

Chapter 1 : Introduction to D.C & C.N. 1-1 to 1-22

Syllabus : Internet basics and network components(Transmission media- Guided, Unguided, Network devices), Various types of networks(only overview)- Connection oriented networks Vs Connectionless networks, Ethernet- Ethernet standards, Zigbee, WiFi, Access technique- CSMA-CD negotiation technique overview. Wireless network, Unified communication- VoIP.

1.1	Introduction	1-2
1.2	Data Communication	1-2
1.3	Networks	1-2
1.3.1	Computer Networks	1-2
1.4	Transmission Media	1-3
1.4.1	Classification of Transmission Media	1-3
1.4.2	Types of Wired Media	1-3
1.5	Twisted Pair Cables	1-3
1.5.1	UTP (Unshielded Twisted Pair)	1-3
1.5.2	STP (Shielded Twisted Pair)	1-4
1.6	Co-axial Cables	1-4
1.7	Optical Fiber Cables	1-5
1.7.1	Characteristics of Optical Fiber Cables	1-6
1.7.2	Advantages of Optical Fibers	1-6
1.7.3	Disadvantages of Optical Fiber	1-7
1.7.4	Applications	1-7
1.8	Wireless Media	1-7
1.9	Types of Wireless Media	1-7
1.9.1	Radio Wave Transmission Systems	1-7
1.9.2	Microwave Transmission System	1-8
1.10	Types of Networks	1-9
1.10.1	Connection Oriented Networks	1-9
1.10.2	Connectionless Networks	1-10
1.11	Ethernet (Wired LANs)	1-11
1.11.1	Ethernet Standards	1-12
1.12	IEEE Standards	1-12
1.13	Medium Access Control (MAC)	1-13
1.13.1	Contention	1-13
1.14	Multiple Access Techniques	1-13
1.14.1	Random Access	1-13
1.15	Carrier Sense Multiple Access (CSMA)	1-14
1.15.1	Carrier Sense Multiple Access/Collision Detection (CSMA/CD)	1-14

1.15.2	CSMA/CD Procedure	1-15
1.15.3	CSMA/CA	1-15
1.16	Wi-Fi (Wireless LAN)	1-16
1.16.1	IEEE 802.11	1-16
1.16.2	Classification of WLANs	1-16
1.16.3	Architecture WLAN	1-16
1.16.4	Basic Service Set (BSS)	1-16
1.16.5	Extended Service Set (ESS)	1-17
1.16.6	Types of Stations	1-17
1.17	Wireless Networks	1-18
1.17.1	Types of Wireless Networks	1-18
1.17.2	Wireless PAN (Personal Area Network) ...	1-18
1.17.3	Types of Wireless PANs	1-18
1.18	ZigBee (IEEE 802.15.4)	1-18
1.18.1	Features of ZigBee	1-19
1.18.2	Radio Specifications	1-19
1.18.3	Applications of ZigBee	1-19
1.19	Unified Communications	1-19
1.19.1	Benefits of Unified Communications	1-20
1.19.2	Components of Unified Communications	1-20
1.20	Voice over IP (VoIP)	1-20
1.20.1	Requirements	1-21
1.20.2	Advantage of VoIP	1-21
1.20.3	Disadvantages	1-21
1.20.4	Protocols for VoIP	1-21
1.20.5	Difference Between UC and VoIP	1-21
• Review Questions		1-22

Chapter 2 : Principle of Layering Concept 2-1 to 2-22

Syllabus : Need of layering, ISO-OSI 7 layer model, TCP/IP model, OSI model versus TCP/IP model.

2.1	Layered Tasks	2-2
2.2	Network Software	2-2
2.2.1	Protocol Hierarchies (Layered Architecture)	2-2
2.2.2	Reasons for having Layered Protocols and its Benefits	2-3
2.2.3	Disadvantages of Layered Architecture	2-3
2.2.4	How does Data Transfer take Place ?	2-3
2.2.5	Interface	2-3



2.2.6	Network Architecture	2-4
2.2.7	Service	2-4
2.2.8	Protocol	2-4
2.3	Protocol Layering	2-4
2.3.1	Scenarios	2-4
2.3.2	Principles of Protocol Layering	2-5
2.3.3	Logical Connections	2-6
2.4	Reference Models	2-6
2.5	OSI Model	2-6
2.5.1	Layered Architecture	2-6
2.5.2	A Detailed OSI Model	2-7
2.5.3	Peer to Peer Processes	2-8
2.5.4	Organization of the Layers	2-8
2.5.5	Functions of Different Layers	2-9
2.5.6	Exchange of Information using the OSI Model	2-10
2.5.7	Merits of OSI Reference Model	2-11
2.5.8	Demerits of OSI Model	2-11
2.6	The TCP / IP Reference Model	2-11
2.6.1	Introduction to TCP / IP	2-11
2.6.2	Overview of TCP/IP Architecture	2-11
2.6.3	Description of TCP/IP Model	2-12
2.6.4	Layered Architecture	2-13
2.6.5	Layers in the TCP / IP Protocol Suite	2-13
2.7	Description of Each Layer	2-14
2.7.1	Physical Layer	2-14
2.7.2	Data Link Layer	2-15
2.7.3	Network Layer	2-15
2.7.4	Transport Layer	2-16
2.7.5	Application Layer	2-17
2.8	Encapsulation and Decapsulation	2-17
2.8.1	Encapsulation at the Source Host	2-18
2.8.2	Decapsulation and Encapsulation at the Router	2-18
2.8.3	Decapsulation at the Destination Host	2-19
2.9	Addressing	2-19
2.10	Multiplexing and Demultiplexing	2-19
2.10.1	Demerits of TCP/IP Model	2-20
2.10.2	Comparison of OSI and TCP/IP	2-20
2.10.3	Hybrid (Internet) Reference Model	2-21
	• Review Questions.....	2-21

Chapter 3 : Link Layer Communication 3-1 to 3-36

Syllabus : Error detection and correction techniques, Framing and its types, Flow and error control, HDLC protocol, P2P protocol, Examples based on error detection and correction techniques.

3.1	Introduction	3-2
3.1.1	Position of Data Link Layer	3-2
3.2	Functions of Data Link Layer	3-2
3.3	Framing and Its Types	3-3
3.3.1	Framing Methods	3-3
3.3.2	Character Count	3-3
3.3.3	Starting and Ending Character with Character Stuffing	3-3
3.3.4	Character Stuffing	3-4
3.3.5	Starting and Ending Flags, with Bit Stuffing	3-4
3.3.6	Physical Layer Coding Violations	3-5
3.4	Error Control	3-5
3.4.1	Function of a Timer	3-5
3.5	Error Detection and Correction	3-6
3.5.1	Important Definitions Related to Codes	3-6
3.5.2	Error Detection	3-7
3.5.3	Error Detection Methods	3-7
3.5.4	Parity	3-8
3.5.5	Checksum for Error Detection	3-9
3.5.6	Internet Checksum	3-10
3.5.7	Cyclic Redundancy Check (CRC)	3-11
3.5.8	Error Correction	3-14
3.5.9	Linear Block Codes	3-14
3.5.10	Hamming Codes	3-15
3.5.11	ARQ Technique	3-18
3.6	Flow Control	3-19
3.7	Elementary Data Link Protocols	3-19
3.7.1	An Unrestricted Simplex Protocol	3-19
3.7.2	A Simplex Stop and Wait Protocol	3-20
3.7.3	A Simplex Protocol for Noisy Channel	3-20
3.7.4	Piggybacking	3-21
3.8	Sliding Window Protocols	3-21
3.8.1	A One Bit Sliding Window Protocol (Stop and Wait ARQ)	3-24
3.8.2	A Protocol using GO Back n	3-26



3.8.3	Pipelining	3-28	4.4.2	Address Space	4-9
3.8.4	Selective Repeat ARQ	3-28	4.4.3	Notation	4-10
3.9	High Level Data Link Control (HDLC) Protocol	3-28	4.4.4	IP Address Network Part and Host Part	4-10
3.9.1	Frame Structure in HDLC	3-29	4.5	Classful Addressing	4-10
3.9.2	Frame Types in HDLC	3-30	4.5.1	IPv4 Address Classes	4-10
3.9.3	Transparency in HDLC	3-32	4.5.2	Formats of Various Classes	4-11
3.9.4	Bit Stuffing	3-32	4.5.3	How to Recognize Classes ?	4-11
3.10	SLIP-Serial Line IP	3-32	4.5.4	Two Level Addressing	4-12
3.11	Point-to-Point Protocol (PPP)	3-32	4.5.5	Extracting Information in a Block	4-12
3.11.1	Services Provided by PPP	3-32	4.5.6	Network Address	4-13
3.11.2	Frame Format of PPP	3-32	4.5.7	Network Mask or Default Mask	4-14
3.11.3	Transition Phases	3-33	4.5.8	Default Masks for Different Classes	4-14
3.11.4	Multiplexing	3-34	4.5.9	Finding Network Address using Default Mask	4-14
3.11.5	PPP Stack	3-34	4.5.10	Three Level Addressing Subnetting	4-15
3.11.6	Comparison of HDLC and PPP	3-35	4.5.11	Special IP Addresses	4-15
	• Review Questions.....	3-35	4.5.12	Limitations of IPv4	4-16
<hr/>			4.5.13	Classless Addressing	4-17
Chapter 4 : IP Addressing			4.5.14	Supernetting	4-17
			4.5.15	Who Decides the IP Addresses ?	4-17
			4.5.16	Registered and Unregistered Addresses	4-17
			4.5.17	Solved Examples	4-18
			4.6	Classless Addressing in IPv4	4-19
			4.6.1	Variable Length Blocks	4-19
			4.6.2	The Slash Notation (CIDR Notation)	4-20
			4.6.3	Network Mask	4-20
			4.6.4	Extracting the Block Information	4-21
			4.6.5	Block Allocation	4-23
			4.6.6	Relation to Classful Addressing	4-23
			4.6.7	Subnetting	4-23
			4.6.8	Designing Subnets	4-23
			4.6.9	Finding Information about Each Network	4-24
			4.6.10	Address Aggregation	4-24
			4.7	Special Addresses	4-24
			4.7.1	Special Blocks	4-24
			4.7.2	All Zeros Address	4-24
			4.7.3	All One Address-Limited Broadcast Address	4-25

Chapter 4 : IP Addressing**4-1 to 4-42**

Syllabus : Internet protocol and IPv4 packet format, Addressing, Physical addresses, Logical addresses, Port addresses, Specific addresses, IP address-Network part and Host part, Network masks, Network addresses and Broadcast addresses, Loop back address, Address classes, TCP and UDP connections, TCP performance in wireless network, Overview of IPv6, **IP routing** : Types of routing protocol, Border Gateway Protocol (BGP), Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Routing table concept, Examples based on IP addressing and subnetting.

4.1	Addressing	4-2
4.1.1	MAC Address (Physical Address)	4-2
4.1.2	Logical Addresses (IP Addresses)	4-3
4.1.3	Port Address	4-3
4.1.4	Specific Addresses	4-3
4.2	Internet Protocol Version 4 (IPv4)	4-3
4.2.1	Position of IP	4-3
4.2.2	Internet Protocol (IP)	4-3
4.2.3	Datagrams	4-4
4.2.4	IPv4 Header Format	4-4
4.3	Why IP Address ? 4-8	4-8
4.4	IPv4 Addresses	4-9
4.4.1	Uniqueness of IP Addresses	4-9



4.7.4	Loopback Address	4-25	4.16.4	Types of Attributes	4-40
4.7.5	Private Addresses	4-25	4.17	BGP Sessions	4-41
4.7.6	Multicast Addresses	4-25	4.17.1	External and Internal BGP	4-41
4.7.7	Special Addresses in Each Block	4-25	4.17.2	Types of Messages	4-41
4.7.8	Network Address	4-25	4.17.3	Encapsulation	4-41
4.7.9	Direct Broadcast Address	4-25	4.17.4	How does BGP Solve the Count to Infinity Problem ?	4-41
4.8	Overview of IPv6	4-25		• Review Questions	4-42
4.8.1	Advantages of IPv6	4-26	<hr/>		
4.9	IPv6 Addressing	4-26	Chapter 5 : Application Layer Protocols 5-1 to 5-38		
4.9.1	IPv6 Address	4-26	Syllabus : DHCP- DHCP client, DHCP server, DHCP scope, DNS- Resolution process, Resource records, DNS protocol structure, HTTP- WWW architecture, HTTP-Request and Response message, E-mail protocols- SMTP, POP3, IMAP 4 and MIME, FTP, Telnet.		
4.9.2	Notations	4-26	5.1	Introduction	5-2
4.9.3	Abbreviation	4-27	5.1.1	Position of Application Layer	5-2
4.10	IPv6 Packet Format	4-28	5.2	Providing Services	5-3
4.10.1	Payload	4-29	5.2.1	Standard and Non-standard Protocols	5-3
4.10.2	Extension Headers	4-29	5.2.2	Standard Protocols	5-3
4.11	Comparison between IPv4 and IPv6	4-30	5.2.3	Nonstandard Protocols	5-3
4.12	IP Routing	4-31	5.3	Application Layer Paradigms	5-3
4.12.1	Routing	4-31	5.3.1	Traditional Paradigm Client Server	5-3
4.12.2	Cost or Metric	4-31	5.3.2	New Paradigm Peer-to-Peer (P2P)	5-4
4.12.3	Routing Tables	4-32	5.4	Standard Client Server Applications	5-5
4.13	IP Routing Protocols.....	4-32	5.5	Host Configuration DHCP	5-5
4.13.1	Unicast Routing Protocols	4-32	5.5.1	Previously used Protocols	5-5
4.14	RIP (Routing Information Protocol)	4-32	5.5.2	DHCP	5-6
4.14.1	RIP Updating Algorithm	4-33	5.5.3	Advantages of DHCP	5-6
4.14.2	Initializing the Routing Table	4-33	5.5.4	Components of DHCP	5-7
4.14.3	Updating the Routing Table	4-33	5.5.5	DHCP Operation	5-7
4.14.4	RIP Operation	4-33	5.5.6	DHCP Operation on Different Networks.....	5-8
4.14.5	RIP Message Format	4-34	5.5.7	UDP Ports	5-8
4.14.6	Problems in RIP	4-34	5.6	Domain Name System (DNS)	5-9
4.15	OSPF	4-35	5.6.1	How does DNS Work ?.....	5-9
4.15.1	Features of OSPF	4-36	5.6.2	Name Space	5-9
4.15.2	Metric	4-37	5.6.3	Flat Name Space	5-9
4.15.3	Types of Links	4-37	5.6.4	Hierarchical Name Space	5-10
4.15.4	Virtual Link	4-38	5.7	Domain Name Space	5-10
4.15.5	OSPF Packet Types	4-38	5.8	Distribution of Name Space	5-11
4.15.6	Comparison between RIP and OSPF	4-39	5.8.1	Hierarchy of Name Servers	5-11
4.16	Border Gateway Protocol (BGP)	4-40	5.9	DNS in the Internet	5-13
4.16.1	Types of Autonomous Systems	4-40			
4.16.2	CIDR	4-40			
4.16.3	Path Attributes	4-40			



5.9.1	Generic Domains	5-13	5.16.3	Components of E-mail System	5-30
5.9.2	Country Domain	5-13	5.16.4	SMTP Commands	5-30
5.9.3	Inverse Domain	5-13	5.16.5	SMTP Operation	5-31
5.10	Name Address Resolution	5-13	5.17	Message Access Agent POP and IMAP	5-31
5.10.1	Recursive Resolution	5-14	5.17.1	POP 3	5-32
5.10.2	Iterative Resolution	5-14	5.17.2	IMAP4	5-32
5.10.3	The DNS Message Format	5-15	5.18	File Transfer Protocol (FTP)	5-33
5.10.4	Caching	5-15	5.18.1	Communication in FTP	5-33
5.11	DNS Records	5-15	5.18.2	File Types	5-34
5.11.1	Question Records	5-15	5.18.3	Data Structure	5-34
5.11.2	Resource Record	5-16	5.18.4	Transmission Mode	5-34
5.12	World Wide Web (WWW)	5-16	5.18.5	File Transfer	5-35
5.12.1	Web from the Users Side	5-16	5.18.6	FTP Commands	5-35
5.12.2	Web from the Servers Side	5-18	5.18.7	Anonymous FTP	5-35
5.12.3	WWW Architecture	5-18	5.18.8	Security for FTP	5-35
5.12.4	Browser (Web Client)	5-19	5.19	Remote Login	5-36
5.12.5	Server	5-19	5.19.1	TELNET	5-36
5.12.6	Uniform Resource Locator (URL)	5-19	5.19.2	Network Virtual Terminal (NVT)	5-37
5.12.7	Cookies User-Server Interaction	5-19	5.19.3	Security Problems of TELNET	5-37
5.13	HTTP (Hypertext Transfer Protocol)	5-20		• Review Questions	5-37
5.13.1	Principle of HTTP Operation	5-20	Chapter 6 : Network Security 6-1 to 6-22		
5.13.2	The Web and HTTP	5-20	Syllabus : Active and passive attacks, Cryptography (Symmetric and Asymmetric), Firewall. Examples on Symmetric and Asymmetric algorithms.		
5.13.3	Non-persistent and Persistent Connection	5-21	6.1	Introduction	6-2
5.13.4	HTTP Messages	5-23	6.1.1	Security Goals	6-2
5.13.5	Request Message	5-23	6.1.2	Attacks	6-2
5.13.6	Methods (Request Type)	5-23	6.1.3	Attacks on Confidentiality	6-2
5.13.7	Response Message	5-24	6.1.4	Attacks on Integrity	6-2
5.14	Electronic Mail	5-24	6.1.5	Attacks on Availability	6-3
5.14.1	E-mail Architecture and Services	5-24	6.1.6	Services and Techniques	6-3
5.14.2	Message Formats	5-26	6.2	Cryptography	6-3
5.15	MIME – Multipurpose Internet Mail Extensions	5-27	6.2.1	Encryption model	6-3
5.15.1	Principle of MIME	5-27	6.2.2	Steganography	6-4
5.16	Message Transfer Agent SMTP	5-29	6.3	Cryptographic Attacks	6-4
5.16.1	Commands and Responses	5-29	6.3.1	Passive Attacks	6-4
5.16.2	SMTP (Simple Mail Transfer Protocol)	5-29	6.3.2	Active Attacks	6-5



6.3.3	Comparison of Active and Passive Attacks	6-6	6.12	Firewalls	6-20
6.3.4	Confidentiality	6-6	6.12.1	Types	6-20
6.4	Symmetric Key Ciphers	6-7	6.12.2	Packet Filter Firewall	6-20
6.4.1	Types of Symmetric Key Ciphers	6-7	6.12.3	Proxy Based Firewall	6-20
6.4.2	Traditional Symmetric Key Ciphers	6-7		• Review Questions	6-21
6.4.3	Substitution Ciphers	6-7	<hr/>		
6.4.4	Transposition Cipher	6-8	Chapter 7 : Socket Programming 7-1 to 7-18		
6.5	Modern Symmetric Key Ciphers	6-9	Syllabus : Introduction, Berkeley sockets, Specifying a protocol interface, The socket abstraction, System data structures for sockets, Specifying an endpoint address, A generic address structure, Major system calls used with sockets, Utility routines for integer conversion, Using socket calls in a program, (The socket can be created in any language).		
6.5.1	A Modern Block Cipher	6-9	7.1	Introduction	7-2
6.6	Data Encryption Standard (DES)	6-10	7.2	Berkeley Sockets	7-2
6.6.1	Key Generation	6-10	7.3	Specifying A Protocol Interface	7-2
6.7	Asymmetric Key Ciphers	6-11	7.4	The Socket Abstraction	7-2
6.7.1	Public Key (Asymmetric) Cryptosystem ..	6-11	7.4.1	System Data Structures for Sockets	7-3
6.7.2	The RSA Cryptosystem	6-12	7.5	Specifying an Endpoint Address	7-4
6.7.3	Comparison of Secret Key and Public Key Cryptosystems	6-13	7.6	A Generic Address Structure	7-4
6.8	Digital Signature	6-13	7.7	Major System Calls Used with Sockets	7-5
6.8.1	Digital Signature Process	6-13	7.7.1	The Socket Call	7-5
6.8.2	Signing the Digest	6-14	7.7.2	The Connect Call	7-5
6.8.3	Services Provided by Digital Signature ...	6-14	7.7.3	The Write Call	7-5
6.8.3.1	Message Authentication	6-14	7.7.4	The Read Call	7-5
6.8.3.2	Message Integrity	6-14	7.7.5	The Close Call	7-6
6.8.3.3	Nonrepudiation	6-14	7.7.6	The Bind Call	7-6
6.9	Network Layer Security	6-15	7.7.7	The Listen Call	7-6
6.9.1	IPsec (IP security)	6-15	7.7.8	The Accept Call	7-6
6.9.2	Modes of Operation of IPsec	6-16	7.8	Utility Routines for Integer Conversion	7-7
6.10	Transport Layer Security	6-17	7.9	Using Socket Calls in A Program	7-7
6.10.1	Design Goals of SSL	6-17			
6.10.2	SSL - Secure Socket Layer	6-17			
6.11	Application Layer Security	6-17			
6.11.1	Email Security	6-18			
6.11.2	PGP - Pretty Good Privacy	6-18			
6.11.3	PGP Working	6-19			