x</td>
<td>Elective-II</td>
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<tr>
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</table>

### Elective I
- CNE111 Cloud Infrastructure and Services
- CNE112 Network Flow Algorithms
- CNE113 Network Management
- CNE114 Computer Systems Performance Analysis
- CNE115 Switching and Statistical Multiplexing

### Elective-II
- CNE121 Web Technologies
- CNE122 Protocol Engineering
- CNE123 Advanced Topics in Graph Theory
- CNE124 Ad Hoc Wireless Networks
- CNE125 Mobile Computing

**Note:**
- Continuous Internal Assessment (CIA) involves both theory tests and practical evaluation.
- There will be SEE for lab component of Core subjects of I and II Semester wherever practices are associated with the subject.
- Where ever there is a combined theory and lab, students must score minimum passing marks in each of the component.
- SEE question paper will contain 2 questions from each unit. Student must answer one full question from each unit.
- M.Tech(CNE) course is an interdisciplinary course, where undergraduates from computer science, information science, electronics and communication, electrical and electronics and telecommunication engineering are eligible for admission. **However, computer**
science and information science undergraduates are encouraged to take electives, which they have not studied during their BE degree course.

- Self study components under elective subjects include referring to advanced topics related to the subject from Technical journals and giving a seminar and a write-up.
NMAM INSTITUTE OF TECHNOLOGY, NITTE  
DEPT. OF INFORMATION SCIENCE AND ENGINEERING  
SCHEME OF TEACHING AND EXAMINATION FOR  
M.TECH.COMPUTER NETWORK ENGINEERING  
(AUTONOMOUS SCHEME: 2015-2016)  

II Semester  

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Credits (L/T/P/S)</th>
<th>C.I.A.</th>
<th>SEE</th>
<th>Credits</th>
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<tr>
<td>1</td>
<td>CNE201</td>
<td>Cellular Networks</td>
<td>4+0+1+0</td>
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Total 300 250 25

Elective I
- CNE211 Information Theory and Coding
- CNE212 Advanced Digital Communication
- CNE213 Internet Routing Design Principles
- CNE214 Topics in Analysis of Computer Networks
- CNE215 Advance Network Security

Elective IV
- CNE221 Wireless Sensor Networks
- CNE222 Multimedia Communications
- CNE223 Wireless MIMO Communications
- CNE224 Digital Forensics for Networks
- CNE225 Wireless Broadband Networks
### NMAM INSTITUTE OF TECHNOLOGY, NITTE
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#### III Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Duration Practical/Field work / Assignment</th>
<th>C.I.A.</th>
<th>SEE</th>
<th>Credits</th>
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<tr>
<td>1</td>
<td>CNE301</td>
<td>Industrial Training / Mini Project / Certification exam</td>
<td>Full Time weeks 8</td>
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<td>2</td>
<td>CNE302</td>
<td>Seminar + Technical paper writing</td>
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<tr>
<td>3</td>
<td>CNE303</td>
<td>Project (Problem statement, Literature Survey, Initial Design )</td>
<td>Remaining weeks of 3\textsuperscript{rd} sem.</td>
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### IV Semester (30 Credits)

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<th>Subject</th>
<th>Duration Practical/ Field work / Assignment</th>
<th>C.I.A.</th>
<th>SEE</th>
<th>Credits</th>
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**GRAND TOTAL from 1st to 4th semester : 100 credits**
Wireless Networks

Subject Code: CNE101
Total Hours: 52

<table>
<thead>
<tr>
<th>Unit</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Unit I</td>
<td>10 Hours</td>
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<tr>
<td>Unit II</td>
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<td>Unit III</td>
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<tr>
<td>Unit IV</td>
<td>12 Hours</td>
</tr>
<tr>
<td>Unit V</td>
<td>10 Hours</td>
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</table>

Unit I

Unit II

Unit III

Unit IV

Unit V

M.Tech. in Computer Network Engineering, 2015-16
Textbooks:

1. 802.11 Wireless Networks: The definitive guide, 2nd Edition, Matthew Gast, O'Reilly Publisher, 2005. (Chapter 2, 3, 4, 5, 6, 7, 8, 10, 11, 12)


Cryptography and Network Security

Subject Code: CNE102
Total Hours: 52

Hours/ Week: 04
Exam Hours: 03

Unit I

Unit II

Unit III

Unit IV

Unit V
Internet Security Protocols and System Level Security:

Text books:


Reference Books:


Network Programming

Subject Code: CNE103
Total Hours: 52

Hours/ Week: 04
Exam Hours: 3

UNIT-I 09 Hrs
**Review of Basic Concepts:** Layering, OSI model, Processes, A simplified model, Client-Server model, A history of Unix Networking; Review of TCP/IP.

UNIT-II 11 Hrs
**Sockets:** Introduction, Unix domain protocols, socket addresses, elementary socket system calls, advanced socket system calls, reserved ports, stream pipes, passing file descriptions, socket options, asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, sockets and signals, Internet superservers, socket implementation.

UNIT-III 11 Hrs
**TFTP Protocol:** Introduction, protocol, security, data formats, connections, client user interface, UDP implementation, TCP implementation.

UNIT-IV 10 Hrs
**Remote Command Execution:** Introduction, Security issues, rcmd function and rshd server, rexec function and rexecd server.

UNIT V 11 Hrs
**Remote Login:** Introduction, Terminal line disciplines, pseudo terminal, terminal modes, control terminals rlogin overview, rlogin client, rlogin server.
**JAVA Network Programming:** Introduction, Client-Server Computing, The InetAddress class, Serving multiple clients, Applet clients, Sending and receiving objects, Retrieving objects from Web servers, Datagram Sockets

TEXT BOOKS:

REFERENCE BOOKS:
LABORATORY WORK

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple echo server and demonstrate its working. Both the server and client are to be connection-oriented and use TCP. The system works as follows: Client reads a line from the standard input and writes the line to the server; the server reads a line from its network input and echoes the line back to the client; the client reads the echoed line and prints it on its standard output.

2. Repeat the above experiment using UDP instead of TCP.

3. Repeat the Experiment 1 using JAVA network programming facilities.

4. Modify the above program such that the client sends an integer value supposed to represent the radius of a circle and the server is to compute and return the corresponding area.

5. Extend the above program such that the server responds to multiple clients.

Mini Project: Design, develop, and execute a program in C under UNIX / LINUX environment to implement any utility in TCP/IP suite like PING, TFTP etc.
Cloud Infrastructure and Services

Subject Code: CNE111
Total Hours: 52

UNIT 1

UNIT II

UNIT III
Cloud Computing Technology: Hardware and Infrastructure-client, security, network and services, Accessing the Cloud (basics to APIs)-platform, web application, web API’s and web browser, Cloud Storage-overview and cloud storage providers, standards-Application, client, infrastructure and service.

UNIT IV
Cloud Computing at Work-Software as a Service, Software plus Services, Developing Applications-Google, Microsoft, cast iron cloud, bungee connect, Local Clouds and Thin Clients- virtualization in your organization, Migrating to the Cloud-which applications do you need, sending existing data and use the wave approach, Best Practices- finding right vendor, phased-in vs flash-cut approach and be creative in your approach.

UNIT V
Governing the cloud-deciding on a governor, knowing risk, measurement methods, making it work. Virtualization and the cloud-s/w, h/w provisioning, security issues Managing desktop and devices in the cloud-Virtualizing desktop, putting desktop in cloud, managing desktop SOA and cloud-SOA characteristics, caching enterprise service bus, serving business with SOA and cloud.

TEXT BOOKS:
2. Cloud Computing, A Practical Approach , Toby Velte, Anthony Velte, Rober Elsenpeter, PUBLISHER: Tata McGraw-Hill Authors(Unit 2,3,4)
3. Cloud Computing for Dummies- Judith Hurwitz, Robin Bloor.(Unit 5)
REFERENCE BOOK:
Network Flow Algorithms

Subject Code: CNE112                  Hours/ Week: 04
Total Hours: 52                      Exam Hours: 3

Unit I                                  8 Hrs


Unit II                                 12 Hrs


Unit III                                10 Hrs

Maximum and Minimum Flow Algorithms

Unit IV                                 10 Hrs


Unit V                                  12 Hrs


Text Book:

Reference Books:

Network Management

Subject Code: CNE113  
Hours/ Week: 04
Total Hours: 52  
Exam Hours: 3

UNIT-I  
10 Hrs
Data Communications and Network Management Overview
Analogy of telephone network, Data and telecommunication network, Distributed computing environment, Internet, Protocols and standards, IT management, Network and system management, Current status and future of network management

UNIT-II  
10 Hrs
Basic Foundations: Standards, Models, and Language
Network Management Standards, Network Management Model, Organizational Model, Information Model, Communication Model, Abstract Syntax Notation One, TLV Encoding, Functional Model.

UNIT-III  
10 Hrs
SNMPv1 Network management: Organization and Information Models

UNIT-IV  
12 Hrs
SNMP Management: RMON
What is Remote Monitoring? RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, Case Study, Case Study Results

UNIT-V  
10 Hrs
Broadband Network management
ATM Technology, ATM Network management, HFC Management, DSL Technology and ADSL Management, Network management applications

Text Book:
Computer Systems Performance Analysis

Subject Code: CNE114
Total Hours: 52

Hours/ Week: 04
Exam Hours: 3

Unit I  
8 Hrs

Unit II  
8 Hrs

Unit III  
12 Hrs
Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs.

Unit IV  
10 Hrs

Unit V  
14 Hrs
Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little’s Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little’s Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm,

**Text Book:**

**Reference Books:**
Switching & Statistical Multiplexing in Telecommunications

Subject Code: CNE115
Total Hours: 52
Hours/ Week: 04
Exam Hours : 3

Unit I
10 Hrs
Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks

Unit II
10 Hrs
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization

Unit III
10 Hrs
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks.

Unit IV
12 Hrs
Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoder, Pulse Transmission, Line Coding, Time Division Multiplexing.
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

Unit V
10 Hrs

TEXT BOOKS:
Web Technologies

Subject Code: CNE121
Total Hours: 52

Hours/ Week: 04
Exam Hours: 3

Unit I
10 Hrs
HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, CSS

Unit II
10 Hrs

Unit III
10 Hrs
Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API.
Web servers: Tomcat Server installation & Testing.
Introduction to Servelets: Lifecycle of a Serverlet, JSDK The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters.

Unit IV
10 Hrs
Introduction to JSP: The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC architecture. AJAX.

Unit V
12 Hrs
JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations
Database Access Database Programming using JDBC Studying Javax.sql.* package Accessing a Database from a JSP Page Application – Specific Database Actions
Deploying JAVA Beans in a JSP Page

TEXT BOOKS:
   Dreamtech (UNIT 1,2)
2. The complete Reference Java 2 Fifth Edition ,Patrick Naughton and Herbert Schildt.,
   TMH (Chapters: 25) (UNIT 2,3)
3. Java Server Pages –Hans Bergsten, SPD O’Reilly (UNITs 3,4,5)
REFERENCE BOOKS:
1. Programming world wide web-Sebesta,Pearson
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES, Marty Hall and Larry Brown Pearson
3. Internet and World Wide Web – How to program , Dietel and Nieto PHI/Pearson.
5. Murach’s beginning JAVA JDK 5, Murach, SPD
6. An Introduction to web Design and Programming –Wang-Thomson
8. Java Server Programming, Ivan Bayross and others,The X Team,SPD
10. Beginning Web Programming-Jon Duckett WROX.
12. Java Script,D.Flanagan,O’Reilly,SPD.
Protocol Engineering

Subject Code: CNE122
Total Hours: 52

UNIT I 10 Hrs

UNIT II 12 Hrs

UNIT III 12 Hrs


UNIT IV 10 Hrs
Protocol Conformance and Performance Testing: Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Testing Multimedia Systems, quality of service test architecture(QOS), Performance Test methods, Interoperability testing, Scalability testing

UNIT V 08 Hrs
TEXT BOOKS:

REFERENCE BOOKS:
Advanced Topics in Graph Theory

Subject Code: CNE123
Total Hours : 52

Hours/ Week: 04
Exam Hours : 3

Unit I

8 Hrs

Planar Graphs: Plane and Planar Graphs, Different Representations of a Planar Graph, Euler’s Formula, Kuratowski’s Theorem, Dual of Planar Graph- Geometric Dual and Combinatorial Dual.

Unit II

10 Hrs

Directed Graphs: Directed Graphs, Types of Digraphs, Digraphs and Binary Relations, In Degree and Out Degree, Bruijn Sequence, Tournaments, Traffic Flow-The Hopcroft and Tarjan Algorithm.

Unit III

12 Hrs


Unit IV

12 Hrs


References:

Ad hoc Wireless Networks

Subject Code: CNE124
Total Hours: 52
Hours/ Week: 04
Exam Hours: 3

Unit I 08 Hours

Review of Wireless Networks: IEEE802.11 Standard, Basic MAC layer mechanisms, CSMA/CA mechanisms and other MAC layer functionalities.

Unit II 10 Hours


Unit III 10 Hours

Table drive routing protocol: DSDV, WRP, CHGWS. On-demand routing protocol: DSR, AODDV, LAR, FORP.
Hybrid routing protocol: CEDAR, ZRP. Routing protocols with effective flooding mechanisms: PLBR. Hierarchical routing protocols: FSR. Metrics used by power aware routing protocols.

Unit IV 10 Hours


Unit V 10 Hours


M.Tech. in Computer Network Engineering, 2015-16 Draft
Textbooks:

Reference Books:
Course Description:
This course introduces the concepts of Mobile computing. It mainly focuses on theory and design aspects mobile network and computing issues.

Objectives:
The main objective of the course is to learn the computing concepts of mobile networking. Focus is given on issues related mobile computing and solutions available for each issues.
After completion of the course the students will be able to
- Identify basic protocols of mobile networks
- Explain the computing concepts of mobile networks
- Know to perform performance comparison of mobile networks

UNIT I 10 Hrs
Introduction to mobile computing: Mobile Technologies, Anatomy of a Mobile Device, Survey of Mobile Devices Applications of Mobile Computing
Types of Mobility: Mobility in cellular based wireless network: channel allocation, interferences, handoffs and location management. IP mobility: Mobile IP and IDMP

UNIT II 12 Hrs
Impacts of mobility and portability in computational model and algorithms for mobile environment: Disconnected operation. Analysis of algorithms and termination detection.

UNIT III 12 Hrs
Application Design: Context, Information Architecture, Design Elements, Mobile Web vs Native Applications

UNIT IV 10 Hrs
Mobile Databases and Handover Management: Indexing in Air, Mobile Databases and transaction. Handover management, location management, registration, tunneling and encapsulation, route optimization, dynamic host configuration
Logical mobility: Migrating processes, mobile agents

UNIT V 08 Hrs
Next era: Cloud Computing

TEXT BOOKS:
REFERENCE BOOKS:
Cellular Networks

**Subject Code:** CNE201  
**Total Hours:** 52  
**Hours/ Week:** 04  
**Exam Hours:** 3

**UNIT I**  
11 Hrs  
Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications  
Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

**UNIT II**  
11Hrs  
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  
Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.

**UNIT III**  
10 Hrs  

**UNIT IV**  
10 Hrs  
Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols, Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems

**UNIT V**  
10 Hrs  

**TEXT BOOKS:**  

M.Tech. in Computer Network Engineering, 2015-16  
Draft
REFERENCE BOOKS:

LABORATORY WORK

1. Using any package like MATLAB or using any programming language of your choice, implement the BPSK algorithm and study its performance.
2. Repeat the above experiment for QPSK algorithm and compare its performance with that of BPSK.
3. Using any Network simulation package or using any programming language of your choice, implement and study the performance of PRMA.
   i. Mini Project: Using any platform like ANDROID, J2ME etc, implement any mobile application like Location Based Services, Emergency Services, Remote Monitoring etc.
Advanced Computer Networks

Subject Code: CNE202  
Total Hours: 52  
Hours/ Week: 04  
Exam Hours: 3

Unit 1  
8 Hrs  

Unit 2  
12 Hrs  
Direct Link Networks: Physically Connecting Hosts, Hardware Building Blocks: Nodes, Links, Encoding: (NRZ, NRZI, Manchester, 4B/5B), Framing: Byte-Oriented Protocols (PPP), Bit-Oriented Protocols (HDLC), Clock-Based Framing (SONET), Error Detection: Two-Dimensional Parity, Internet Checksum Algorithm, Cyclic Redundancy Check, Reliable Transmission: Stop-and-Wait, Sliding Window, Concurrent Logical Channels, Token Rings: (802.5, FDDI, RPR), Token Ring Media Access Control, Token Ring Maintenance, FDDI, Resilient Packet Ring (802.17), Wireless(802.11), Bluetooth (802.15.1), Wi-Fi (802.11), WiMax (802.16), Cell Phone Technologies.

Unit 3  
12 Hrs  

Unit 4  
12 Hrs  

Unit 5  
8 Hrs  
Data Compression: Lossless Compression Algorithms, Image Compression (JPEG), Video Compression (MPEG), Transmitting MPEG over a Network, Audio Compression (MP3). Applications: Name Service (DNS), Traditional Applications: Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Network Management (SNMP).

Text Books:

M.Tech. in Computer Network Engineering, 2015-16  
Draft
Optical Networks

Subject Code: CNE203
Total Hours: 52

UNIT I  14 Hrs

Introduction: Three generations of Digital Transport Networks; Key Optical Nodes; Other Key Terms; Key attributes of Optical Fiber: Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion; Lasers.

Timing and Synchronization: Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and DS1; Timing Downstream Devices; Building Integrated Timing Supply; Synchronization Status Messages and Timing Loops.

UNIT II  08 Hrs

SONET and SDH: Introduction; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; The Overhead Bytes; SONET and SDH Concatenation.

Architecture of Optical Transport Networks: The Digital Wrapper; Control Planes; In-Band and Out-Band Control Signaling; The OTN Layered Model; Encapsulation and Decapsulation Operations; Generic Framing Procedure

UNIT III  12 Hrs

WDM: The WDM Operation; DWDM, TDM and WDM Topologies; Relationship of WDM to SONET / SDH; EDF; WDM Amplifiers; Add-Drop Multiplexers; WDM Cross-Connects; Wavelength Continuity Property; Examples of DWDM Wavelength Plan; Higher Dispersion for DWDM; Tunable DWDM Lasers.

Network Topologies and Protection Schemes: The Non-Negotiable Requirement Robust Networks; Diversity in the Network; Line and Path Protection Switching; Types of Topologies; Working and Protection Fibers; Point-to-Point Topology; BLSR; Protection Switching on Four-Fiber BLSR; Meshed Topologies; PONs; Ethernet in the Wide Area Backbone? Metro Optical Networking

UNIT IV  12 Hrs

Architecture of IP and MPLS-Based OTNs: IP, MPLS, and Optical Control Planes; Interworking the three Control Planes; Management of the Planes; A Framework for the IP over Optical Networks; The Link Management Protocol (LMP): Basic functions of LMP; Control Channel Management; Link Property Correlation; Fault Management; Extending LMP operations for Optical Link Systems.

Optical Routers: Optical Switching; Evolution of Switching Networks; Optical Router; Optical Switching Technologies; Optical Resources; Protecting The Label Switched Paths; Protection of the OSP; Wavelength OSP and MPLS LSP; Nesting the LSPs and OSPs; Topologies for a Node Failure; Plane Coupling and De-Coupling; Approach to the Problem of LSP and OSP Interworking; MEMS and Optical Switching; Thermo-Optic Switches.

UNIT V  06 Hrs

ATM versus IP in Optical Internets: IP over ATM over SONET; The OSI and Internet Layered Models; ATM in the SONET / SDH Payload Envelope; PPP in the SONET Payload Envelope; Encapsulation / Framing Rules; The PPP Packet; The ATM versus IP; Overhead of IP M.Tech. in Computer Network Engineering, 2015-16

Draft
and ATM; Three encapsulation methods. ASON Operation at the UNI and NNI: Objectives of ASON; UNI and NNI; Types of Connections; NNI; UNI and NNI Signaling Services. Evolving to 3G Architecture: Migration of IP Optical Networking; IP and the Optical Backbones; Placing MPLS into the Picture; Putting it together

TEXT BOOKS:
1. Uyless Black: Optical Networks, Pearson Education Asia, 2002

REFERENCES:
Information Theory and Coding

Subject Code: CNE211
Total Hours: 52
Hours/ Week: 04
Exam Hours: 3

UNIT – I 10 Hrs
INFORMATION THEORY AND CHANNEL CAPACITY: Introduction, Measure of Information, Average Information Content of Symbols in Long Independent Sequences, Average Information Content of Symbols in Long Dependent Sequences, Mark-off Statistical Model for Information Sources. Entropy and Information Rate of Mark-Off Sources.

UNIT – II 10 Hrs
Encoding of the Source Output, Shannon’s Encoding Algorithm, Communication Channels, discrete Communication Channels, Rate of Information Transmission Over a Discrete Channel, Capacity of a Discrete Memory Less Channel, discrete Channels with Memory Continuous Channels, Shannon Hartely Law and its Implications.
(Text 1: Chapter 4 : Section 4.1)

UNIT – III 10 Hrs
FUNDAMENTAL LIMITS ON PERFORMANCE: Some Properties of Entropy, Extension of a DMS, Prefix Coding, Source Coding Theorem, Huffman Coding, Mutual Information, Properties of Mutual Information, Differential Entropy and Mutual Information for Continuous Ensembles.
(Text 2, Chapter 2: Section 2.1 to 2.9)

UNIT – IV 10 Hrs
ERROR CONTROL CODING: Rationale for Coding and Types of Code, Discrete Memory less channels, Examples of Error Control Coding, Methods of Controlling Errors, Types of Errors, Types of Codes, Linear Block Codes, Error Detection and Error Correction Capabilities of Linear block codes. Single Error Correcting Hamming Codes, Lookup Table (or Syndrome) Decoding using Standard Array, Binary Cyclic Codes, Algebraic Structures of Cyclic Codes.

UNIT – V 12 Hrs
Encoding using an (n-k) Bit Shift Register, Syndrome Calculation, Error Detection and Error Correction, BCH Codes, RS Codes, Golay Codes, Shortened Cyclic Codes, Burst Error Correcting Codes, Shortened Cyclic Codes, Burst Error Correcting Codes. (Text 1, Chapter 9, Section 9.1 to 9.4) Convolution Codes, Time Domain Approach, Transfer Domain Approach, State, Tree and Trellis diagrams, Encoders and Decoders (using Viterbi algorithm only) for (n,k,l) Convolution Codes. (Text 2, Chapter 8 : Section 8.5 to 8.6)

TEXT BOOKS:
REFERENCE BOOKS:
Advanced Digital Communication

Subject Code: CNE212
Total Hours: 52

UNIT I


UNIT II


UNIT III

Brief Review of digital communication systems: Elements of Digital communication systems; Communication channels and their characteristics; Historical perspective in the development of digital communication; Review of the features of a decreases memory less channel and the channel capacity theorem

UNIT IV


UNIT V

Base band Shaping for data transmission: Discrete PAM signals, Inter-symbol interference (ISI) Nyquist criterion for distortion-less Base band binary transmission, correlative coding, Eyepattern, transmission, correlative coding, Eyepatterns Based and M-ary PAM system, Adoptive Equalization, The zero forcing algorithm, The LMA algorithm

TEXT BOOKS:

REFERENCE BOOKS:
Internet Routing Design Principles

Subject Code: CNE213

Total Hours: 52

Hours/ Week: 04

Exam Hours: 3

Unit I


Unit II


Unit III


Unit IV


Unit V


Text Books:

Topics in Analysis of Computer Networks

Subject Code: CNE214
Total Hours: 52

Hours/ Week: 04
Exam Hours: 3

Unit I
8 Hrs
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

Unit II
10 Hrs
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

Unit III
10 Hrs
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

Unit IV
12 Hrs
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

Unit V
12 Hrs
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive Window Protocol; Bandwidth sharing in a Network.

TEXT BOOKS:

REFERENCE BOOKS:
Advance Network Security

Subject Code: CNE215
Hours/Week: 04
Total Hours: 52
Exam Hours: 3

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

**Text Books:**

Wireless Sensor Networks

Subject Code: CNE221
Total Hours: 52

Course Description:
This course introduces provides an essential study of issues and methods in wireless sensor networks, which are composed of either fixed or mobile devices employing various wireless sensor network communication schemes.

Objectives:
The objective of this course is to give the student a basic knowledge about wireless sensor network, understanding issues related routing, data aggregation, routing, localization etc. After completion of the course the students will be able to

- Identify basic architecture of wireless sensor network
- Analyze the issues related to communication in wireless sensor network
- Identify the current and future trends in wireless sensor networks

UNIT I 10 Hrs
Introduction to wireless communication networks and wireless sensor networks: Basics of Wireless communication; signal propagation related issues: fading, multipath propagation, ISI, hidden and exposed terminal issues, susceptibility to errors, solutions applied (abstract only).


UNIT II 12 Hrs
Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management. protocols to be studied from recent research papers for solving localization and positioning issues from recent research papers.

UNIT III
Link Layer Protocols: Issues in designing the link layer protocols, Selected protocols to be studied from recent research papers

Network Protocols: Issues in designing MAC protocol for WSNs, Why current MAC protocols for wired or wireless scenarios can not be reused? – A feasibility study. Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Selected protocols to be studied from recent research papers
UNIT IV
Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. Selected protocols to be studied from recent research papers

Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Study of representative data aggregation protocol from each class. Selected protocols to be studied from recent research papers

UNIT V
Security issues: How security issues of WSN are different from that of other wired or wireless scenarios? Issues in providing security for WSNs. Attacks and countermeasures. Selected protocols to be studied from recent research papers
Recent trends: Introduction to multimedia sensor networks, architecture, functioning, and applications. Mobile Agents: concepts, and uses and discussion of relevant protocol from research papers

TEXT BOOKS:

REFERENCES:
Multimedia Communications

Subject Code: CNE222
Total Hours: 52
Hours/ Week: 04
Exam Hours : 3

UNIT I

UNIT II

UNIT III
Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.

UNIT IV
Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:
Wireless MIMO Communications

Subject Code: CNE223                  Hours/ Week: 04
Total Hours: 52                      Exam Hours: 3

Unit I

Unit II

Unit III

Unit IV

Unit V

Reference Books:
Digital Forensics for Networks

Subject Code: CNE224
Total Hours: 52

Hours/ Week: 04
Exam Hours: 3

Unit I

Unit II
*Capturing Network Traffic:* The Importance of DHCP Logs, Using TCPDump/WinDump, Using Wireshark, Using SPAN Ports or TAPS, Using Fiddler, Firewalls, Placement of Sensors.
*Using Snort for Network-Based Forensics:* IDS Overview, Snort Architecture, Snort Preprocessor Component, Snort Detection Engine Components, Network Forensics Evidence Generated with Snort

Unit III
*Other Network Evidence:* Overview of Botnets and Other Network-Aware Malware, Temporal, Relational, and Functional Analyses and Victimology, First Responder Evidence, Dynamic Evidence Capture, Malware Analysis: Using Sandbox Technology.
*Deciphering a TCP Header:* OSI and TCP Reference Models, TCP Header, Decipherment of a TCP Segment, TCP Signature Analysis.

Unit IV
*NetWitness Investigator:* NetWitness Investigator Architecture, Import/Live Capture Network Traffic, Collections, Parsers, Feeds, and Rules, Navigation Views, Data Analysis, Exporting Captured Data

Unit V

References:
UNIT 1
Orthogonal Frequency-division multiplexing and other clock based transmissions; Wireless communication systems, Block-based Transmissions, Orthogonal Frequency-division Multiplexing Systems, Single-carrier Cyclic Prefix Systems, Orthogonal Frequency-division Multiple Access, Single-carrier Frequency-division Multiple Access, CP-based Code Division Multiple Access, Receiver Design.
Ultra wideband: Introduction, Time-Hopping Ultra wideband, Direct-Sequence Ultra wideband, Multiband, Other Types of UWB.

UNIT 2
Mobility Resource Management: Types of Handoffs, Handoff Strategies, Channel Assignment Schemes, Multiclass Channel Assignment Schemes, Location Managements, Mobile IP, Cellular IP, HAWAII.

UNIT 3
Radio Resource Management for Wireless Broadband Networks: Packet Scheduling, Admission Control,

UNIT 4
Ad Hoc Wireless Sensor Networks (WSNs), Communication Coverage, Sensing Coverage, Localization Routing, Function Computation, Scheduling, S-MAC, IEEE 802.15.4 (Zigbee)

UNIT 5
Wireless Local Area Network: Network Architectures, Physical Layer of IEEE802.11n. Medium Access Control, Mobility Resource Management, Quality of Services, Applications.
Convergence of Networks: 3GPP/WLAN Interworking, IEEE 802.11u, Interworking with External Networks, LAN/WLAN/WiMax/3G Interworking based on IEEE 802.22 Media Independent Handoff, Future Cellular/WiMax/WLAN/WPAN Interworking, Analytical Model for Cellular/WLAN Interworking.
Text Books: