

# Master of Science - Network Technology & Management

## Syllabus - First Semester

### COMPUTER PROGRAMMING IN C LANGUAGE

Course Code: NTM4101

Credit Units: 03

#### Course Objective:

This course provides an introduction to C programming, focusing on the C basic feature, syntax, structure and implementation. The C programming language exposes details of how the underlying hardware stores data and executes software. It is commonly used in situations where there is no support for higher-level languages — e.g., operating systems, device drivers, and embedded systems Functions. Array, Pointer and File System are the important contents of the syllabus.

#### Learning Outcomes:

- Upon successful completion of this course, the student should
- Be able to implement, test, debug, and document programs in C and C++
- Program with pointers and arrays, perform pointer arithmetic, and use the pre-processor
- Be able to write programs that perform explicit memory management
- Understand how to write and use functions, how the stack is used to implement function calls, and parameter passing options
- Understand and use the common data structures typically found in C programs — namely arrays, strings.

#### Course Contents:

##### Module I: Introduction to C

History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

##### Module II: Decision Making and Looping

C Statements, Decision making with if statement , if-else, nesting of if, switch and break, Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types (automatic, register etc.), predefined processor.

##### Module III: Arrays and Functions

One dimensional arrays , declaration and initialization of one dimensional arrays, 2-D arrays Use in matrix computations, passing array to function, memory map of 2-D array  
Concept of Sub-programming, functions , Example of user defined functions. Function prototype, Return values and their types, function call, function argument, call by value, call by reference, recursion.

##### Module IV: Pointer and Strings

Fundamentals of Pointers, Declaration of a Pointer Variable, Passing Pointers to a Function. Pointers and One Dimensional Array, Dynamic Memory Allocation, Operations on Pointers, Array of Pointers, Passing Functions to Other Functions.  
Introduction of Strings, declaration and initialization of string variables and C string library functions.

### **Module V: Structure and File Management in C**

Structure and Union. Defining C structures, declaring structure variables, accessing structure members, Structure Initialization, Array of structure, Nested structure, structure and pointers  
File Management in C: introduction, defining and opening a file, closing a file, input/output operation on files, file opening modes, text file and binary file programs.

#### **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

#### **Text:**

- “ANSI C” by E Balagurusamy
- YashwantKanetkar, “Let us C”, BPB Publications, 2<sup>nd</sup> Edition, 2001.

#### **References:**

- Kernighan & Ritchie, “C Programming Language”, The (Ansi C Version), PHI, 2<sup>nd</sup> Edition.
- J. B Dixit, “Fundamentals of Computers and Programming in ‘C’.
- Herbert Schildt, “C: The complete reference”, Osbourne Mcgraw Hill, 4<sup>th</sup> Edition, 2002.
- V. Raja Raman, “Computer Programming in C”, Prentice Hall of India, 1995.
- Gottfried, “Schaum’s Outline series in C Programming”, McGraw Hill.

# OPERATING SYSTEM

**Course Code: NTM4103**

**Credit Units: 03**

## **Course Objective:**

- Learn the role of operating systems.
- Learn the theory underlying how operating systems are implemented and the implications of resulting design choices.
- It emphasizes the basic concepts of OS organization and structure, processes and threads, synchronization, memory management and file systems.
- To learn about the state-of-art Operating systems used in form of case studies.

## **Learning Outcomes:**

- This course will provide the students with an in-depth understanding of the process management of LINUX & Windows Operating systems running on a uni-processor machine.
- The students must be able to distinguish different styles of operating system design.
- The students must understand device and I/O management functions in operating systems as part of a uniform device abstraction.
- The students will have an understanding of disk organization and file system structure.
- The students will be able to give the rationale for virtual memory abstractions in operating systems.
- They will understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.

## **Course Contents:**

### **Module-I: Introduction**

Significance & Industry relevance of course. Basic Concepts, functions of operating systems, Overview of various Operating Systems, System Calls and operating system services.

### **Module-II: Process management**

Process concept, process scheduling, and operation on processes; CPU scheduling, scheduling criteria, Scheduling algorithms, Process synchronization: Critical Section Problems, synchronization hardware, semaphores, The dining-philosophers problem. Threads.

### **Module-III: Principles of Deadlock**

System Model for deadlocks, Deadlock Characterization, Methods for handling Deadlocks: prevention, avoidance and detection, deadlock recovery.

### **Module-IV: Memory Management**

Address Space, swapping, contiguous Memory allocation, non-contiguous memory allocation, paging and segmentation techniques, Segmentation with paging; virtual memory management - Demand Paging & Page-Replacement Algorithms.

### **Module-V: File & I/O Systems**

I/O management & disk scheduling and management, file concept, file organization & access mechanism.

### **Module-VI: Advance Operating System: Case Study**

Cloud Operating System, Mobile Operating System, Linux, Windows, UNIX, Overview of Distributed Operating System.

**Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT1</b>	<b>A/C/Q</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:**

**Text:**

- Operating System Concepts by Silberchatz et al, 6th edition, 2002, Addison-Wesley.
- Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.

**References:**

- Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice – Hall
- Operating Systems By Deitel, 1990, AWL.

# NETWORK FUNDAMENTALS

**Course Code: NTM4105**

**Credit Units: 03**

## **Course Objective:**

The goal of CCNA Exploration Network Fundamentals course is to introduce you to fundamental networking concepts and technologies. The course aims at training the student for the following: Install, maintain, and troubleshoot computer hardware; connect a variety of peripherals to a PC and correctly configure them. This course will assist you in developing the skills necessary to plan and implement small networks across a range of applications.

## **Learning Outcomes:**

Upon completion of the course, the student will be able to:

- Demonstrate the understanding of computer hardware and networking devices.
- Describe the protocols and services provided by the application, transport, network, data link and physical layers in the OSI model and describe how these layers operate in various networks.
- Explain the importance of communications and data networks in supporting business communications and everyday activities.
- Connecting and configuring computers, switches, and routers into an ethernet LAN.
- Identify various network media needed to make successful LAN and WAN connections and their distinct roles.
- Design, calculate, and apply subnet masks and addresses to fulfill given requirements. Explain the fundamental concepts of routing

## **Course Contents:**

### **Module I: Network Devices & Hardware**

Introduction to Computer components- CPU, Motherboard types, NIC, RAM categories, storage devices, BIOS and CMOS, boot process, Installation, configuration and troubleshooting of system components.

Introduction to Network hardware- Workstation, printer, Server, UPS. Cable types, Networking devices and their role- Hub, repeater, amplifier, bridge, switch, router, gateway, firewall, multiplexer, demultiplexer, modem, wireless Access Point.

### **Module II: Introduction to Networks & OSI Model**

Elements of Network, Introduction to different types of Networks-LAN, WAN, MAN, SAN and others, Network topologies, OSI Model and functionality of each layer of OSI model, data entities at each layer- Segment, packet and frame. Protocols and services supported by OSI layers, Application layer protocols- HTTP, FTP, TFTP, ICMP, DNS, DHCP, Telnet, SSH, SMTP, POP, IMAP etc.

### **Module III: OSI Transport and OSI Network layer**

Role of transport layer, TCP-communicating with reliability, UDP- Communicating with low overhead, IPv4, IPv4 addresses for different purposes, assigning addresses, calculating addresses, sub-netting, Routing- handling data packets.

### **Module IV: OSI Data Link and OSI Physical layer**

Accessing the Media, MAC techniques for shared and non-shared media, MAC- addressing and framing data, Overview of Ethernet, ARP; LANs-Making the Physical connections (topological design), Device Selection Factors, Device Interconnecting.

### **Module V: Configuring and Troubleshooting**

Configuring CISCO devices –IOS basics, applying a Basic Configuration using CISCO IOS, Verifying Connectivity; Common symptoms and problems with hardware. Isolating problems using error codes, POST audible/visual codes. Troubleshooting procedures, Troubleshooting commands for IOS.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>PR.</b>	<b>ATTD.</b>	<b>EE</b>
<b>Weightage (%)</b>	10	15	5	70

**Text & References:**

**Text:**

- Network Fundamentals: CCNA Exploration Companion Guide (CiscoNetworking Academy).
- A+ Guide to PC Hardware Maintenance and Repair, Volume 1, By Michael W. Graves.

**References:**

- Data Communications and Networking by Behrouz Forouzan, 3e, Tata McGraw-Hill
- Computer Networks by Andrews S. Tanenbaum, 4e, Pearson Education.
- Computer Networking for LANS to WANS: Hardware, Software and Security by Kenneth C. Mansfield, Jr., James L.

# MOBILE COMPUTING

**Course Code: NTM4106**

**Credit Units: 03**

## **Course Objective:**

The objective of this consortium is to shape and expand a full-scale and sound mobile computing system market. To achieve this, cooperation is required of interests related to communication (network), computer hardware/software, system integrators (including service providers), and the media.

## **Learning Outcomes:**

- Learning of concepts of Mobile computing system
- Knowledge of Computer network system
- Understanding of mobile services

## **Course Contents:**

### **Module I: Introduction to Personal Communications Services (PCS)**

PCS Architecture, Mobility management, Networks signaling, Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

### **Module II: General Packet Radio Services (GPRS) & Wireless Application Protocol (WAP)**

GPRS Architecture, GPRS Network Nodes, Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP, Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML).

### **Module III: Third Generation (3G) Mobile Services**

Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G, Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

### **Module IV: Global Mobile Satellite Systems : Case studies**

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems.

### **Module V: Enterprise Networks**

Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. Advanced techniques in mobile computing.

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

## **Text & References:**

### **Text:**

- “Wireless and Mobile Networks Architectures”, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.
- “Mobile and Personal Communication systems and services”, by Raj Pandya, Prentice Hall of India, 2001.

**References:**

- “Guide to Designing and Implementing wireless LANs”, by Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
- “Wireless Web Development”, Ray Rischpater, Springer Publishing, 2000.
- “The Wireless Application Protocol”, by Sandeep Singhal, Pearson Education Asia, 2000.
- “Third Generation Mobile Telecommunication systems”, by P.Stavronlakis, Springer Publishers, 2001.

# DATA COMMUNICATION AND COMPUTER NETWORKS

Course Code: NTM4110

Credit Units: 03

## Course Objective:

The objective is to acquaint the students with the basics of data communication and networking. A structured approach to explain how networks work from the inside out is being covered. The physical layer of networking, computer hardware and transmission systems have been explained. In-depth application coverage includes email, the domain name system; the World Wide Web (both client- and server-side); and multimedia (including voice over IP).

## Learning Outcomes:

- Understand Data Communications System and its components.
- Identify the different types of network topologies and protocols
- Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
- Identify the different types of network devices and their functions within a network
- Understand and building the skills of subnetting and routing mechanisms.
- Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

## Course Contents:

### Module I: Introduction

Introduction to computer networks, evolution of computer networks and its uses, reference models, example networks, The physical layer: transmission media, wireless transmission, PSTN, communication satellites.

### Module II: The data link layer

Data link layer design issues, error detection and correction, Cyclic codes, data link protocols, sliding window protocols, example of data link protocols- HDLC, PPP Access.

### Module III: Medium access layer

Channel allocation problem, multiple access protocols, ALOHA, CSMA/CD, CSMA/CA, IEEE Standard 802 for LAN and MAN, Bridges, Wireless LANs. Introduction to wireless WANs: Cellular Telephone and Satellite Networks, SONET, Virtual-Circuit Networks: Frame Relay and ATM.

### Module IV: The network layer

Network layer concepts, design issues, internetworking, IPv4 & IPv6, Address mapping, ICMP, IGMP, static and dynamic routing algorithms, shortest path routing, flooding, distance vector routing, link state routing, distance vector routing, multicast routing, congestion control and quality of service,

### Module V: The transport layer

The transport services, elements of transport protocols, TCP and UDP

The application layer: Brief introduction to presentation and session layer, DNS, E-mail, FTP, WWW and HTTP.

## Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:**

Text:

- Behrouz A. Forouzan, Data Communication and Networking, Third Edition, Tata McGraw-Hill
- Computer networks: Tanenbaum, Andrew S, Prentice Hall

**References:**

- Data and Computer Communications, Seventh Edition (7th.) William Stallings Publisher: Prentice Hall
- Computer network protocol standard and interface: Uyles, Black
- Computer Networking: A Top-Down Approach Featuring the Internet (3rd Edition) by James F. Kurose

# WIRELESS NETWORKING TECHNOLOGIES

Course Code: NTM4109

Credit Units: 03

## Course Objective:

The course gives the practical and theoretical aspects of the installation, configuration and site survey preparation and other related technical requirements for the access point, bridges and antennas.

## Course Contents:

### Module I: Wireless LANs and 802.11 Specifications

What is a wireless LAN? Evolution of wireless LANs; **Wireless media, Challenges and Issues, Radio Wave Propagation:** Propagation of RF, Refraction, Reflection, Diffraction and scattering, Multipath, Path-loss **802.11 Standards:** Overview, IEEE and 802.11, IEEE 802.2 LLC review, Wireless LAN general description, Logical architecture; **802.11 MAC Layer :** MAC services, MAC frame structure, architecture, and operation, Carrier-sense mechanism, MAC-level acknowledgements, and interframe spaces; **Physical Layer (PHY):** Scope and functions, IEEE 802.11b (High-Rate) DSSS PHY specification, 802.11b modulation, IEEE 802.11a PHY specification, IEEE 802.11g PHY specification, FHSS and Infrared (IR) PHY specifications.

### Module II: Wireless Topologies

**Components: WLAN Topologies:** Wireless repeater, System redundancy and load balancing, Roaming, Scalability; **Channel Setup:** Overview, Access point coverage and comparison, Multirate implementation, Channel usage and interference; **Bridge Topologies:** Root modes, Point-to-point configuration, Point-to-multipoint configuration, Distance limitations, Bandwidth; **Sample Topologies:** Basic topologies, Campus topologies, WLAN addition to AVVID; **VLAN, QoS, and Proxy Mobile IP:** VLAN features, Quality of Service (QoS) feature, eDCF, Proxy mobile IP

### Module III: Wireless Devices

**Access Points, Access Point Connection: Basic Configuration :** Configuration summary, Setting the APs IP address and SSID, **Ethernet Port Configuration :** Overview, Ethernet identification page, Ethernet hardware page, Ethernet protocol filter page, Ethernet advanced page **AP Radio Port Configuration :** Overview, Radio port identification, Radio port hardware, Radio port filters, AP radio advanced, **Wireless Bridges:** Wireless bridging defined, Roles of a bridge in a network, Installation considerations, Distance and path loss considerations and its basic configuration, **Antennas:** Introduction, terminology, types-Dipole antenna, Discone, Ferrite rod antenna, Horn antenna, Log periodic antenna, Loop antenna overview, Parabolic reflector, Vertical antennas, Yagi antenna, Satellite antennas

### Module IV: Security and Troubleshooting

**Security Fundamentals:** WLAN vulnerabilities, WLAN threats, **Basic WLAN Security Technologies:** Wired equivalent privacy (WEP), Authentication and association; Wi-Fi Protected Access (WPA), Cisco Wireless LAN Security, Modes of unauthorized access in WLAN, Security measures to prevent unauthorized access in WLAN, **Configuring Basic WLAN Security,** Using VPNs; **Other Enterprise Security Services:** VLANs, Spanning tree, **General Approach to Troubleshooting:** Overview, Symptom - diagnosis - solution, Preparing for network failure, Network and fault management; **OSI Troubleshooting:** Model overview, Troubleshooting layers, Layer 1: media, connectors, and devices, Layer 2: bridges and switches, Layer 3: routers, Troubleshooting TCP/IP; **Diagnostic Tools**

### Module V: Emerging Technologies

**Ultra-wideband Wireless** : Overview of ultra-wideband (UWB) wireless, UWB applications, UWB acceptance, **VoIP and Voice over WLANs** : Overview of voice over IP (VoIP), Components of VoIP, Centralized and distributed VoIP architectures, The ITU-T umbrella protocol: H.323, Session Initiation Protocol (SIP), MGCP and H.248/Megaco, VoIP and Quality of Service (QoS), **Mobile Wireless** Brief history of mobile wireless, Overview of mobile wireless systems, Roaming in a mobile wireless system, Mobile wireless middleware, Wireless Application Protocol (WAP), The Open Mobile Alliance (OMA), future of mobile wireless.

#### Examination Scheme:

Components	CT1	A/C/Q	Attnd	EE
Weightage (%)	10	15	5	70

#### Text & References:

- K. Feher, Wireless Digital Communication, PH 1995 Jochen Schiller, Mobile Communication, Pearson Education
- B. Forouzan, Data Communications and Computer Networks, TH McGraw-Hill, 4<sup>th</sup> edition, 2006

# NETWORK FUNDAMENTALS LAB

Course Code: NTM4107

Credit Units: 01

## Course Contents:

- Introduction to Computer peripherals, hardware components and networking devices
- Demonstrate the use of various cable types and connectors for communication media.
- Explain common netstat
- command parameters and outputs and use netstat to examine protocol information.
- Demonstrate the use of common network statistics commands- ping, tracert, route, telnet, ipconfig etc.
- Calculate no. of subnets, subnet address, broadcast address, range of host addresses for a particular subnet from provided ip address and subnet mask.
- Basic Cisco device configuration for network devices like switch and router.
- Test different cables for type and wiring problems and become familiar with the most common functions of cable tester.
- Configure HyperTerminal to establish console session with Cisco IOS switch/ router.
- Datagram Analysis using Wireshark for TCP/UDP segment, IP packet and Ethernet frame.

## Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

## Software Requirement:

- Wireshark.
- Packet Tracer.

# COMPUTER PROGRAMMING IN C LANGUAGE LAB

Course Code: NTM4108

Credit Units: 01

## Course Contents:

1. Write a program to read 3 numbers x, y, z. Use conditional statement and evaluate values of variables a, b and c. Perform the sum with 2 set of variable. Check the sum for equality and print the sum.
2. Write a program to shift input data by 2 bits left and right.
3. Write a program to use bitwise "&" operator between 2 integer and display the result.
4. Write a program to input 6 numbers and find the biggest and smallest using nested if.
5. Write a program to enter a year and find the number of:
  - a. Minutes
  - b. Hours
  - c. Days
  - d. Months
- e. Seconds
6. Write a program to find the sum of even and odd numbers using switch, if, if..else, nested if between 1 and 20.
7. Write a program to find the numbers between 1 and 100 that are not divisible by 2, 3 and 5.
8. Write a program to enter a character (alphabetical) and display its position and its corresponding ASCII value.
9. Write a program to find the sum of its digits till the result is in single digit.
10. Write a program to print the series:  $x - x^3/3! + x^5/5! - x^7/7! \dots xn/n!$
11. Write a program to generate the following figures: Any two
12. Write a program to find the factorial of a given number with recursion & without recursion.
13. Write a program to find the roots of a quadratic equation with each condition.
14. Write a program to find numbers between 7 and 100 which is exactly divisible by 4 and is divisible by either 5 or 6.
15. Write a program to perform Arithmetic operation on an array i.e. Addition, Subtraction, Multiplication and store the result in another array.
16. Write a program to perform following string operation: with string functions & without string functions
  - a. Reverse a string
  - b. Concatenate 2 string – strcat()
  - c. Compare 2 string – strcmp(), strcmpi()
17. Write a program to display and count the number of vowels in a string.
18. Write a program to generate a palindrome.
19. Write a program to find the factorial of a number using recursion.
20. Write a program to perform different arithmetic operations using pointers
21. Write a program to obtain prime factors of any integer number using functions i.e. 24 - > 2, 2, 2, & 3.
22. Write a program to obtain Fibonacci series by using recursion & without using recursion.
23. Write a program to find the larger of the two numbers using macro with arg.
24. Write a program to count the number of character, word and lines in a text file whose name is supplied in the command line.
25. Write a program to arrange a list by using any sorting method.

**Examination Scheme:**

<b>IA</b>				<b>EE</b>	
<b>A</b>	<b>PR</b>	<b>LR</b>	<b>V</b>	<b>PR</b>	<b>V</b>
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

# Syllabus - Second Semester

## LAN SWITCHING

**Course Code: NTM4201**

**Credit Units: 03**

### **Course Objective:**

The goal of CCNA Exploration LAN Switching and Wireless course is to introduce you to develop an understanding of how switches are interconnected and configured to provide network access to LAN users. This course also teaches how to integrate wireless devices into a LAN.

### **Learning Outcomes:**

Upon completion of the course, the student will be able to:

- demonstrate understanding of implementing hierarchical network design.
- demonstrate understanding of the commands required for switch management and switch security configuration.
- distinguish between cut-through and store-and-forward LAN Switching.
- describe the benefits and operation of Virtual LANs.
- describe the operation of Spanning Tree Protocol and its benefits.
- demonstrate understanding of configuration VLAN Trunking Protocol and its benefits.

### **Course Contents:**

#### **Module I: LAN Design**

Switched LAN Architecture, Functionality of core layer, distribution layer and access layer, Principles of Hierarchical Network Design, Advantages of Hierarchical Network design over flat network, Matching Switches to Specific LAN Functions.

#### **Module II: Ethernet LAN & Basic Switch Concepts**

Introduction to Ethernet/ 802.3 LAN, Various switching techniques-store& forward switching and cut-through switching, Ethernet frame structure, Switch Management Configuration, Configuring Switch Security- password based security and switch-port security.

#### **Module III: Virtual LANs and VLAN Trunking Protocol (VTP)**

Introducing VLAN, Types of VLANs- Native VLAN, Management VLAN, Default VLAN, Voice VLAN, Data VLAN, Access mode and Trunk mode for switch interfaces, Trunking modes-On, Dynamic-desirable, Dynamic-auto, non-negotiate. Configuring VLAN and Trunks, Trouble Shooting VLANs and Trunks, VTP Concept, VTP Operation- VTP server, VTP client and VTP transparent modes, Configuring and Troubleshooting VTP.

#### **Module IV: Inter-VLAN Routing and Spanning Tree Protocol**

Introduction to Inter- VLAN Routing, Configuring Inter-VLAN Routing, Trouble Shooting Inter-VLAN Routing, Redundant Layer 2 Topology, Introduction to STP, STP Convergence, RSTP, MSTP, PVSTP, PVSTP+, Paired PVSTP+.

#### **Module V: Basic Wireless Concepts and Configuration**

The Wireless LAN, Wireless LAN Security- Open-access, WEP, WPA, WPA2, Configuring Wireless LAN Access, Trouble Shooting Simple WLAN Problems

**Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT1</b>	<b>PR</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:****Text**

- LAN Switching and Wireless, CCNA Exploration Companion Guide by Wayne Lewis.
- Cisco LAN Switching Fundamentals by David Barnes, BasirSakandar.
- Cisco LAN Switching Configuration Handbook by Stephen McQuerry, David Jansen, David

**References:**

- Cisco Networking Academy Programme CCNA 3 & 4 Engineering General, 3<sup>rd</sup>Edn by Pearson Education
- Cisco Networking Academy Programme CCNA 3 & 4 Lab Companion, 3<sup>rd</sup>Edn by Pearson Education

# LAN SWITCHING LAB

**Course Code: NTM4209**

**Credit Units: 01**

## **Course Contents:**

1. Basic switch Configuration including name, password security, switchport speed, duplex properties using IOS Command Line Interface (CLI).
2. Managing switch operating system and configuration files using tftp server backup and restoration.
3. Configuring switchport security on switch to prevent unauthorized physical access to switch ports.
4. Configuring, updating and managing Virtual LAN configurations.
5. Configuring various trunking modes on switches connected to each other in different topologies.
6. Configuring and troubleshooting VLAN Trunking Protocol (VTP) including VTP Server, VTP Client and VTP Transparent mode on various switches in a LAN topology.
7. Verify the operation of Spanning Tree Protocol on switches.
8. Configuring and troubleshooting Inter-VLAN routing and trunking for inter-VLAN communication.
9. Configuring and troubleshooting Wireless LAN using wireless access points with different SSIDs and different security features- open-access, WEP and WPA.
10. Configuring and troubleshooting Wireless LAN using wireless Linksys router connected to Ethernet switches.

## **Examination Scheme:**

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

## **Software Requirement:**

- Packet Tracer.

# ROUTING PROTOCOLS AND CONCEPTS

Course Code: NTM4202

Credit Units: 03

## Course Objective:

The goal of CCNA Exploration Routing Protocols and Concepts course is to develop an understanding of how a router learns about remote networks and determines the best path to those networks. This course includes both static routing and dynamic routing protocols.

## Learning Outcomes:

Upon completion of the course, the student will be able to:

- demonstrate the understanding of the techniques of how to configure a router.
- identify problems that each routing type encounters when dealing with topology changes and describe techniques how to resolve them.
- describe the techniques for loading and backing up IOS software image.
- demonstrate understanding static and dynamic routing and routing protocols.
- demonstrate understanding of the commands required for configuring various routing protocols and Redistribution.

## Course Contents:

### Module I: Introduction to Routing

Routing Process, Building the Routing Tables, Path Determination and forwarding packets, Types of Routing- Static Routing vs Dynamic Routing, Interior Routing vs Exterior Routing, Types of Dynamic Routing Protocols- Distance-vector Routing, Link-state Routing and Hybrid Routing.

### Module II: Introduction to Static and Dynamic Routing

Introduction, Static Routes with “Next Hop”, Addresses, Static Routes with Exit Interface, Summary and Default Static Routes, Configuring and Troubleshooting Static Routes; Classifying Dynamic Routing Protocols, Metrics, Administrative Distance, Shortest path algorithms- Dijkstra’s Algorithm and Bellman-ford Algorithm.

### Module III: Distance Vector Routing Protocols- RIPv1 & RIPv2

Introduction and operation of Distance Vector Routing Protocol- Network Discovery, Routing Table Maintenance, Routing Loops, Comparison of RIPv1 and RIPv2 Features, configuring & troubleshooting RIPv1 and RIP2.

### Module IV: Link State Routing Protocol-OSPF

Introduction and operation of Link State Routing Protocol and operation, OSPF, Basic OSPF Configuration, The OSPF metric, OSPF and Multi-access Networks.

### Module V: Hybrid Routing Protocols- EIGRP, BGP

Introduction and operation of Hybrid Routing Protocol, EIGRP operation, DUAL, EIGRP Metric Calculation, EIGRP Configuration, Exterior gateway routing protocol- BGP & Redistribution,

## Examination Scheme:

Components	CT1	PR.	ATTD.	EE
Weightage (%)	10	15	5	70

**Text & References:*****Text:***

- Routing Protocols and Concepts, CCNA Exploration Companion Guide by Rick Graziani, Allan Johnson.
- Routing Protocols and Concepts: CCNA Exploration Labs and Study Guide by Allan Johnson.
- Cisco IOS IP Configuration Guide, Release 12.2.

***References:***

- Data Communications and Networking by Behrouz Forouzan, 3e, Tata McGraw-Hill
- Computer Networks by Andrews S. Tanenbaum, 4e, Pearson Education

# ROUTING PROTOCOLS AND CONCEPTS LAB

Course Code: NTM4208

Credit Units: 01

## Course Contents:

1. Basic Router Configuration including password security, Ethernet interface configuration and Serial interface configuration using IOS Command Line Interface (CLI).
2. Configuring Static Routing with next hop address and/or exit interfaces on routers with default ing
3. Configuring and troubleshooting Routing Information protocol v1 on routers for Interior Gateway Routing.
4. Configuring and troubleshooting Routing Information protocol v2 v1 on routers for Interior Gateway Routing.
5. Configuring and troubleshooting Open Shortest Path Algorithm (OSPF) on routers for Interior Gateway Routing.
6. Configuring and troubleshooting Enhanced Interior Gateway Routing Protocol (EIGRP) on routers for Interior Gateway Routing.
7. Configuring and troubleshooting Border Routing Protocol (BGP) on routers for Exterior Gateway Routing.
8. Configuring Redistribution on routers for multiple routing protocol environments.
9. Configuring IP multicast routing on routers.

## Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

## Software Requirement:

- Packet Tracer.

# NETWORKING MANAGEMENT

**Course Code: NTM4205**

**Credit Units: 03**

## **Course Objective:**

- Students will have an understanding of network management architectures and protocols.
- Students will become comfortable with using the different TCP/IP Protocols.
- Students will be comfortable using a variety of network management tools.
- Students will be familiar with a variety of computer network security issues.
- To learn about the state-of-art Network Management used in form of case studies.

## **Learning Outcome:**

Upon successful completion of the course, a student will be able to:

- Understand the issues related to network management and data communication administration.
- Describe network management and the network management architecture
- Explain the various functions of network management.
- Gain in-depth theoretical and practical knowledge of network management, and in particular of SNMP (Simple Network Management Protocol).
- Compare a number of variations of the network management architecture.

## **Course Contents:**

### **Module I: Fundamental of Network Management and Large Enterprise Networks**

Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Managing Enterprise Networks, use of network management.

### **Module II: Network Management and SNMP(v3)**

SNMPv3 Structure. SNMPv3 Engine. SNMPv3 Applications. SNMPv3 Message Formats. MessageVersion. MessageID. MaxMessageSize. MessageFlags. MessageSecurity. Security Model Data: General. Security Model Data: Authentication Protocol. Security Model Data: Privacy Protocol. Context. PDU. SNMPv3 Security and View-Based Access Control. SNMPv3 Message Exchanges. SNMPv3 GetRequest. SNMPv3 Get-NextRequest. SNMPv3 GetBulkRequest. SNMPv3 SetRequest. SNMPv3 Notifications. Access Rights. Message Size. SNMPv3 Security. Overview of MIB. Managed Objects. Analogy for an NMS. Network Elements. Introducing MPLS, MPLS Concepts. Definition of an LSP.

### **Module III: Network Management Problem and Solutions**

Layer 2 VPN Scalability, Virtual Circuit status Monitoring, other enterprise network scalability issues, Expensive and scarcity of development skill sets, NMS development, MPLS and scalability issues, Solving the Network Management Problem filling the development skill gap, smarter MIB's, smarter NMS.

### **Module IV: Network Management Software Components**

Fault Server. Fault Server Database Tables. Fault Server Software Structure. Topology Update. Configuration Server. Secure User. Trace Files. Generic Connection Table Update. Create Network Objects. Topology Update. Configuration Server Database Tables. Configuration Server MIB Support. Configuration Server Software Structure. NE Software Distribution. NE Configuration Database Backup and Restore. NMS Database Backup, Restore, and Upgrade. Configuring NEs. Middleware. Data Representation

**Module V: Network Management Theory and Practice**

Intelligence in the network, pushing FCAPS into the network, service level network components, need for end to end security, integration with OSS LAYERS, facilitating a solution mindset.

**Examination Scheme:**

Components	A	CT1	A/C/Q	EE
Weightage (%)	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:****Text:**

- Network management, MIB, MPLS, Stephen Morris, Pearson publication
- Network Management System, William Stallings, PHI

**References:**

- Divakara K. Udupa, "Network Management Systems Essentials", McGraw-Hill.
- Alexander Clemm, "Network Management Fundamentals", Cisco Systems, Inc. Network Management System, Mani Subramaniam, P

# DISTRIBUTED SYSTEM

**Course Code: NTM4210**

**Credit Units: 03**

## **Course Objective:**

This course explains what a distributed operating system is, why you would design a system as a distributed system. It describe the problems and challenges associated with distributed systems and how handle them .

## **Learning outcomes:**

- Learn various basic concepts related to distributed system technologies
- Learn advanced architectures of different content distribution systems
- Analyse the underlying principles of distributed scalable web-server systems
- Learn the underlying principles, efficient server selection, server placement, load balancing.

## **Course Contents:**

### **Module I: Introduction**

Distributed Operating System: Introduction, System Models: Architectural models, Fundamental Models

Issues, Characterization of Distributed Systems Inherent Limitations.Lamport’s Logical Clocks, Vector Clock, Global State, Orphan Messages, Domino Effect, ChandyLamort’s Algorithm, Koo-Toueg Algorithm,

### **Module II: Distributed Mutual Exclusion**

Introduction, Classification of distributed mutual exclusion algorithms, Lamppost’s Algorithm , The Ricart –Agarwala Algorithm , Suzuki- Kasamis Broadcast Algorithm , Raymond’s Tree-Based Algorithm, A Comparative Performance Analysis

### **Module III: Synchronization in Distributed System**

Deadlocks in Distributed Systems, Centralized Deadlock- Detection Algorithms, Distributed Deadlock Detection Algorithm’ Path Pushing Algorithm, Edge Chasing Algorithm, Diffusion Computation Based Algorithm.

Distributed Scheduling: Issues in Load Distributing. Components of a Load Distributed Algorithm, Stability, and Load Distributed Algorithms: Sender Initiated Algorithms, Receiver Initiated Algorithms, Symmetrically Intimated Algorithms, Adaptive Algorithms.

### **Module IV: Distributed Shared Memory**

Introduction, Architecture & Motivation Algorithms for Implementing DSM: The Central – Server Algorithms, The Migration Algorithms, The Read – Replication Algorithms, The Full-Replication Algorithms. Memory Coherence, Coherence Protocols: Write Invalidate Protocol, Write Update Protocol, Design Issues: Granularity , Page Replacement

### **Module V: Concurrency Control Algorithms**

Basic Synchronization Primitives, Two –Phase Locking Protocol, Timestamp Based Algorithms, Two –Phase Commit Protocol. Voting Protocols: Static Voting, Majority Based Dynamic Voting Protocol.

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:****Text:**

- Singhal& Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
- Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.

**References:**

- Ajay D Kshemkalyani, MukeshSignal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge
- George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth

# WIRELESS AD HOC NETWORKS

**Course Code: NTM4211**

**Credit Units: 03**

## **Course Objective:**

The goal of Wireless Ad Hoc Networks course is to introduce the students about wireless networks and routing protocols at network layers. The students will get benefit by understanding the routing techniques and challenges in networks such as security, QoS, Energy management etc. This course will assist in developing the skills necessary to develop an ad hoc networks and its real-world applications.

## **Learning Outcomes:**

- Learning the concept of Wireless ad hoc networks and their applications.
- Understanding of Routing protocols at network layer.
- Knowledge to explore challenges in ad hoc networks with theory and practical.

## **Course Contents:**

### **Module I: AD HOC NETWORKS**

Wireless Networks, Wireless Ad Hoc networks, Applications and Challenges, Types of Ad Hoc Networks: Mobile Ad Hoc Network (MANET), Wireless Sensor Networks (WSN).

### **Module II: ROUTING PROTOCOLS**

Routing concepts, Issues in Designing a Routing Protocol for Wireless Ad Hoc Networks, Classifications of Routing Protocols: Flat, Hierarchical and Geographical Protocols: Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), Optimized Link State Routing Protocol (OLSR) and On Demand Protocols– Ad Hoc On Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Zone Routing Protocols (ZRP) etc.

### **Module III: SECURITY IN AD HOC NETWORKS**

Security in Wireless Ad Hoc Networks, Requirements Issues and Challenges in Security Provisioning – Network Security Attacks, Key Management and Secure Routing protocols in Wireless Ad hoc Networks.

### **Module IV: QUALITY OF SERVICE**

Meaning of QoS, Issues and Challenges in Providing QoS in Wireless Ad hoc Networks: Classifications of QoS Solution: MAC Layer Solutions, Network Layer Solutions: QoS Frameworks for Wireless Ad hoc Networks.

### **Module V: ENERGY MANAGEMENT**

Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes: Transmission Power Management Schemes, System Power Management Schemes.

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text :**

- C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks, Architectures and Protocols”, Prentice Hall, PTR, 2004.
- C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.
- Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
- Stefano Basagni, Marco Conti, Silvia Giordano , Ivan Stojmenovic , S. Basagni, “Mobile Ad Hoc Networking”, Wiley & Sons, 2010.

**References:**

- KazemSohraby, Daniel Minoli and TaiebZnati, “Wireless Sensor Networks Technology Protocols and Applications”, John Wiley & Sons, 2007.
- Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Elsevier publication, 2004.

# WIRELESS AD HOC NETWORK LAB

Course Code: NTM4213

Credit Units: 01

## Course Contents:

This exercise will focus on wireless network simulation. Many network simulation softwares are available (e.g. NS, OPNET, QUALNET, OMNET etc.) for simulating the wireless topologies with different routing protocols. In wireless network lab, students will create various network topologies and then by using different routing algorithms DSDV, DSR, AODV etc. students will test the network performance parameters.

## Exercises:

- Installing Network Simulator in Fedora/Redhat, Ubuntu Platforms. (2 weeks)
- Learning OTCL-Scripts and NS basics. (2 weeks)
- Using Wireless Modules in NS: Build a wireless network for small, (medium and large) scale and test performance of network using AODV routing algorithm. (3 weeks)
- Using Wireless Modules in NS: Build a wireless network for small, (medium and large) scale and test performance of network using DSR routing algorithm. (3 weeks)
- Using Wireless Modules in NS: Build a wireless network for small, (medium and large) scale and test performance of network using DSDV routing algorithm. (3 weeks)
- Calculate in each case the following metrics: Packet Ratio, End2End Delay, Throughput, Jitter, QoS and other parameters in over all connections. Discuss the results based on your understanding of the routing algorithms.(2 Weeks)

## Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

## References:

- <http://www.isi.edu/nsnam/ns/tutorial/>
- <http://nile.wpi.edu/NS/>
- <http://www.cs.virginia.edu/~cs757/slidespdf/cs757-ns2-tutorial1.pdf>
- [www.opnet.com](http://www.opnet.com)
- <http://web.scalable-networks.com/content/qualnet>.

# Syllabus - Third Semester

## SYSTEM ADMINISTRATION IN LINUX

**Course Code: NTM4307**

**Credit Units: 03**

### **Course Objective:**

The Course aims at training the students for the following:

- Install, configure, manage and support a network infrastructure that uses Linux.
- Students will gain skills needed to create a networking services infrastructure design that supports the required network applications;
- Learn network solution technologies: including DHCP, IP, OSPF, RIP, and IGMP;
- They will also acquire skills needed to design a security framework for small, medium, and enterprise networks using Linux

### **Learning Outcomes:**

Upon successful completion of this course, the student will able to

- Configure process to create a properly functioning Linux environment.
- Use programs and utilities to administer a Linux machine.
- Understand how a Linux server can be integrated within a multi-platform environment.
- Analyze the need for security measures for a Linux environment.

### **Course Contents:**

#### **Module I: Introduction to Red Hat Linux System Administration**

Duties of the system administration, Planning the network, Installing the red hat linux, Red hat linux file system: Understanding File system, File System Commands, Working with Linux supported file system, Linux Disk Management. Red Hat System Configuration File: Examining the system configuration file, examining the network configuration file, Managing the init scripts.

#### **Module II: Linux Network Services**

TCP/IP Networking: Understanding Network Classes, Setting up NIC, Understanding Subnetting, CIDR, Configuring DHCP, Configuring PPP connection, Network File System: NFS Overview, Configuring NFS client and server, Tuning NFS, Examining NFS. Connecting to Microsoft Network: Installing Samba, Configuring Samba Server, Configuring the Samba Client.

#### **Module III: Linux Internet Services**

Introduction to internet services: secure services, less secure services, Inetd Server, Domain Name System (DNS): Understanding DNS, Installing software, types of domain servers, Configuring FTP services: Installing WU-FTPD, Configuring the server, maintaining the server, FTP security, Configuring mail services: Introduction to Email and SMTP, Configuring the email Client, maintaining the E-mail security, Configuring web server: Introducing Apache, How web server works, Installing and configuring Apache

#### **Module IV: Linux System Maintenance**

Using the Red Hat Networks: , Upgrading and Customizing the Kernel, Configuring on Command Line, Administering User and Groups: Understanding the root accounts, working with users and groups, Using File System Quotas. Backing and Restoring the File system: Choosing media for backup, Understanding backup methods, using backup tools. Installing and upgrading software package: Package Installation and Removal, Checking Software Version, Obtaining Newer software, Installing software.

**Module-V: Security and Networking**

Introducing basic security concepts, Implementing local security: Exploring the nature of Physical security, Maintaining user and password security, Securing file integrity. Firewalls and Internet Security: Limiting Network Services, A firewall Primer. TCP/IP and Network Security, Monitoring your system, Handling Attacks, Network Security Tools.

**Examination Scheme:**

Components	A	CT1	PR	EE
Weightage (%)	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text Book:**

- Terry Collings and Curt Wall, "Red Hat Linux Network and System Administration", Red Hat Press.

**Reference Books**

- Wale Soyinka, "Linux Administration: A beginner's Guide", Fifth Edition, The McGraw Hill.
- Maxim Svistunov, Stephen Wadeley and Jana Heves, "Red Hat Enterprise Linux 7 System Administrator's Guide"

## SYSTEM ADMINISTRATION LAB

**Course Code: NTM4311**

**Credit Units: 01**

**Course Contents:**

- Installing Red Hat operating system. Create users, and their quotas and managing users.
- Designing and Creating a Forest and Domain Infrastructure in Active Directory.
- Designing and Creating Network Connectivity in Active Directory.
- Designing and Creating Organization Unit in Active Directory
- Designing and Creating Group Policy in Active Directory.
- Designing and Creating Network Access Infrastructure in Active Directory.
- Designing and Creating Site Infrastructure in Active Directory.
- Designing and Creating Name Resolution in Active Directory.
- Configuring mail, web, print server, file server.

**Examination Scheme:**

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

# HIGH PERFORMANCE NETWORKS

**Course Code: NTM4309**

**Credit Units: 03**

## **Course Objective:**

The course aims at providing the various high speed digital access and broadband technologies, switching techniques used for communication; congestion control, performance issues and quality of service required for better performance of high speed networks.

## **Learning Outcomes:**

After successful completion of the course, student will be able to

- Understand the basics of high speed networking technologies
- Demonstrate the knowledge of network planning and optimization
- Apply the concepts learnt in this course to optimize performance of high-speed networks
- Design and configure networks to support a specified set of applications

## **Course Contents:**

### **Module I: Introduction**

History of Networking; Need for Speed and Quality of Service; Advanced TCP/IP Networks Backbone Networks; High Performance Networks; TCP Services; TCP format and connection management; SCTP; Encapsulation in IP; UDP Services, Format and Encapsulation in IP; IP Services; Header format and addressing; Fragmentation and reassembly; classless and subnet address extensions; subnetting and supernetting.

### **Module II: High Speed LAN**

Standard Ethernet, fast Ethernet, gigabit Ethernet, FDDI, Token Bus , Token Ring , performance comparison of 802.3 ,802.4and 802.5 IEEE standards

### **Module III: High Speed Digital Access & Broadband Technologies**

**DSL Technologies:** ADSL, other DSL Technologies; **Cable Networks:** Traditional Cable Networks, HFC Networks, Internet Over Cable, Spectrum Allocation, Sharing, Cable Modems, CM & CMTS, Data Transmission Schemes DOCSIS etc., ADSL versus Cable; **SONET:** Architecture, SONET Devices, SONET Frame, Synchronous Transport Signals, Sonet Networks, Virtual Tributaries, Higher-Rate Services; B-ISDN architecture;

### **Module IV: Virtual Circuit Switching**

**Virtual Circuit Switching:** Global Addressing, Virtual Circuit Identifier, Three Phases, Data Transfer Phase, Setup Phase, Teardown Phase; **Frame Relay:** Architecture, Frame Relay Layers, FRADs, VOFR, LMI, Congestion Control and Quality of Service; **ATM:** Design Goals, Problems, Main Features of ATM, Architecture, cell format & Switching Addressing, signaling and routing, ATM traffic and Congestion Control, Flow Control, Error Detection and Error Control, Quality of Service, Internetworking with ATM, ATM LANs. ATM networks performance measures – cell transfer delay, cell delay variation, CDV tolerance; cell loss ratio buffer over flow probability;

### **Module V: Congestion and Quality Control**

**Data Traffic:** Traffic Descriptor, Traffic Profiles; **Congestion:** Network Performance; **Congestion Control:** Open-Loop Congestion Control, Closed-Loop Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Load Shedding, Jitter Control; **Quality of Service:** Requirements, Flow Characteristics, Flow Classes; **Techniques to improve QoS:** Scheduling, Traffic Shaping, Resource Reservation, Admission Control; **Integrated Services:** Signalling, Flow Specification, Admission, Service Classes, RSVP, Problems with Integrated Services; **Differentiated Services; QoS in Switched Networks:** QoS in Frame Relay, QoS in ATM, **Performance**

**Issues:**Performance Problems in Computer Networks, Network Performance Measurement, System Design for Better Performance

**Examination Scheme:**

Components	A	CT1	A/C/Q	EE
Weightage (%)	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:**

**Text:**

- Stallings W., “High-Speed Networks and Internets, Performance and Quality of Service”, Pearson Education.
- Behrouz A. Forouzan, Data Communication and Networking, Third Edition, Tata McGraw-Hill
- William stallings, “ISDN and broadband ISDN with frame relay and ATM”, Pearson Education Asia, Fourth Edition, 2001.

**References:**

- Mahbub Hassan, Raj Jain, “High Performance TCP/IP Networking, Concepts, Issues, and Solutions”, Pearson Education
- Neelakanta P.S., A textbook on ATM Telecommunication Principles and Implementation; CRC Press, First edition; 2000.
- Tom Sheldon, Encyclopedia of Networking and Telecommunication, Tata McGraw Hill, 2001
- Andrew S. Tanenbaum, Computer Networks, Fourth Edition, Prentice Hall India

# NETWORK SECURITY & CRYPTOGRAPHY

**Course Code: NTM4308**

**Credit Units: 03**

## **Course Objective:**

This subject is very useful for students because Security of data in transit over the Internet becomes increasingly necessary because of steadily growing data volume and importance. Nowadays, every user of a public network sends various types of data, from email to credit card details daily, and he would therefore like them to be protected when in transit over a public network. To this end, a practical SSL protocol has been adopted for protection of data in transit that encompasses all network services that use TCP/IP to support typical application tasks of communication between servers and clients. In this subject student will learn all security method for securing public & private network by configuring different protocols.

## **Learning Outcomes:**

- Understanding of some of the factors driving the need for network security
- Identification and classification of examples of attacks
- Understanding of the terms vulnerability, threat and attack
- Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

## **Course Contents:**

### **Module-I: Introduction to Network security**

Computer security concepts, OSI security architecture, security attacks, security services, security mechanisms, A model for network security.

### **Module-II: Encryption Methods**

Symmetric Ciphers: Classical encryption techniques, symmetric cipher model, steganography, Block ciphers, Data Encryption Standard (DES), Number Theory, Finite Fields, Advance Encryption Standards (AES)

### **Module-III: Cryptography System**

Cryptography: Plain Text, Encryption, Key, Cipher Text, Decryption and cryptanalysis; Public Key, Encryption, Conventional Encryption Techniques. Asymmetric Ciphers: Public Key Cryptography and RSA, Diffie-Hellman cryptosystem, ElGamal Cryptosystem, Secure Hash Algorithm (SHA).

### **Module-IV: Network and Internet Security**

Web security issues, Secure socket layers (SSL), Transport Layer security (TLS), HTTPS, Secure Shell (SS), Wireless Network Security.

### **Module-V: System Security**

Intruders, Malicious, Virus & Intruders, Firewalls and protocols, Design Principles of Firewalls, Trusted systems, IT act and cyber laws (Global Standards), Virtual Private Network – Issues relating to network security, Recent attacks on networks.

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT1</b>	<b>PR</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:*****Text:***

- W. Stallings, Networks Security Essentials: Application & Standards, Pearson Education, 2000
- W. Stallings, Cryptography and Network Security, Principles and Practice, Pearson Education, 2000.

***References:***

- Network Security: The Complete Reference by Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, etal - Tata McGraw-Hill presents
- Network Security: The Complete Reference by Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, etal - Tata McGraw-Hill presents

# IT ENABLED SERVICES

**Course Code: NTM4310**

**Credit Units: 03**

## **Course Objective:**

It gives the introduction and concepts of the IT enabled Services. The world is going global and the technical know how of latest advancements needed for Business outsourcing is necessary for the students.

## **Learning Outcomes:**

On completion of the course, the student will be able to:

- Demonstrate the understanding and application areas of of IT enabled services.
- Design and manage business processes and understand service ecosystems and platforms.
- Demonstrate the understanding of various technology implementations at Call Center.
- Be able to professionally utilize information technology for the purpose of facilitating service innovation.
- Have knowledge on the latest enabling technologies and tools and training required for Call Center staff.

## **Course Contents:**

### **Module I: Introduction to ITes and Call Centers**

What is IT Enabled Services (ITeS), The need for ITeS, Application Areas for ITeS, Types of ITeS: Voice Based, Data Based, Web Based, , Types of Call Centres: Captive & Non-Captive, Inbound and outbound, Domestic and International; Analysing Call Center requirements, Vendor solutions, Call Center development process.

### **Module II: Call Center Technology**

Computer Telephony Integration (CTI), Network Structures & CTI Servers, Basic CTI Services, CTI in the Call Center, CTI implementation guidelines, Automatic Call Distribution (ACD), database management technology, H.323 based VoIP Technology, SIP Based VoIP Technology.

### **Module III: Organizing and Managing the Call Center**

Management guidelines for a productive Call Center, Characteristics of best-managed Call Centers, Service level-a core Value, Creating value through workforce optimization, Disaster and Contingency planning in Call Centers, Outsourcing the Call Center, Call Handling features, Call Transfer, Call Conferencing, 3<sup>rd</sup> Party Verification, Voice logging, Monitoring & Agent quality management, Call Detail Record (CDR) and reporting, Administration, Provisioning and maintenance.

### **Module IV: Selecting & Training Call Center Staff**

Overview, staff selection criteria, training CSR staff, toolkits, advanced CSR training, taining supervisory and management staff

### **Module V: Case Studies**

Case Studies of Domestic Call Center (Voice &/or Data Based) and International Call Center (Voice &/or Data Based).

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT1</b>	<b>A/C/Q</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text & References:*****Text:***

- Call Center Operation: Design, Operation, and Maintenance by Duane Sharp .
- Voice-Enabling the Data Network: H323, Mgep, Slip, Qos, Slas, and Security by James Durkin.

***References:***

- Call Centers For Dummies By Real Bergevin, Afshan Kinder, Winston Siegel.
- Call Center Management on Fast Forward: Succeeding in Today's Dynamic By Brad Cleveland, Julia Mayben.

# ACCESSING WAN

**Course Code: NTM4304**

**Credit Units: 03**

## **Course Objective:**

The aim of the course is to introduce WAN technologies and network services required by converged applications in enterprise networks. The unit uses “Cisco Network Architecture” to introduce integrated network services and explains how to select the appropriate devices and technologies to meet network requirements. This course will assist you in developing the skills necessary to plan and implement small enterprise networks across a range of applications.

## **Learning Outcomes:**

Upon completion of the course, the student will be able to:

- Implement and configure common data link protocols for WAN.
- Apply WAN security concepts and access control policies.
- Demonstrate teleworker services including broadband and vpns.
- Demonstrate the use of various addressing services.
- Detect, troubleshoot, and correct common enterprise network implementation issues.

## **Course Contents:**

### **Module I: Introduction to WAN**

Providing Integrated Services to Enterprise, The Evolving Enterprise, The Evolving Network model, WAN Technology Concept, WAN Connection Option

### **Module II: PPP & Frame Relay**

Serial Point to Point Links, PPP Concept, Configuring PPP, Configuring PPP with Authentication; Basic Frame Relay Concepts, Configuring Frame Relay, Advanced Frame Relay Concept, Configuring Advanced Frame Relay Concept.

### **Module III: Network Security & ACLs**

Introduction to Network Security, Securing Cisco Routers, Secure Router Network Services, Using Cisco SDM, Secure Router Management, Using ACL to Secure Network, Configuring Standard ACLs, Configuring Extended ACLs, Configuring Complex ACLs

### **Module IV: Teleworker & IP addressing Services**

Business requirement for teleworker services, Broadband services, VPN; DHCP & BOOTP, Scaling Network with NAT, IPv6, IPSec, site-to-site GRE tunnels.

### **Module V: Network Troubleshooting**

Establishing Network Performance Base Line, Troubleshooting Methodology and Tools, Common WAN Implementation Issues, Network Troubleshooting

## **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>PR.</b>	<b>ATTD.</b>	<b>EE</b>
<b>Weightage (%)</b>	10	15	5	70

**Text & References:*****Text:***

- Cisco Accessing the WAN: CCNA Exploration Companion Guide by Bob Vachon, Rick Graziani.
- Connecting Networks Companion Guide 1st Edition by Cisco Networking Academy.

***References:***

- Accessing the WAN, CCNA Exploration Labs and Study Guide by John Rullan.
- Cisco Networking Academy Programme CCNA 3 & 4 Engineering General, 3<sup>rd</sup>Edn by Pearson Education

# ACCESSING WAN LAB

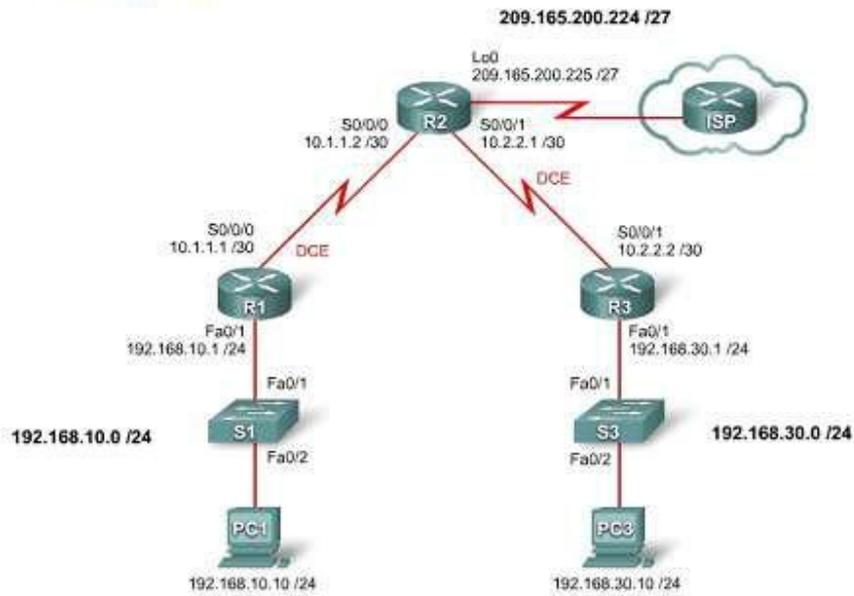
Course Code: NTM4306

Credit Units: 01

## Course Contents:

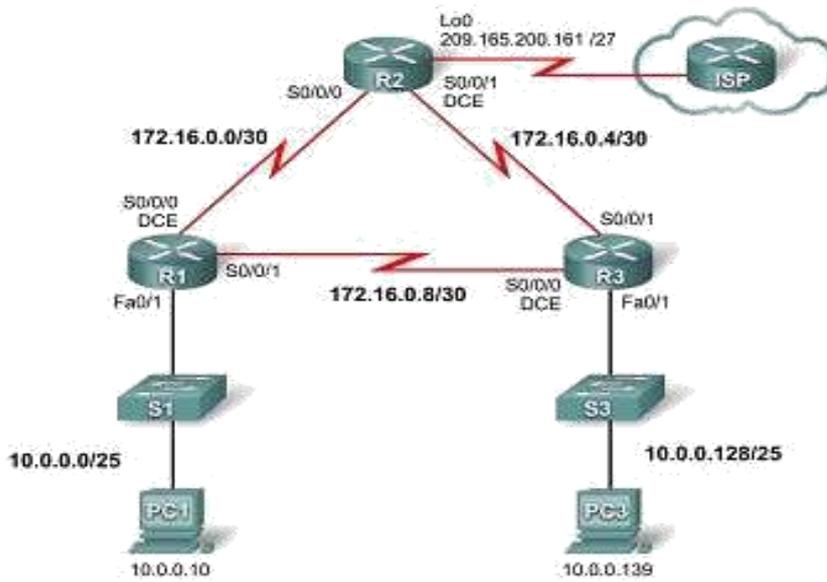
1. Basic PPP configuration using following topology:

Topology Diagram



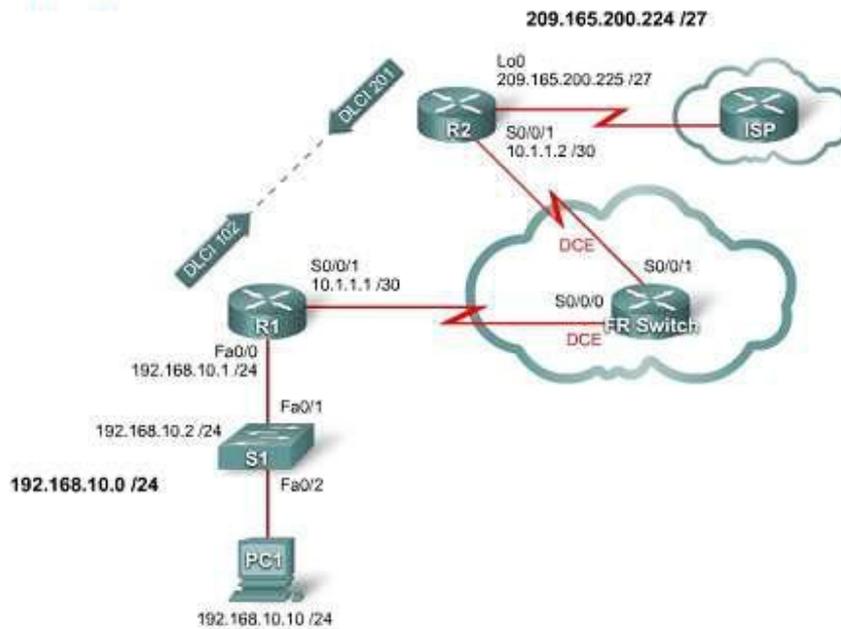
2. Configuring PPP with PAP and CHAP authentication using following topology:

Topology Diagram



3. Basic Frame-Relay configuration using following topology:

Topology Diagram



4. Set up and use Cisco SDM (Security Device Manager) and SDM Express to configure basic router security.
5. Configuring Standard Access Control Lists on Routers for network security.
6. Configuring Extended Access Control Lists on Routers for network security.
7. Configuring and troubleshooting DHCP and NAT (Network Address Translation) for network security.
8. Configuring Virtual Private Network(VPN) on WAN architecture.
9. Configuring site-to-site GRE tunnels for IPv6 network communication over IPv4 network infrastructure.
10. Troubleshooting Enterprise Network.

**Examination Scheme:**

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

**Software Requirement:**

- Packet Tracer.

# Syllabus - Fourth Semester

## CLOUD COMPUTING

**Course Code: NTM4404**

**Credit Units: 03**

### Course Objectives:

The course introduces the basic concepts and methods of Cloud computing and develops the concepts and skills necessary to build applications in Cloud environments. The course starts by explaining the concepts of cloud computing, cloud architecture, model and the concepts of Virtualization. It then explains how such ideas form the basis for creating Computing Clouds where the concept of resources is virtualized. Case studies are used to show how applications can be run in a Cloud and the principles of creating images to run in Clouds are explained. The programming skills for business models that underlie Cloud Computing are also presented.

### Learning Outcomes:

- Knowledge and Understanding of the fundamental principles of Cloud computing
- Understanding the importance of virtualization in cloud computing
- Understand the business models that underlie Cloud Computing
- Intellectual Skills & Practical Skills
- Understanding the issues involved in cloud computing

### Course Contents:

#### Module I: Introduction to Cloud Computing

Overview of Client/Server Computing, Peer to Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing; Behaviour of Cloud Computing; Pros and Cons of Cloud Computing.

#### Module II : Cloud Computing Architecture and Model

Understanding of Cloud Architecture, Cloud Storage, Cloud Services; Types of Cloud service development; Software as a Service, Platform as a Service, Web Services, On Demand Computing; Virtualization: Fundamental concepts of compute storage, Network virtualization; Pros and Cons of Cloud Service Development; Case study with Cloud Services Development Service and Tools.

#### Module III: Scalability and Fault Tolerance

Introduction to Scalability and Fault Tolerance with Cloud Computing; Cloud Solutions; Cloud Ecosystems; Cloud Business Process Management; Portability and Interoperability.

#### Module IV: Security in Cloud

Security Overview; Cloud Computing Security Challenges; Security Policy Implementation, Computer Intrusion Detection and Response, Virtualization Security Management and Virtual Threats; Cloud Security Controls; Cloud Computing Attacks; Cloud Security services; Secure Cloud Software requirements; Policy Implementation.

#### Module V: Programming Model in Clouds

Map Reduce; Hadoop ; Analyzing the data with Hadoop; Case Study on Google App Engine, Microsoft Azure and Hadoop.

### Examination Scheme:

Components	A	CT1	PR	EE
Weightage (%)	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

**Text:**

- Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
- Michael Miller, “Cloud Computing”, Pearson,2012.
- Cloud Computing : A Hands-On Approach by ArshdeepBahga, Vijay Madiseti.

**References:**

- John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010
- Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, TMH,2009.
- Kumar Saurabh, “Cloud Computing – insights into New-Era Infrastructure”, Wiley India, 2011.
- Pankaj Sharma, “Cloud Computing”, Kataria& Sons, India, 2013.

# INTERNET OF THINGS

**Course Code: NTM4403**

**Credit Units: 03**

## **Course Objective:**

The goal of Internet of Things course is to introduce students to physical and virtual objects that are connected to Internet to facilitate intelligent applications and make homes, cities, logistics, industries and many other areas smarter. This course will assist in developing the skills necessary to develop domain-specific Internet of Things and their real-world applications.

## **Learning Outcomes:**

Upon completion of the course, the student will be able to:

- Explain key terms and trends around the Internet of Things.
- Understand the potential and value of the Internet of Things and Smart Services.
- Understand the opportunities and benefits for society, companies, and consumers.
- Able to describe the technologies used for the Internet of Things and mobile devices, including (passive and active) sensors, the physical communications layer, communications protocols, programming frameworks,.
- Able to develop IoT application of moderate complexity for a well-used mobile platform.

## **Course Contents:**

### **Module I: Introduction to Internet of Things**

Definition & characteristics of IoT, physical design of IoT-things in IoT, IoT protocols, logical design of IoT- IoT functional block, IoT communication models, IoT communication APIs, IoT enabling technologies-wireless sensor networks, cloud computing, big data analytics, communication protocols, embedded systems, IoT levels and deployment templates, IoT applications.

### **Module II: IoT and M2M**

Introduction to M2M , difference between IoT and M2M, SDN (software defined networking ) and NFV (Network Function Virtualization) and their applications for IoT.

### **Module III: IoT system management with NETCONF-YANG**

Need for IoT systems management, SNMP and its limitations, Network Operator Requirements, Introduction to NETCONF and YANG.

### **Module IV: Developing Internet of Things**

IoT Design Methodology, Logical design using Python- Python data types & data structures, control flow, functions, modules, packages, classes, file handling, Python packages for IoT-JSON, XML, HTTPLib, URLLib, SMTPLib, IoT end devices-building blocks, Introduction to Raspberry Pi.

### **Module V: Case Studies of IoT**

Home Automation- Smart Lighting, Home Intrusion Detection, Cities- Smart Parking.

## **Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT1</b>	<b>PR</b>	<b>EE</b>
<b>Weightage (%)</b>	5	10	15	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

## **Text & References:**

### ***Text:***

- Internet of Things: A Hands-On Approach by ArshdeepBahga, Vijay Madiseti
- Designing the Internet of Things by Adrian McEwen, Hakim Cassimally

### ***References:***

- From Machine-to-Machine to the Internet of Things: Introduction to a New Age by Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle

## INTERNET OF THINGS LAB

Course Code: NTM4405

Credit Units: 01

### Course Contents:

Embedded Programming Experiments  
RF Experiments  
Sensor based experiments  
IoT Applications

### Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

# MAJOR PROJECT/INDUSTRIAL TRAINING

Course Code: NTM4437

CreditUnits: 15

## GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge, which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

### **In general, the File should be comprehensive and include**

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

### **Report Layout**

The report should contain the following components:

#### **1. File should be in the following specification**

- A4 size paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top & bottom margins: 1 inch/ 2.5 cm
- Left & right margins: 1.25 inches/ 3 cm

#### **2. Report Layout:** The report should contain the following components

Front Page  
Table of Contents  
Acknowledgement  
StudentCertificate  
Company Profile  
Introduction  
Chapters  
Appendices  
References / Bibliography

#### **➤ Title or Cover Page or Front Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

➤ **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

➤ **Acknowledgement**

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

➤ **Student Certificate  
Given by the Institute.**

➤ **Company Certificate & Profile**

This is a certificate, which the company gives to the students. A Company Profile corresponds to a file with company-specific data. Company data can be stored there and included in a booking when needed.

➤ **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➤ **Chapters**

All chapters and sections must be appropriately numbered, titled and should neither be too long nor too short in length.

The first chapter should be introductory in nature and should outline the background of the project, the problem being solved, the importance, other related works and literature survey. The other chapters would form the body of the report. The last chapter should be concluding in nature and should also discuss the future prospect of the project.

➤ **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➤ **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

## **ASSESSMENT OF THE PROJECT FILE**

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following *assessment objectives*:

1. Writing a critical literature review
  - Search for literature
  - Summarizing and presenting the literature
  - Evaluating key content and theories
2. Collecting and analyzing research material

- Choosing and designing research method
  - Conducting the research
  - Analyzing, sorting and classifying the data to make decision
3. Interpreting research method and draw conclusion
    - Findings
    - Recommendation
  4. Assigning the theories and writing the project report
    - Structuring the project in accordance with the given style
  5. Bibliography
    - This refer to the books, Journals and other documents consulting while working on the project

**Examination Scheme:**

<b>Components</b>	<b>S</b>	<b>MPR</b>	<b>V</b>	<b>FP</b>	<b>R</b>
<b>Weightage (%)</b>	20	20	20	20	20

S: Synopsis, MPR: Mid Project Report, V: Viva, FP: Final Presentation, R: Report