

**Chapter 1 : Introduction****1-1 to 1-38**

Syllabus : Transmission Fundamentals : Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing.

Communication Networks : LANs, MANs and WANs, Switching Techniques : Circuit switching, Packet switching.

1.1	Introduction	1-2	1.11.2	Noiseless Channel : Nyquist Information Rate	1-10
1.1.1	Data Communication System	1-2	1.11.3	Noisy Channel : Shannon's Channel Capacity	1-10
1.2	Signals for Conveying Information	1-3	1.12	Transmission Media	1-13
1.2.1	Analog and Digital Data	1-3	1.12.1	Classification of Transmission Media	1-13
1.2.2	Analog and Digital Signals	1-3	1.12.2	Types of Wired Media	1-14
1.3	Classification of Analog Signals	1-3	1.13	Twisted Pair Cables	1-14
1.4	Composite Signal and Transmission Medium	1-4	1.13.1	UTP (Unshielded Twisted Pair)	1-14
1.4.1	Transmission Medium	1-4	1.13.2	STP (Shielded Twisted Pair)	1-15
1.5	Bandwidth	1-4	1.13.3	Comparison of Twisted Pair Cables	1-16
1.5.1	Signal Bandwidth	1-4	1.14	Co-axial Cables	1-16
1.5.2	Channel Bandwidth	1-5	1.15	Optical Fiber Cables	1-17
1.6	Digital Signals	1-5	1.15.1	Characteristics of Optical Fiber Cables	1-18
1.6.1	Advantages of Digital Signals	1-5	1.15.2	Advantages of Optical Fibers	1-18
1.6.2	Bit Interval	1-6	1.15.3	Disadvantages of Optical Fiber	1-18
1.6.3	Bit Rate (Data Rate)	1-6	1.15.4	Applications	1-19
1.6.4	Bauds (or Baud Rate)	1-6	1.15.5	Comparison of Wired Media	1-19
1.7	Bandwidth Utilization	1-6	1.16	Wireless(Unguided) Media	1-19
1.8	Data Transmission Rate and Bandwidth	1-7	1.17	Types of Wireless Media	1-19
1.8.1	Relation between Required Bandwidth and Bit Rate	1-7	1.17.1	Radio Wave Transmission Systems	1-20
1.9	Digital Versus Analog Bandwidth	1-7	1.17.2	Microwave Transmission System	1-20
1.9.1	Analog Bandwidth	1-8	1.17.3	Advantages of Wireless Transmission	1-21
1.9.2	Digital Bandwidth	1-8	1.17.4	Disadvantages of Wireless Transmission	1-22
1.10	Transmission of Digital Signals	1-8	1.18	Comparison of Wired and Wireless Media	1-22
1.10.1	Baseband Transmission	1-8	1.19	Multiplexing	1-22
1.10.2	Broadband Transmission (with Modulation)	1-8	1.19.1	Multiplexing Techniques	1-23
1.10.3	Channel Capacity	1-9	1.20	Frequency Division Multiplexing (FDM)	1-23
1.10.4	Signal to Noise Ratio	1-9	1.20.1	Advantages of FDM	1-24
1.11	Data Rate Limits	1-9	1.20.2	Disadvantages of FDM	1-24
1.11.1	Classification of communication channels	1-10	1.20.3	Applications of FDM	1-24
			1.21	Time Division Multiplexing	1-24
			1.21.1	Advantages of TDM	1-25
			1.21.2	Disadvantages of TDM	1-26
			1.21.3	Applications of TDM	1-26
			1.22	Communication Networks	1-26
			1.22.1	Local Area Networks (LAN)	1-26



1.22.2	Metropolitan Area Network (MAN)	1-27
1.22.3	Wide Area Network (WAN)	1-28
1.22.4	PAN (Personal Area Network)	1-29
1.22.5	Comparison of LAN, WAN and MAN	1-29
1.23	Introduction to Switching	1-30
1.24	Switching Techniques	1-30
1.25	Circuit Switching	1-30
1.25.1	Communication Phases	1-31
1.25.2	Efficiency	1-32
1.25.3	Delay	1-32
1.25.4	Features	1-32
1.25.5	Advantages	1-32
1.25.6	Disadvantages	1-32
1.25.7	Application	1-32
1.26	Packet Switching	1-32
1.26.1	Datagram Packet Switching	1-33
1.26.2	Efficiency	1-34
1.26.3	Delay	1-34
1.26.4	Features of Packet Switching	1-34
1.26.5	Advantages of Datagram Packet Switching	1-34
1.26.6	Disadvantages of Datagram Packet Switching	1-35
1.26.7	Datagram Networks in Internet	1-35
1.27	Virtual Circuit Packet Switching	1-35
1.27.1	Addressing	1-36
1.27.2	Three Phases of Communication :.....	1-36
1.27.3	Efficiency	1-36
1.27.4	Delay	1-36
1.27.5	Circuit Switched Technology in WANs	1-36
1.27.6	Advantages of Virtual Circuit Packet Switching	1-36
1.27.7	Disadvantages of Virtual Circuit Packet Switching	1-36
1.27.8	Comparison of Switching Techniques	1-37
1.28	Comparison of Circuit and Packet Switching	1-37
	• Review Questions	1-38

Chapter 2 : Cellular Wireless Networks 2-1 to 2-56

Syllabus : Cellular Wireless Networks : Principles of Cellular Networks, First-Generation (Analog), Second-Generation TDMA Second-Generation CDMA, Third-Generation Systems.

Antennas and Propagation : Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment. **Spread Spectrum :** The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum. **Coding and Error Control :** Error Detection, Block Error Correction Codes, Convolutional Codes, Automatic Repeat Request.

2.1	Introduction.....	2-3
2.1.1	Wireless Communication	2-3
2.2	Examples of Wireless Systems	2-3
2.2.1	Important Definitions	2-4
2.3	Cellular Wireless Networks	2-5
2.3.1	Principle of Cellular Networks	2-5
2.3.2	Cellular Telephone System	2-6
2.4	Hexagonal Cell Geometry	2-7
2.5	Frequency Reuse	2-8
2.5.1	Advantages of Frequency Reuse	2-8
2.5.2	Frequency Reuse Schemes	2-8
2.5.3	Analysis of Frequency Reuse Concept	2-9
2.5.4	Capacity of Cellular System (C)	2-9
2.5.5	Frequency Reuse Distance	2-10
2.6	Hand Off	2-10
2.6.1	Handoff Strategies	2-10
2.6.2	Dwell Time	2-11
2.6.3	Different Types of Hand Offs	2-11
2.7	Wireless Network Generations	2-13
2.7.1	First Generation Cellular Networks	2-13
2.8	Second Generation Cellular Networks	2-14
2.8.1	Types of 2G Standards	2-14
2.8.2	Technical Specifications of 2G	2-15
2.8.3	Features of 2G Systems	2-16
2.8.4	Evolution to 2.5G Mobile Radio Networks	2-17
2.8.5	Evolution for 2.5-G TDMA Standards	2-18
2.8.5.1	HSCSD for 2.5-G GSM	2-18
2.8.5.2	GPRS for 2.5- G GSM and IS-136	2-19
2.8.5.3	EDGE for 2.5-G GSM and IS-136	2-20



2.8.6	IS-95 B for 2.5-G CDMA	2-21	2.20.3	Types of Frequency Hopping	2-39
2.9	Third Generation (3-G) Wireless Networks	2-22	2.20.4	Advantages of FH-SS System	2-39
2.9.1	Features of Third Generation	2-23	2.20.5	Disadvantages of FH-SS System	2-39
2.9.2	Services Provided by 3G Systems	2-23	2.20.6	Applications of FHSS	2-39
2.9.3	Advantages of 3-G Networks	2-23	2.20.7	Comparison of DS-SS and FHSS	2-40
2.9.4	Comparison of Various Mobile System Generations	2-24	2.21	Error Control	2-40
2.10	Antenna Fundamentals	2-24	2.21.1	Errors and Their Effects	2-40
2.10.1	Radiation Pattern of Antenna	2-25	2.21.2	Need of Error Control Coding	2-40
2.10.2	Directivity	2-25	2.21.3	Encoding and Decoding	2-41
2.10.3	Bandwidth of Antenna	2-25	2.21.4	Redundancy	2-41
2.10.4	Beamwidth	2-25	2.21.5	Classification of Error Control Techniques	2-41
2.11	Microwave Antennas	2-26	2.22	Error Detection Techniques	2-42
2.11.1	Requirements of Microwave Antennas	2-26	2.22.1	Parity Checking	2-42
2.11.2	A Microstrip Patch Antenna	2-26	2.22.2	Two Dimensional Parity Check (Block Parity)	2-43
2.12	Propagation	2-27	2.22.3	Checksum Error Detection	2-44
2.12.1	Ground Wave Propagation	2-27	2.23	Cyclic Redundancy Check (CRC)	2-45
2.12.2	Sky Wave Propagation	2-27	2.23.1	CRC Generator	2-46
2.13	Space Wave Propagation (Line of Sight Propagation)	2-28	2.23.2	CRC Checker	2-47
2.14	Mobile Radio Propagation	2-29	2.24	Error Correction	2-49
2.14.1	Multipath Propagation	2-29	2.25	Classification of Error-correcting Codes	2-49
2.14.2	Multipath Reception and Fading	2-29	2.26	Linear Block Codes	2-49
2.15	Noise	2-30	2.26.1	Some Linear Block Codes	2-50
2.16	Free Space Path Loss	2-31	2.27	Hamming Codes	2-50
2.17	Concept of Fading	2-31	2.27.1	Generation of Hamming Code	2-50
2.17.1	Small Scale Fading	2-32	2.27.2	Selection of Parity Bits	2-50
2.17.2	Types of Small Scale Fading	2-32	2.27.3	Detection and Correction of Errors	2-51
2.17.3	Diversity Reception	2-33	2.28	ARQ Technique (Retransmission)	2-52
2.18	Spread-Spectrum (SSMA)	2-34	2.28.1	Types of ARQ System	2-53
2.18.1	A Spread Spectrum System	2-35	2.28.2	Stop and Wait ARQ System	2-53
2.18.2	Types of Spread Spectrum Technique	2-36	2.28.3	GO Back n ARQ System	2-53
2.19	Direct Sequence Spread Spectrum (DSSS)	2-36	2.28.4	Selective Repeat ARQ	2-54
2.19.1	DSSS Transmitter	2-36	2.29	Convolutional Codes.....	2-55
2.19.2	DS-SS Receiver	2-37		• Review Questions.....	2-55
2.19.3	Advantages of DS-SS System	2-37	<hr/>		
2.19.4	Disadvantages of DS-SS System	2-37	Chapter 3 : Multiple Access in Wireless Systems		
2.19.5	Applications of DS-SS System	2-37	3-1 to 3-20		
2.20	Frequency Hop Spread Spectrum (FH-SS)	2-38	Syllabus : Multiple access in Wireless System :		
2.20.1	Operation of FHSS	2-38	Multiple access scheme, Frequency division multiple access, Time division multiple access, Code division multiple access, Space division multiple access, Packet radio access, Multiple access with collision avoidance.		
2.20.2	FHSS Transmitter and Receiver	2-39			



3.1	Multiple Access.....	3-2
3.1.1	Frequency Division Duplexing (FDD)	3-2
3.1.2	Time Division Duplexing (TDD)	3-3
3.2	Multiple Access Techniques	3-3
3.3	Frequency Division Multiple Access (FDMA)	3-3
3.3.1	Features of FDMA	3-4
3.3.2	Nonlinear Effects in FDMA	3-4
3.3.3	Number of FDMA Channels	3-5
3.3.4	Merits of FDMA	3-5
3.3.5	Demerits of FDMA	3-5
3.4	Time Division Multiple Access (TDMA)	3-6
3.4.1	Number of Channels in TDMA System	3-6
3.4.2	Efficiency of TDMA System	3-6
3.4.3	TDMA Features	3-7
3.4.4	Advantages of TDMA	3-7
3.4.5	Advantages of TDMA over FDMA	3-7
3.4.6	Disadvantages	3-8
3.4.7	Problems with FDMA and TDMA	3-8
3.5	Code Division Multiple Access (CDMA)	3-8
3.5.1	Spread Spectrum and CDMA	3-9
3.5.2	Basic Structure of CDMA System	3-10
3.5.3	Salient Features of CDMA Systems	3-10
3.5.4	Multiple Access Techniques in Cellular Systems	3-11
3.5.5	Advantages of CDMA	3-12
3.5.6	Disadvantages	3-12
3.5.7	CDMA Applications	3-12
3.6	Space Division Multiple Access (SDMA)	3-12
3.6.1	Advantages of SDMA	3-13
3.6.2	Applications of SDMA	3-13
3.7	Packet Radio Multiple Access	3-13
3.7.1	Advantages of PRMA	3-14
3.7.2	Disadvantages of PRMA	3-14
3.7.3	CSMA Protocols	3-14
3.8	Multiple Access with Collision Avoidance	3-15
3.8.1	Types of CSMA	3-15
3.8.2	Flow diagram of CSMA-CA	3-15
3.8.3	RTS/CTS Handshake.....	3-15
3.8.4	Types of CSMA / CA	3-17
3.9	Comparison of Multiple Access Strategies.....	3-18

• **Review Questions..... 3-19**

Chapter 4 : GSM and GPRS

4-1 to 4-50

Syllabus : Global system for mobile communication :

Global system for mobile communication, GSM architecture, GSM entities, Call routing in GSM, PLMN interface, GSM addresses and identifiers, Network aspects in GSM, GSM frequency allocation, Authentication and security.

General packet radio service (GPRS) : GPRS and packet data network, GPRS network architecture, GPRS network operation, Data services in GPRS, Applications of GPRS, Billing and charging in GPRS.

4.1	Global System for Mobile (GSM)	4-2
4.2	GSM System Architecture	4-2
4.2.1	Detail Architecture of GSM	4-3
4.2.2	Various Subsystems in GSM	4-4
4.2.3	MS (Mobile Station)	4-4
4.2.4	BSS (Base Station Subsystem)	4-5
4.2.5	NSS (Network Switching Subsystem) ...	4-5
4.2.6	OMSS Operation and Maintenance Subsystem	4-7
4.2.7	Characteristics / Features of GSM Standard	4-7
4.2.8	GSM Entities	4-8
4.3	GSM Radio Subsystem	4-8
4.3.1	GSM Specifications / GSM air Interface	4-10
4.3.2	GSM Frequency Spectrum	4-10
4.4	Network Aspects in GSM	4-11
4.4.1	GSM Interfaces	4-11
4.4.2	Mobile Station-Base Transceiver Station Signaling Protocols	4-12
4.4.3	Abis Interface / Base Transceiver Station (BTS)-Base Station Controller (BSC) Signaling Protocols	4-13
4.4.4	A Interface / Base Station Controller (BSC) – Mobile Switching Centre (MSC) Signaling Protocols	4-13
4.5	Signalling System - 7 (SS7)	4-13
4.5.1	Primary Characteristics of SS7	4-14
4.5.2	Functions of SS7	4-14
4.5.3	Features of SS7	4-14
4.6	GSM Addresses and Identifiers	4-14



4.6.1	IMSI (International Mobile Subscriber Identity)	4-14	4.16.2	Advantages of GSM	4-37
4.6.2	MSIN (Mobile Subscriber Identification Number)	4-15	4.16.3	Disadvantages of GSM	4-37
4.6.3	Subscriber Identity Module (SIM)	4-15	4.17	GSM Evolution	4-37
4.6.4	Mobile System ISDN (MSISDN)	4-15	4.17.1	Evolution from 2G to 3G Cellular Networks	4-38
4.6.5	LAI (Location Area Identity)	4-16	4.17.2	Comparison of GSM and CDMA (IS-95) System	4-39
4.6.6	IMSEI (International MS Equipment Identity) / IMEI (International Mobile Equipment Identity)	4-16	4.18	GPRS - General Packet Radio Service	4-39
4.6.7	MSRN (Mobile Station Roaming Number)	4-17	4.18.1	Features of GPRS	4-40
4.6.8	TMSI [Temporary Mobile Subscriber Identity]	4-17	4.18.2	GPRS Architecture	4-40
4.7	GSM Channels	4-17	4.18.3	GPRS Radio Interface	4-41
4.8	GSM Logical Channel	4-18	4.18.4	GPRS Physical Layer	4-43
4.8.1	GSM Traffic Channels (TCHs)	4-18	4.18.5	Logical Channels in GPRS	4-43
4.8.2	GSM Control Channels (CCH)	4-19	4.18.6	GPRS Frame Structure and Channel Coding	4-44
4.9	Frame Structure of GSM	4-21	4.18.7	GPRS Transmission Management	4-44
4.10	Call Routing in GSM	4-22	4.18.8	GPRS Protocol Stack / GPRS Protocol Reference Model	4-45
4.10.1	An Example of Call Routing	4-24	4.18.9	GPRS Data Services	4-46
4.11	PLMN Interfaces	4-25	4.18.10	Characteristics of GPRS	4-46
4.12	Call Procedures in GSM	4-26	4.18.11	Advantages of GPRS	4-46
4.13	GSM Handoff Procedures	4-28	4.18.12	Disadvantages of GPRS	4-46
4.13.1	Handover in GSM	4-28	4.18.13	Applications of GPRS	4-47
4.13.2	Types of Handover in GSM	4-29	4.18.14	Comparison of GSM and GPRS	4-47
4.14	Security in GSM	4-30	4.19	Billing and Charging in GPRS	4-48
4.14.1	Access Control and Authentication	4-30		Review Questions.....	4-49
4.14.2	Confidentiality	4-30	Chapter 5 : Wireless System Operations and Standards		
4.14.3	Anonymity	4-31	5-1 to 5-30		
4.14.4	Authentication in GSM	4-31	Syllabus : Cordless Systems, Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards, Mobile IP and Wireless Application Protocol.		
4.14.5	Authentication Algorithm A3	4-32	5.1	Cordless Systems.....	5-2
4.14.6	Data Encryption Process using A5 and A8 Algorithm	4-32	5.2	Cordless Telephone Systems	5-2
4.15	GSM Services	4-33	5.3	DECT Standard	5-2
4.15.1	Teleservices	4-33	5.3.1	Features of DECT	5-3
4.15.2	Data Services / Bearer Services	4-34	5.3.2	DECT Protocol Architecture	5-3
4.15.3	Bearer Services	4-34	5.3.3	DECT Radio Specifications	5-4
4.15.4	Supplementary Services	4-35	5.3.4	Applications of DECT	5-5
4.16	Applications of GSM	4-35	5.4	Fixed Wireless Networks	5-5
4.16.1	Other applications of GSM	4-37	5.4.1	Wireless Local Loop (WLL)	5-5



5.4.2	WLL Architecture	5-6	5.9.2	Mobile IP	5-16
5.5	WLL Technologies	5-7	5.9.3	Addressing in Mobile IP	5-17
5.5.1	Satellite-Based Systems	5-7	5.9.4	Agents in Mobile IP	5-17
5.5.2	Cellular-Based Systems	5-7	5.10	Operation of Mobile IP	5-18
5.5.3	Low-Tier PCS or Microcellular-Based Systems	5-8	5.10.1	Agent Discovery (Steps 1 to 4)	5-19
5.5.4	Fixed Wireless Access (FWA) Systems	5-8	5.10.2	Registration (Steps 5 to 8)	5-19
5.5.5	Features of WLL	5-8	5.10.3	Data Transfer (Tunnelling and Encapsulation)	5-19
5.5.6	Advantages of WLL	5-8	5.10.4	Tunnelling and Encapsulation	5-20
5.5.7	Disadvantages of WLL	5-9	5.10.5	Transparency	5-21
5.5.8	Applications of WLL	5-9	5.10.6	Inefficiency in Mobile IP	5-21
5.6	Wireless MAN (WMAN)	5-9	5.10.7	Applications of Mobile IP	5-22
5.6.1	Wi-MAX	5-9	5.11	Wireless Application Protocol (WAP)	5-22
5.6.2	Wi-Bro (Wireless Broadband)	5-10	5.11.1	WAP Model / WAP Architecture	5-23
5.6.3	Need of WMAN	5-10	5.11.2	WAP Gateway	5-24
5.7	IEEE 802.16 (Wi-MAX)	5-10	5.11.3	WAP Protocol	5-24
5.7.1	Wi-Max Standards	5-10	5.11.4	WAP 2.0	5-27
5.7.2	Structure of WMAN	5-10	5.12	WML (Wireless Markup Language)	5-28
5.7.3	IEEE Project 802.16 (Wi-Max)	5-11	5.12.1	WML Script	5-28
5.7.4	New Standards	5-11	5.12.2	Advantages of WAP	5-29
5.7.5	Spectrum Allocation	5-11	5.12.3	Disadvantages of WAP	5-29
5.7.6	Layers in 802.16 (Protocol Stack)	5-11	5.12.4	Applications of WAP	5-29
5.7.7	Physical Layer (IEEE 802.16)	5-12	• Review Questions.....	5-29	
5.7.8	Specifications of IEEE 802.16	5-12	Chapter 6 : Wireless LAN Standards 6-1 to 6-34		
5.8	Types of Wi-Max Services	5-13	Syllabus : Wi-Fi and the IEEE 802.11 Wireless LAN Standard : IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi protected access.		
5.8.1	Fixed Wi-Max Services	5-13	6.1	Introduction to WLAN	6-2
5.8.2	Mobile Wi-Max Services	5-13	6.1.1	IEEE Standards	6-2
5.8.3	Comparison between Fixed and Mobile Wi-MAX	5-14	6.1.2	Wi-Fi	6-2
5.8.4	Internet Access	5-14	6.1.3	ISM Band	6-2
5.8.5	Mobile Phones based on Wi-Max	5-14	6.2	Architectural Comparison	6-3
5.8.6	Spectral Efficiency	14	6.2.1	Medium	6-3
5.8.7	Advantages of IEEE 802.16 (Wi-MAX)	5-14	6.2.2	Hosts	6-3
5.8.8	Disadvantages of Wi-MAX	5-15	6.2.3	Isolated LANs	6-3
5.8.9	Uses / Applications of Wi-Max	5-15	6.2.4	Connection to Other Networks	6-4
5.8.10	Comparison of Wi-Fi and Wi-Max	5-15	6.2.5	Moving between Environments	6-4
5.9	Mobile IP	5-16	6.3	WLAN Equipment	6-4
5.9.1	Limitations of Traditional IP for Mobile User	5-16	6.3.1	LAN Adapter	6-4
			6.3.2	Access Point (AP)	6-4



6.3.3	Outdoor LAN Bridges	6-5	6.10.4	Ranges and Zones	6-25
6.4	WLAN Topologies	6-6	6.10.5	Distributed Co-ordination Function (DCF)	6-25
6.4.1	Peer-to-peer (ad hoc) Topology	6-6	6.10.6	Hidden Station Problem	6-27
6.4.2	AP Based Topology	6-6	6.11	Point Co-ordinate Function (PDF)	6-27
6.5	Characteristics of WLANs	6-6	6.11.1	Fragmentation	6-28
6.5.1	Attenuation	6-6	6.12	Framing	6-28
6.5.2	Interference	6-7	6.13	Address Mechanisms	6-29
6.5.3	Multipath Propagation	6-7	6.13.1	Exposed Station Problem	6-30
6.5.4	Error	6-7	6.14	Advantages of WLANs	6-30
6.5.5	Design Goals for WLANs	6-7	6.14.1	Disadvantages of WLAN	6-31
6.5.6	Factors Considered to Deploy WLAN	6-8	6.15	Applications of Wireless LAN	6-31
6.6	Medium Access Control (MAC)	6-9	6.16	Wi-Fi Protected Access	6-31
6.6.1	MAC Protocol Issues	6-9	6.16.1	The Wi-Fi Technology	6-31
6.6.2	Hidden Terminal Problem	6-9	6.16.1.1	IEEE 802.11b	6-31
6.6.3	Exposed Station Problem	6-10	6.16.1.2	IEEE 802.11a	6-32
6.6.4	Reliability	6-11	6.16.1.3	IEEE 802.11g	6-32
6.6.5	Collision Avoidance	6-11	6.16.2	Comparison of IEEE 802.11 and IEEE 802.16	6-32
6.6.6	Congestion Avoidance	6-12	6.16.3	Comparison of Wi-Fi and 3G	6-32
6.6.7	Congestion Control	6-12	6.17	Comparison of Wired and Wireless LANs	6-33
6.6.8	Energy Efficiency	6-12		• Review Questions	6-33
6.6.9	Other MAC Issues	6-13			
6.7	WLAN Technologies	6-13			
6.7.1	IR (Infrared) Technology	6-13			
6.7.2	UHF Narrowband Technology	6-14			
6.7.3	Spread Spectrum Technology	6-14			
6.8	IEEE 802.11 Standard for WLAN	6-14			
6.8.1	Classification of WLANs	6-14			
6.8.2	The IEEE 802.11 Protocol Stack	6-15			
6.8.3	802.11 Network Architecture	6-16			
6.8.4	Types of Stations	6-17			
6.9	The Physical Layer	6-17			
6.9.1	IEEE 802.11 FHSS	6-19			
6.9.2	IEEE 802.11 DSSS	6-20			
6.9.3	IEEE 802.11 Infrared	6-21			
6.9.4	IEEE 802.11 a OFDM	6-21			
6.9.5	IEEE 802.11 b HR-DSSS	6-22			
6.9.6	IEEE 802.11 g OFDM	6-23			
6.9.7	IEEE 802.11 n OFDM	6-23			
6.10	MAC Sublayer	6-23			
6.10.1	RTS and CTS Messages	6-24			
6.10.2	The Retry Counters	6-24			
6.10.3	Different Time Intervals	6-24			

Chapter 7 : Bluetooth**7-1 to 7-18**

Syllabus : Bluetooth : Radio specification, Baseband specification, Link manager specification, Logical link control and adaptation protocol.

7.1	PAN (Personal Area Network)	7-2
7.2	Wireless PAN (WPAN)	7-2
7.2.1	Need of Wireless PAN	7-2
7.3	Bluetooth IEEE 802.15.1	7-3
7.4	Principle of Bluetooth	7-3
7.5	Bluetooth Devices	7-4
7.5.1	Features of Bluetooth	7-4
7.5.2	Radio Specifications of BT	7-4
7.6	Bluetooth Architecture	7-5
7.6.1	Piconets	7-5
7.6.2	Scatternets	7-6
7.6.3	Comparison of Piconet and Scatternet	7-7
7.7	Bluetooth Protocol Stack	7-7
7.7.1	Logical Link Control and Adaptation Protocol (L2CAP)	7-9



7.7.2	Frame Format in Baseband Layer	7-10	8.3.5	Applications	8-4
7.7.3	TDMA (Time Division Multiple Access)	7-11	8.4	Android Application Programming Interface (APIs)	8-5
7.7.4	Frequency Band	7-13	8.5	The Application Components	8-5
7.7.5	FHSS	7-13	8.5.1	Basic Components in Android Application	8-6
7.7.6	Modulation	7-13	8.5.2	Additional Components in Android Application	8-6
7.8	Link Types	7-13	8.6	Android Manifest File	8-7
7.8.1	SCO Link	7-13	8.7	Downloading and Installing the Android	8-7
7.8.2	ACL Link	7-13	8.8	Exploring the Development Environment, Developing and Executing the First Android Application	8-8
7.9	Packet Transmission in Bluetooth	7-13	8.9	Working with Activities	8-10
7.10	State Model of Bluetooth	7-14	8.9.1	Different States of an Activity	8-10
7.10.1	Standby Mode	7-14	8.9.2	Activity Lifecycle Methods	8-11
7.10.2	Connection Mode	7-14	8.10	Android Layouts	8-13
7.10.3	Connection Establishment in BT	7-15	8.10.1	The Linear Layout	8-13
7.10.4	Advantages of Bluetooth	7-16	8.10.2	The Relative Layout	8-14
7.10.5	Disadvantages of Bluetooth	7-16	8.10.3	The Frame Layout	8-14
7.10.6	Security Limitations in Bluetooth	7-16	8.10.4	The Scroll View Layout	8-14
7.11	Applications of BT	7-17	8.10.5	The Table Layout	8-15
7.12	Comparison of B.T. and WLAN :	7-17	8.11	Android UI Controls	8-15
	• Review Questions	7-18	8.11.1	TextView	8-15
Chapter 8 : Android			8.11.2	EditText View	8-16
8-1 to 8-20			8.11.3	ButtonView	8-16
<p>Syllabus : Android APIs, Android Architecture, Application Framework, The Application components, The manifest file, Downloading and installing Android, Exploring the Development Environment, Developing and Executing the first Android application, Working with Activities, The Linear Layout , The Relative Layout, The Scroll View Layout, The Table Layout, The Frame Layout, Using the Text View, Edit Text View, Button View, Radio Button, Checkbox, Image Button, Rating Bar, The options Menu, The Context Menu.</p>					
8.1	Introduction	8-2	8.11.3.1	ImageButton	8-16
8.2	Features of Android	8-2	8.11.3.2	ToggleButton	8-16
8.3	Android Architecture	8-3	8.11.4	CheckBox	8-16
8.3.1	The Linux Kernel	8-3	8.11.5	RadioButton	8-17
8.3.2	Native Libraries	8-4	8.12	Rating Bar	8-17
8.3.3	Android Runtime	8-4	8.13	Menus in Android	8-17
8.3.4	Application Framework	8-4	8.13.1	Option Menu	8-17
			8.13.2	Context Menu	8-17
			8.14	Advantages of Android	8-18
			8.14.1	Disadvantages of Android	8-18
			8.14.2	Applications of Android	8-18
			• Review Questions	8-19	