

Post Graduate Diploma in Enterprise Network Engineering

Course Name: PGDENE

WELCOME TO THE PGDENE TRAINING PROGRAM

Objective of the Course : We, proudly introduce our PGDENE (Post graduate Diploma in Enterprise Network Engineering) course package, for candidates aspiring to pursue their career as Network Administrators, System Administrators, WAN & Wireless Administrators etc. in large institutions like Hospitals, Banks, Hotels, Colleges etc. This course program aims to provide a better understanding of System Administration, Network Administration, Network Planning, WAN and Wireless Administration.

Network Engineers, also termed Network Administrators involve in design, configuration, installation and maintenance of computer communication systems within an organization or between organizations. These systems allow users to share files and resources, access the internet and email, and collect and process data pertaining to their organization in accordance with the privilege assigned to them.

Network Administration is a modern profession responsible for the maintenance of computer hardware and software that comprises a computer network. This normally includes the deployment, configuration, maintenance and monitoring of active network equipments and components. A related role is that of the network specialist, or network analyst, who concentrates on network design and security.

The Network Administrator is usually assigned the highest privilege with respect to an organizational network and will rarely be involved with direct user support. The Network Administrator concentrates on the overall availability and



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performance of the network, server deployment, authorization, security etc. thus ensuring the performance of the network connectivity throughout a company's LAN / WAN infrastructure. Network Administrators are generally considered as Tier 3 support personnel who address break / fix issues that are not resolved at the Tier1 (helpdesk) or Tier 2 (desktop/network technician) levels.

The actual role of the Network Administrator will vary from company to company, but will commonly include activities such as network address assignment, assignment of routing protocols and routing table configuration as well as configuration of authentication and authorization – directory services. It often includes maintenance of network facilities in individual machines, such as drivers and settings of personal computers as well as printers and such other devices. It sometimes also includes maintenance of specific network servers : file servers, VPN gateways, intrusion detection systems, etc.

Opportunities ... come capitalize on the growth!

Starting with network or system administration, career opportunities can open up in areas ranging from security, storage, WAN management, wireless systems, data center management, unified Communications and many others.

Career Path

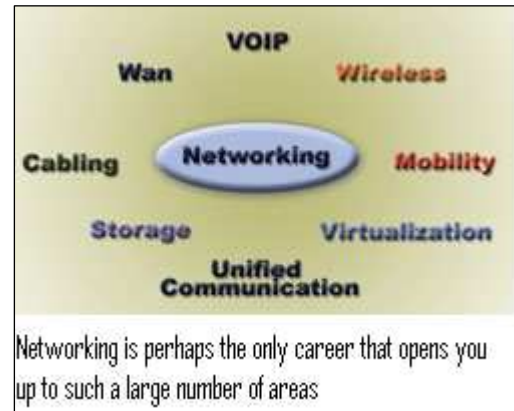
In an enterprise, a professional typically starts his career as a LAN Administrator. Next, role is that of a senior level Network Manager who will be into planning and design of LAN, including security. After acquiring sufficient experience in planning and designing a network, a professional can confidently take up the role of a Network Consultant. But to grow further, one has to enhance skill set beyond the knowledge of LAN configuration and administration, and look ahead to technologies that are part of networking. A few of the specialized streams of networking domains, where network professionals are in demand, include Storage, Security, WAN, Virtualization / Consolidation, Wireless and Mobility. The networking domain has a plethora of job titles, many of which refer to very similar and at times identical job roles, like Network Engineer, Network Administrator, Network Analyst, Systems Administrator, etc. Now with specializations coming into picture, new job titles that are coming up in the enterprises include Security Analyst for network security, Network Storage Administrator for storage management and Wireless Network Engineer for a Wi-Fi

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consulting agency. Let's have a look at various specialized domains where a network professional can build his career.

This course package is meant for fresh Engineering Graduates / Graduates in related discipline as a job oriented special package and also for working professionals as a knowledge booster in the field of Computer Networking hardware and software which is a mandatory part of any organization and extremely useful in the career of computer professionals.

Each section in this course package fully explain common and not so common Problems, what cause problems and how to handle problems when they arrive.



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SCHEME OF EXAMINATION AND AWARD OF MARKS

The scheme of examination shall consist of external end examinations and internal assessments based on periodical tests, assignments and attendance in theory subjects and sessional mark in practical subjects

a) The total Marks (internal and external) of the course program shall be as follows:

Course	Course Fee	Duration	Marks (Examination)	Marks (Internals)	Marks (Total)
PGDENE	23000/- (4000+3000*7)	300 Hrs	400	100	500

ELIGIBILITY: Engineering Degree / Graduation in a relevant discipline. Students in their final year of Graduation are also eligible to apply. Post Graduate Diploma Certificate shall be issued only after completion of Graduation. However, course completion certificate shall be issued as an interim measure.

b) Subjects :

SUBJECT TITLE	SUBJECT CODE	MARKS FOR WRITTEN EXAM	INTERNAL MARKS	Duration (Hours)
System Administration	PGDENE M001	100	25	30
Network Fundamentals	PGDENE M002	100	25	30
Network Administration & Security	PGDENE M003	100	25	150
Implementation of Wide Area & Wireless Networks	PGDENE M004	100	25	90
Practical Exam	PGDENE M005	80 (40 For Result + 20 For Procedure + 20 For Viva)	20	
TOTAL MARKS		480	120	300

SUBJECT TITLE : SYSTEM ADMINISTRATION

SUBJECT CODE: PGDENE M001

TOTAL Hrs: 30Hrs

MARKS: 100 + Internal 25

Theory session

Familiarization of PC Components

Overview of computer system

- CPU
- Input Units
- Output Units
- Working Storage Units
- Permanent Storage



Storage Devices

- Primary storage
- Secondary storage
- Need for permanent storage
- Difference between primary and secondary

Layers of PC

- Non-Standard Hardware
- Firmware-BIOS
- Standard Operating System
- Standard Application Software
- Users

Hardware

- Logical Hardware
- Peripheral Hardware



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Software

- Driver Software
- Firmware
- System Software
- Application Software

Types of Operating System

- Operating System
- Single User Single Tasking
- Single User Multi Tasking
- Multi User Single Tasking
- Multi User Multi Tasking

Different Components of PC

- Key Board
- Mouse
- Monitor
- CRT
- LCD
- Gas Plasma
- Hard Disk Drive
- IDE
- SCSI
- SATA
- CD/DVD
- Floppy Disk Drive
- Flash Drive
- Tape Drive
- ZIP Drive
- Power Supply
- Mother Board
- Processor
- Memory
- Case



Other Daughter Cards

- Video Cards
- Sound Cards
- Network Interface Cards
- Internal Modem
- TV Tuner Cards
- AGP
- SCSI

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Identification of Mother Board Components

- Processor's Sockets and Slots
- BIOS
- Cooling Methods
- CMOS Battery
- Chipset

Identification of Expansion Slots and Cards

- ISA
- PCI
- AGP
- AMR
- CNR
- PCI Express

Interfaces and Ports

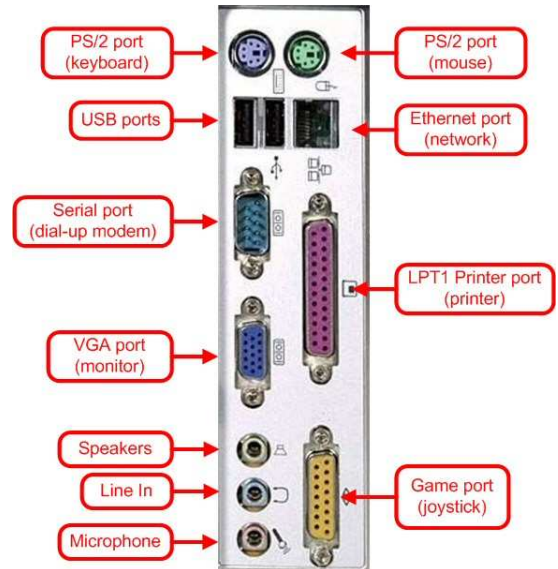
- PCMCIA
- USB
- Fire wire
- PS/2
- Serial Port
- Parallel Port
- Game/MIDI Port
- Centronics 36, 50, 68
- SVideo
- DVI

Power Supply Connectors

- AT
- ATX Main Power Connection
- ATX Auxiliary Power Connection
- ATX 12V Connectors
- MOLUX Connectors

External Peripherals

- Internal and External modems
- Printers
- Plotters
- Scanners
- Joystick



Annexure-1

- Light Pen
- Touch Screen
- Web Cam
- UPS

Preventive Maintenance

- VIRUS
- Anti VIRUS Programs
- Cleanup
- Using Wrist Strap

Preventive Maintenance Tools

- Scandisk
- Defrag
- SFC
- Ms config
- Regedit
- Antivirus



Lab session

Introducing and Installing Microsoft Windows

- The Windows Family
- Windows XP
- Configuration Preparing for Windows Installation
- Hardware Requirements and Compatibility
- Hard Drive and File System
- Installing Windows
- Device drivers installation
- Modify boot records
- Control panel applets
- SFC
- Shedule tasks
- Backup
- Understanding power management
- Upgrade or Clean Install
- Post installation Tasks

Troubleshooting

1. Various troubles and rectification procedures of motherboard – CPU- memory modules- display adapters- monitors- SMPS – key boards- FDC- FDDs, HDD –

Annexure-1

CMOS set-up –CD ROM driver- sound cards- DMP – inkjet printer- scanners-
modem- mouse

2. OS related problems (dos, windows 98)
3. Other software installation procedures
4. Virus problem and solution- Antivirus software
5. Common problems
6. Power Supply Problems
7. Display related Problems
8. Booting Problems
9. Intermittent system hanging problems
10. Intermittent system restarting problem
11. File recovery utilities

SUBJECT TITLE : NETWORK FUNDAMENTALS

SUBJECT CODE: PGDENE M002

TOTAL Hrs: 30Hrs

MARKS: 100 + Internal 25

Theory session

TERMINOLOGY

- Signals and Protocols
- Server
- Server Farm
- Blade Server
- Client
- Thick/Fat Client
- Thin Client
- Protocols
- Workstation
- Host
- Node
- Servant
- Operating Systems
- Desktop OS
- Network OS
- Transmission Types
- Broadband
- Base band
- Bandwidth
- Hardware, Operating System and Virtual machine
- Different Topologies
- Star
- Bus
- Ring
- Mesh
- Network Medium
- Segments and Backbones
- Storage Server
- Fault Tolerant Environment
- Fault Tolerant
- Circuit Switching
- Message Switching
- Packet Switching
- Duplex

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- Login Process
- Workgroup
- Domain
- Client-Server

IP Address and subnetting

- IP Address and Subnet mask
- Octet
- Network ID and Broadcast ID
- IP Version
- IP Classes
- Private and Public IP s
- Classless IP Addressing and Sub netting

OSI Layers

- Evolution of Networks
- Standards Organizations
- The OSI Reference Model
- Advantages of OSI Reference Model
- Protocols and devices Used in each layer
- The TCP/IP Reference Model
- Comparison between two Models

Devices

- Building Large Networks
- Need for an Amplification
- Repeater
- Hubs
- Passive Hubs
- Active Hubs
- Collision Domain
- Broadcast Domain
- Problems While Extends LAN Using Hubs
- Bridges
- Working Principles
- Creating MAC Table
- Filtering
- Forwarding
- Multi Port Bridges (Switch)
- Advantages
- ATM Switch
- LAN Switch
- Bridges vs. Switches

Annexure-1

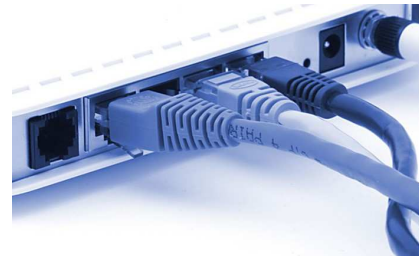
- Router
- How Router Works
- Routing Table Components
- Filtering And Forwarding
- WAP
- Gateway
- Modems

TOPOLOGIES

- What is Topology?
- Network Topologies
- Hybrid
- Mesh
- Wireless
- Sending the Signal
- Terminator
- Network expansion
- Star Topology
- Tree Topology
- Trouble Shooting Problems
- Hub-based Topology
- Network Planning Problem

CABLES

- Network medium
- How to pick your cabling
- Types of cables
 - co-axial
 - Thin
 - Thick
 - Twisted pair
 - STP
 - UTP
 - SCTP
 - FTP
 - Optical fiber cable
 - Single mode
 - Multi mode
- Comparison
- Principle of operation
- Making twisted pair network cables
- Color code standards
- Cross over cables
- Rollover cables



Lab session

Trouble shooting the Network

Using TCP/IP utilities

- PING
- NETSTAT
- NBTSTAT
- TRACERT
- IPCONFIG
- NSLOOKUP
- WINIPCFG
- ARP

SUBJECT TITLE : NETWORK ADMINISTRATION & SECURITY

SUBJECT CODE: PGDENE M003

TOTAL Hrs: 150Hrs

MARKS: 100 + Internal 25

Theory session

WINDOWS ADMINISTRATION

Network Services

DHCP

- Origins of DHCP
- DHCP Components
- The DHCP lease process
- DHCP Server redundancy

ROUTING

- What is the need of a Router?
- Routed Protocols
- Routing Protocols

DNS

- Different types of naming systems
- Introductions to DNS
- Advantage of Domain Naming System
- DNS structure
- Overview of the Name Resolution Process
- How a web client connect a web server using DNS
- DNS Queries
- Forward lookup zone
- Reverse lookup zone
- Stub zone
- Need of DNS in a Company network
- IIS

Remote Access Service

- Overview of RAS
- Features of RAS
- RAS Client
- RAS Server

Annexure-1

- Dial up Equipment and Wan Infrastructure
- Remote access Protocols
- Remote Access Security
- Managing Remote Access

Active Directory Service

- Introduction to ADS
- Understanding Active Directory concepts
- Planning Active Directory implementation
- Importance of DNS in active directory
- Introduction to OU, GPO
- Administrating group policies

Computer Security

- What is Computer Security?
- Password Protection
- Enforcing Strong Password throughout Your Organization
- Password complexity Requirements
- Encryption
- Account Policies
- Unlocking a User Account
- Apply or Modify Account Lockout Policies
- Password Best Practices
- Security Model
- Local Security
- File level Security

Security threats facing modern network infrastructures

- Mitigation methods for common network attacks
- Mitigation methods for Worm, Virus, and Trojan Horse attacks
- Cisco Self Defending Network architecture

Annexure-1

Secure Cisco routers

- Securing Cisco routers using the SDM Security Audit feature
- One-Step Lockdown feature in SDM to secure a Cisco router
- Securing administrative access to Cisco routers by setting strong encrypted passwords, exec timeout, login failure rate and using IOS login enhancements
- Securing administrative access to Cisco routers by configuring multiple privilege levels
- Securing administrative access to Cisco routers by configuring role based CLI
- Securing the Cisco IOS image and configuration file



Implementation of AAA on Cisco routers using local router database and external ACS

- Functions and importance of AAA
- Features of TACACS+ and RADIUS AAA protocols
- Configuration of AAA authentication
- Configuration of AAA authorization
- Configuration of AAA accounting

Mitigation of threats to Cisco routers and networks using ACLs

- Functionality of standard, extended, and named IP ACLs used by routers to filter packets
- Configuration & verification of IP ACLs to mitigate given threats (filter IP traffic destined for Telnet, SNMP and DDoS attacks) in a network using CLI
- Configuration of IP ACLs to prevent IP address spoofing using CLI
- Caveats to be considered when building ACLs

Annexure-1

Implementation of secure Network Management and Reporting

- Use of CLI and SDM to configure SSH on Cisco routers to enable secured management access
- Use of CLI and SDM to configure Cisco routers to send Sys log messages to a Sys log server

Mitigation of common Layer 2 attacks

- Prevention of layer 2 attacks by configuring basic Catalyst switch security features

Implementation of the Cisco IOS firewall feature set using SDM

- Operational strengths and weaknesses of the different firewall technologies
- Stateful firewall operations and the function of the state table
- Implementation of Zone Based Firewall using SDM

Implementation of the Cisco IOS IPS feature set using SDM

- Network based vs. host based intrusion detection and prevention
- IPS technologies, attack responses, and monitoring options
- Enabling & verification of Cisco IOS IPS operations using SDM

Implement site-to-site VPNs on Cisco Routers using SDM

- Different methods used in cryptography
- IKE protocol functionality and phases
- Building blocks of IPSec and the security functions it provides
- Configuration and verification of an IPSec site-to-site VPN with pre-shared key authentication using SDM

Lab session

WINDOWS ADMINISTRATION

DHCP

- Configuring DHCP Server
- Backing up and restoring DHCP database
- DHCP relay agent
- IP lease Renewal and Release

ROUTING

- Static Routing
- Dynamic Routing

DNS

- Configuring DNS Server
- DNS integrated with DHCP
- Secondary server Configuration
- Forwarders and delegations
- Dynamic DNS
- Round robin
- IIS

Remote Access Service

- RAS Client
- RAS Server
- ICS
- NAT

Active Directory Service

- Installing AD Service
- Folder redirection
- Scripts
- Securities
- Software Development through GP

Security in CISCO Routers

- a. Securing Cisco routers using the SDM Security Audit feature
- b. One-Step Lockdown feature in SDM to secure a Cisco router
- c. Securing administrative access to Cisco routers by setting strong encrypted passwords, exec timeout, login failure rate and using IOS login enhancements

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- d. Securing administrative access to Cisco routers by configuring multiple privilege levels
- e. Securing administrative access to Cisco routers by configuring role based CLI
- f. Securing the Cisco IOS image and configuration file
 - Configuration of AAA authentication
 - Configuration of AAA authorization
 - Configuration of AAA accounting
 - Configuration and verification of IP ACLs to mitigate given threats (filter IP traffic destined for Telnet, SNMP, and DDoS attacks) in a network using CLI
 - Configuration of IP ACLs to prevent IP address spoofing using CLI
 - Use of CLI and SDM to configure SSH on Cisco routers to enable secured management access
 - Use of CLI and SDM to configure Cisco routers to send Syslog messages to a Syslog server
 - Configuration of basic Catalyst switch security features to prevent attack of Layer 2
 - Implementation of Zone Based Firewall using SDM
 - Enabling and verification of Cisco IOS IPS operations using SDM
 - Configuration and verification an IPsec site-to-site VPN with pre-shared key authentication using SDM

Linux Administration

- Linux History
- Linux Installation (Text Mode and Graphics Mode)
- Linux packages
- Abt Shell, Doemon, Kernel
- Linux Grub, Run levels, Editions in Linux
- User level commands
- User and group administration
- RPM package installation
- Partition and File System
- LVM manager
- RAID
- File compression
- Mounting Volume
- Permissions
- Printing in Linux
- Remote login service
- NFS
- File sharing between Windows and Linux (SAMBA Server)
- DHCP
- DNS
- Web server

Annexure-1

- Web accessing in Linux

Remote Application Delivery

- Applied and Architectural Concepts for Presentation Server
- Installing and Managing CITRIX Presentation Server
- Publishing Applications and Content Using CITRIX Presentation Server
- Deploying Applications in CITRIX Presentation Server

**SUBJECT TITLE : IMPLEMENTATION OF WIDEAREA & WIRELESS
NETWORKS**

SUBJECT CODE: PGDENE M004

TOTAL Hrs: 90Hrs

MARKS: 100 + Internal 25

Theory session

INTRODUCTION TO WIDE AREA NETWORKS

- OSI Model
- TCP/IP Protocol Stack
- Defining network components
- CISCO 3-layer hierarchical network model
- Mapping devices to layers

FUNCTIONS OF INTER NETWORKING DEVICES

- Repeater, Hub
- Data link layer functions & devices
- Network layer functions & devices
- Transport layer functions
- Wan-overview, devices, physical layer, data link layer, protocols

NETWORK MEDIA

- Roll over cable DTE&DCE
- DSL
- Introduction to virtual LAN
 - Benefits
 - Identifying VLAN components



INTERNET LAYER PROTOCOLS

- IP
- ICMP
- ARP
- RARP
- DHCP
- TCP/UDP header format & its functionality

Annexure-1

WAN TOPOLOGY BASICS

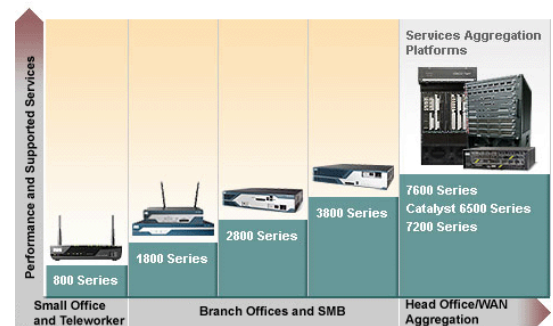
- Circuits switching
- Packet switching
- Point to point
- Cell switching
- WAN access technologies
 - PPP
 - ITM

CISCO IOS

- Basic operations
- IOS start up
- Command line interfaces
- Router components
- Booting CISCO IOS device

ROUTING BASICS

- Routed protocols
- Routing protocols, IGP & EGP
 - Distance vector
 - Link state
 - Hybrid
- Metrics, administrative distance
- Preventing routing loops
- Configuring static route, default route



BASIC IP TRAFFIC MANAGEMENT

Configuring Access list

- Standard
- Extended & named access lists
-

NETWORK ADDRESS TRANSLATION

- Dynamic NAT
- PAT

CONFIGURING A CATALYST SWITCH

- Default port configurations

Annexure-1

- VLAN, STP
- Assigning permanent MAC address
- VLAN trunking
- VTP modes
- Configure inter V LANs routing

Introduction to Wireless LANs

- The Wireless LAN Market
- History of Wireless LANs
- Today's Wireless LAN Standards
- Applications of Wireless LANs
- Mobile Offices



Radio Frequency (RF) Fundamentals

- Radio Frequency
- RF Behaviors
- Voltage Standing Wave Ratio (VSWR)
- Principles of Antennas
- Line of Sight (LOS)
- Fresnel Zone
- Antenna Gain
- Intentional Radiator
- Equivalent Isotropic ally Radiated Power (EIRP)
- Radio Frequency Mathematics
- Units of Measure

Spread Spectrum Technology

- Introducing Spread Spectrum
- Narrow Band Transmission
- Spread Spectrum
- Uses of Spread Spectrum
- FCC Specifications
- Frequency Hopping Spread Spectrum (FHSS)
- How FHSS Works
- Frequency Hopping Systems
- Direct Sequence Spread Spectrum (DSSS)
- How DSSS Works
- Direct Sequence Systems
- Comparing FHSS and DSSS
- Narrow band Interference
- Data rate & throughput
- Security
- Standards Support



Annexure-1

Wireless LAN Infrastructure

- Access Points
- Access Point Modes
- Common Options
- Configuration and Management
- Wireless Bridges
- Wireless Bridge Modes
- Common Options
- Configuration and Management
- Wireless Workgroup Bridges
- Common Options
- Configuration and Management
- Wireless Residential Gateways
- Common Options
- Configuration and Management
- Enterprise Wireless Gateways
- Configuration and Management



Antennae and Accessories

- RF Antenna
- Omni-directional (Dipole) Antenna
- Semi-directional Antenna
- Highly –directional Antenna
- RF Antenna Concepts
- Antenna Installation
- Wireless LAN Accessories
- RF Amplifiers
- RF Attenuators
- Lighting Arrestors
- RF Splitters
- RF Connectors
- RF Cables

Wireless LAN Organization and Standards

- Federal Communications Commission
- ISM and UNI bands
- Industrial Scientific
- Unlicensed National Information In fracture bands
- Power Output Rules
- Institute of Electrical and Electronics Engineers
- IEEE 802.11
- IEE 802.11b
- IEE 8002 11a
- IEEE 802 IIG

Annexure-1

- IEE Standards Summary
- Major Organizations
- Wifi Alliance

802.11 Network Architecture

- Locating a Wireless LAN
- Service Set Identifier
- Beacons
- Passive Scanning
- Active Scanning
- Authentication & Association
- Authentication
- Association
- States of Authentication & Association
- Authentication Methods
- Service Sets
- Basic Service Set (BSS)
- Extended Service Set (ESS)
- Independent Basic Service Set (IBSS)
- Roaming
- Power Management Features
- Continuous Aware Mode
- Power save Polling

MAC and Physical Layers

- How Wireless LANs Communicate
- Wireless LAN Frames vs. Ethernet Frames
- Collision Handling
- Fragmentation
- The Communications Process
- Modulation

Wireless LAN Security

- Wired Equivalent Privacy
- Why WEP Was Chosen
- WEP Keys
- Advanced Encryption Standard
- Filtering
- Jamming
- WEP Key Management
- Temporal Key Integrity Protocol (TKIP)
- Wireless Gateways
- 802.1x and Extensible Authentication Protocol
- Corporate Security Policy
- Keeping Sensitive Information Private

Annexure-1

- Physical Security
- Wireless LAN Equipment Inventory & Security Audits
- Using Advanced Security Solutions
- Limited and Tracked Access
- Security Recommendations
- WEP
- Cell Sizing
- User Authentication
- Security Needs
- Use of Additional Security Tools
- Switches and hubs
- Wireless DMZ

Lab session

CISCO IOS

- Basic router configurations
 - Configuring and verifying
 - Name
 - Password
 - Secret
 - Interface
 - Sub interface
 - TELNET
 - CDP, saving, configurations

SERIAL POINT TO POINT CONNECTIONS

- Configuring IP routing protocols in CISCO Routers
- RIP
- IGRP
- OSPF
- EIGRP

BASIC IP TRAFFIC MANAGEMENT

Configuring Access list

- Standard
- Extended & named access lists

NETWORK ADDRESS TRANSLATION

- Dynamic NAT

Annexure-1

CONFIGURATION OF CATALYST SWITCH

- Default port configurations
- VLAN, STP
- Assigning permanent MAC address
- VLAN trunking
- VTP modes
- Configure inter V LANs routing

CONFIGURING WIRELESS NETWORK

- **AD Hoc Configuration**
- **Access point Configuration**

Certification Options

CE-CELL – KELTRON Combined Certification

- Certification Name: Post Graduate Diploma in Enterprise Network Engineering (PGDENE)
- It is suggested that the Certification shall be done jointly by the College and KELTRON as a token of Industrial Partnership.
- In the case of Students who complete their course while pursuing their Graduation, the PG Diploma Certificate shall be issued only after successful completion of the Graduation Programme. However, a Course completion certificate shall be issued as an interim measure.

Additionally, this curriculum is adequate to enable Candidates to successfully attempt the following additional Certification programmes.

1. Central Govt. NCVT Certification (according to the Central Govt. Modular Employable Scheme)

- Certification Name: Computer Fundamentals, MS Office & Internet / Computer Networking (NCVT Trade certificates)
- Certification Charge: Rs. 800 / Certification. The exam fee of students (those belonging to SC/ST/OBC/BPL/Women/Physically Handicapped) who successfully pass out NCVT examinations will be refunded.

2. International Certification Programmes

- Certification Name : MCP (Microsoft Certified Professional) / CCNA (CISCO Certified Network Associate) / CCNA Security / CWNA / N+
- Certification Charge: As per Microsoft / CISCO / CompTIA Notification