

Subject Name Solutions

4361101 – Summer 2025

Semester 1 Study Material

Detailed Solutions and Explanations

Question 1(a) [3 marks]

State different DSL technology and discuss ADSL

Solution

DSL Technology Types:

DSL Type	Full Name	Speed
ADSL	Asymmetric DSL	1-8 Mbps
SDSL	Symmetric DSL	768 Kbps
VDSL	Very high DSL	52 Mbps
HDSL	High bit-rate DSL	1.5 Mbps

ADSL Features:

- **Asymmetric:** Different upload/download speeds
- **Frequency Division:** Uses existing copper telephone lines
- **Download Speed:** Higher than upload speed

Mnemonic

“ADSL Downloads Faster”

Question 1(b) [4 marks]

Describe the network classification of based on Architecture.

Solution

Network Architecture Classification:

Architecture	Description	Features
Peer-to-Peer	All nodes equal	No central server
Client-Server	Centralized model	Dedicated server

Client-Server Advantages:

- **Centralized Control:** Easy management and security
- **Resource Sharing:** Efficient utilization of resources
- **Scalability:** Can handle more users effectively
- **Data Security:** Better backup and recovery

P2P Characteristics:

- **Decentralized:** No single point of failure
- **Cost Effective:** No need for dedicated server

Mnemonic

“Client Serves Better”

Question 1(c) [7 marks]

Draw the diagram of OSI Model and explain in detail with all layers.

Solution

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph LR
    A[Application Layer {- 7} {-}{-}{-} B[Presentation Layer {-} 6]]
    B {-}{-}{-} C[Session Layer {-} 5]]
    C {-}{-}{-} D[Transport Layer {-} 4]]
    D {-}{-}{-} E[Network Layer {-} 3]]
    E {-}{-}{-} F[Data Link Layer {-} 2]]
    F {-}{-}{-} G[Physical Layer {-} 1]]
{Highlighting}
{Shaded}
```

OSI Layer Functions:

Layer	Function	Examples
Application	User interface	HTTP, FTP, SMTP
Presentation	Data formatting	Encryption, Compression
Session	Session management	NetBIOS, RPC
Transport	End-to-end delivery	TCP, UDP
Network	Routing	IP, ICMP
Data Link	Frame delivery	Ethernet, PPP
Physical	Bit transmission	Cables, Signals

Key Features:

- **Layered Approach:** Each layer serves specific function
- **Standardization:** Universal communication model
- **Troubleshooting:** Easy to identify network problems

Mnemonic

“All People Seem To Need Data Processing”

Question 1(c OR) [7 marks]

Draw the diagram of TCP/IP protocol suite and explain the functions of Application Layer, Transport Layer and Network Layer in detail.

Solution

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph LR
    A[Application Layer {-}{-}{-} B[Transport Layer]]
    B {-}{-}{-} C[Network Layer]]
    C {-}{-}{-} D[Data Link Layer]]

    A1[HTTP, FTP, SMTP, DNS] {-}{-}{-} A
    B1[TCP, UDP] {-}{-}{-} B
    C1[IP, ICMP, ARP] {-}{-}{-} C
{Highlighting}
```

{Shaded}

Layer Functions:

Layer	Primary Function	Protocols
Application	User services	HTTP, FTP, SMTP
Transport	End-to-end delivery	TCP, UDP
Network	Routing packets	IP, ICMP

Application Layer Functions:

- **Web Services:** HTTP for web browsing
- **File Transfer:** FTP for file sharing
- **Email:** SMTP for mail delivery

Transport Layer Functions:

- **Reliable Delivery:** TCP ensures data integrity
- **Unreliable Delivery:** UDP for fast transmission
- **Port Numbers:** Identify specific applications

Network Layer Functions:

- **Logical Addressing:** IP addresses for devices
- **Routing:** Best path selection for packets
- **Fragmentation:** Breaking large packets

Mnemonic

“Applications Transport Networks”

Question 2(a) [3 marks]

Explain WWW.

Solution

World Wide Web (WWW):

Component	Description
Web Browser	Client software
Web Server	Hosts websites
HTTP	Communication protocol
URL	Web address

WWW Features:

- **Hypertext:** Linked documents using HTML
- **Client-Server Model:** Browser requests, server responds
- **Universal Access:** Platform independent

Components:

- **HTML:** Markup language for web pages
- **Browser:** Firefox, Chrome, Safari

Mnemonic

“Web Works Worldwide”

Question 2(b) [4 marks]

Explain FDDI and CDDI.

Solution

FDDI vs CDDI Comparison:

Feature	FDDI	CDDI
Medium	Fiber optic	Copper wire
Speed	100 Mbps	100 Mbps
Distance	200 km	100 meters
Cost	High	Low

FDDI Features:

- **Dual Ring Topology:** Primary and secondary rings
- **Token Passing:** Access control method
- **Fault Tolerance:** Self-healing capability

CDDI Features:

- **Copper Based:** Uses twisted pair cables
- **Cost Effective:** Cheaper than fiber
- **Limited Distance:** Shorter transmission range

Applications:

- **FDDI:** Backbone networks, long distances
- **CDDI:** Local area networks, cost-sensitive environments

Mnemonic

“Fiber Fast, Copper Cheap”

Question 2(c) [7 marks]

Describe a network management system with functions of OS, CLI, Administrative Functions, Interfaces.

Solution

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph TD
    A[Network Management System] --> B[Operating System]
    A --> C[CLI Interface]
    A --> D[Administrative Functions]
    A --> E[GUI Interfaces]

    B --> B1[Resource Management]
    C --> C1[Command Line]
    D --> D1[User Management]
    E --> E1[Graphical Interface]
{Highlighting}
{Shaded}
```

Network Management Components:

Component	Function	Examples
OS Functions	Resource management	Process, memory, file management
CLI	Command interface	Terminal, console commands
Admin Functions	System control	User accounts, security
Interfaces	User interaction	GUI, web interface

Operating System Functions:

- **Process Management:** Control running applications
- **Memory Management:** Allocate system resources
- **File System:** Organize and store data

CLI Functions:

- **Direct Commands:** Text-based control
- **Scripting:** Automated task execution
- **Remote Access:** SSH, Telnet connections

Administrative Functions:

- **User Management:** Create, modify user accounts
- **Security Policies:** Access control, permissions
- **System Monitoring:** Performance tracking

Interfaces:

- **GUI:** Graphical user interface for easy navigation
- **Web Interface:** Browser-based management
- **SNMP:** Simple Network Management Protocol

Mnemonic

“Operating CLI Administers Interfaces”

Question 2(a OR) [3 marks]

Compare connection-oriented protocol and connection less protocol.

Solution**Protocol Comparison:**

Feature	Connection-Oriented	Connectionless
Setup	Required	Not required
Reliability	High	Low
Speed	Slower	Faster
Example	TCP	UDP

Connection-Oriented Features:

- **Three-way Handshake:** Establishes connection before data transfer
- **Reliable Delivery:** Guarantees packet delivery and order

Connectionless Features:

- **No Setup:** Direct data transmission
- **Best Effort:** No delivery guarantee

Mnemonic

“TCP Connects, UDP Delivers”

Question 2(b OR) [4 marks]

Explain Network device Repeater.

Solution**Repeater Functions:**

Function	Description
Signal Amplification	Boosts weak signals
Range Extension	Increases network distance
Noise Reduction	Cleans signal quality

```

Input Signal      Repeater      Output Signal
    |              |              |
weak {-}{-}{-}{-}{-}{-} [AMPLIFY] {-}{-}{-}{-}{-}{-} strong}
noisy              |              clean

```

Repeater Characteristics:

- **Physical Layer Device:** Operates at Layer 1
- **Bit-by-Bit:** Regenerates digital signals
- **No Intelligence:** Cannot filter or route data

Applications:

- **LAN Extension:** Extend Ethernet segments
- **Signal Recovery:** Restore degraded signals

Limitations:

- **Collision Domain:** Does not segment collisions
- **No Filtering:** Forwards all signals

Mnemonic

“Repeater Regenerates Signals”

Question 2(c OR) [7 marks]

Differentiate between Router, Hub and Switch.

Solution

Network Device Comparison:

Feature	Hub	Switch	Router
OSI Layer	Physical (1)	Data Link (2)	Network (3)
Collision Domain	Single	Multiple	Multiple
Broadcast Domain	Single	Single	Multiple
Intelligence	None	MAC learning	IP routing
Full Duplex	No	Yes	Yes

Mermaid Diagram (Code)

```

{Shaded}
{Highlighting}[]
graph TD
    A[Network Devices] --> B[Hub -- Layer 1]
    A --> C[Switch -- Layer 2]
    A --> D[Router -- Layer 3]

    B --> B1[Shared Bandwidth]
    C --> C1[Dedicated Bandwidth]
    D --> D1[Inter-network Connection]
{Highlighting}
{Shaded}

```

Hub Characteristics:

- **Shared Medium:** All ports share bandwidth
- **Half Duplex:** Cannot send and receive simultaneously
- **Collision Prone:** Single collision domain

Switch Characteristics:

- **MAC Address Table:** Learns device locations
- **Full Duplex:** Simultaneous send/receive
- **VLAN Support:** Virtual network segmentation

Router Characteristics:

- **IP Routing:** Forwards packets between networks
- **Routing Table:** Maintains network topology
- **NAT Support:** Network Address Translation

Applications:

- **Hub:** Legacy networks (mostly obsolete)
- **Switch:** LAN connectivity, VLAN implementation
- **Router:** Internet connectivity, WAN connections

Mnemonic

“Hub Shares, Switch Switches, Router Routes”

Question 3(a) [3 marks]

Draw neat diagram of UTP, Coaxial and Fiber optic cable

Solution

UTP Cable:

```

+{ } Plastic Jacket}
|   +{ } Twisted Pairs}
|   |
+{ }{ }+====+  +====+
|   |   |   |
+{ }{ }{ }+  +{ }{ }{ }+}

```

Coaxial Cable:

```

+{ } Outer Jacket}
|   +{ } Shield}
|   |   +{ } Dielectric}
|   |   |   +{ } Center Conductor}
+{ }{ }{ }+{ }{ }{ }+{ }{ }{ }+====+
|   |   |
+{ }{ }{ }+{ }{ }{ }+}

```

```
+{-{-} Outer Jacket}
|   +{-{-} Strength Member}
| |   +{-{-} Cladding}
| | |   +{-{-} Core}
+{-{-}{-}+{-}{-}{-}+{-}{-}{-}+===+}
    |       |
    +{-{-}{-}+{-}{-}{-}+}
```

Cable Type	Core Material	Bandwidth
UTP	Copper wire	100 MHz
Coaxial	Copper conductor	1 GHz
Fiber Optic	Glass/Plastic	Very high

“Twisted Copper Glass”

Differentiate switching circuit and packet switching circuit.

Solution

Switching Methods Comparison:

Feature	Circuit Switching	Packet Switching
Path	Dedicated	Shared
Setup Time	Required	Not required
Bandwidth	Fixed	Variable
Example	Telephone	Internet

Circuit Switching Features:

- **Dedicated Path:** Exclusive connection between communicating parties
- **Constant Bandwidth:** Fixed data rate throughout communication
- **Setup Phase:** Connection established before data transfer

Packet Switching Features:

- **Store and Forward:** Packets stored at intermediate nodes
- **Dynamic Routing:** Different paths for different packets
- **Resource Sharing:** Multiple users share network resources

Advantages:

- **Circuit:** Guaranteed bandwidth, low latency
- **Packet:** Efficient resource utilization, fault tolerance

“Circuit Connects, Packet Shares”

Question 3(c) [7 marks]

Describe unguided media and guided media.

Solution

Transmission Media Classification:

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph TD
    A[Transmission Media] --> B[Guided Media]
    A --> C[Unguided Media]

    B --> B1[Twisted Pair]
    B --> B2[Coaxial Cable]
    B --> B3[Fiber Optic]

    C --> C1[Radio Waves]
    C --> C2[Microwaves]
    C --> C3[Infrared]
{Highlighting}
{Shaded}
```

Guided Media Characteristics:

Type	Material	Distance	Cost
Twisted Pair	Copper	100m	Low
Coaxial	Copper + Shield	500m	Medium
Fiber Optic	Glass	2km+	High

Unguided Media Characteristics:

Type	Frequency	Range	Application
Radio Waves	3KHz-1GHz	Long	AM/FM Radio
Microwaves	1GHz-300GHz	Line of sight	Satellite
Infrared	300GHz-400THz	Short	Remote control

Guided Media Advantages:

- **Security:** Physical protection from interference
- **Reliability:** Stable signal transmission
- **High Bandwidth:** Greater data capacity

Unguided Media Advantages:

- **Mobility:** Wireless connectivity
- **Coverage:** Wide area reach
- **Installation:** No physical cabling required

Applications:

- **Guided:** LAN, backbone networks, high-speed connections
- **Unguided:** Mobile networks, satellite communication, WiFi

Mnemonic

“Guided Wires, Unguided Airs”

Question 3(a OR) [3 marks]

Discuss various connectors used in Computer Networks.

Solution

Network Connectors:

Connector	Cable Type	Application
RJ-45	UTP/STP	Ethernet
BNC	Coaxial	Legacy networks
SC/ST	Fiber optic	High-speed networks

Connector Features:

- **RJ-45:** 8-pin modular connector for twisted pair
- **BNC:** Bayonet connector for coaxial cables
- **SC/ST:** Push-pull and twist-lock fiber connectors

Mnemonic

“RJ BNC Fiber Connect”

Question 3(b OR) [4 marks]

Explain IP addressing scheme with examples.

Solution

IP Address Classes:

Class	Range	Default Mask	Example
A	1-126	/8	10.0.0.1
B	128-191	/16	172.16.0.1
C	192-223	/24	192.168.1.1

IP Address Structure:

- **Network Part:** Identifies the network
- **Host Part:** Identifies the device
- **Subnet Mask:** Separates network and host portions

Special Addresses:

- **Loopback:** 127.0.0.1 (localhost)
- **Private:** 10.x.x.x, 172.16.x.x, 192.168.x.x
- **Broadcast:** All host bits set to 1

Example Calculation: IP: 192.168.1.100/24

- Network: 192.168.1.0
- Broadcast: 192.168.1.255

Mnemonic

“A Big Class Networks”

Question 3(c OR) [7 marks]

Differentiate between IPv4 and IPv6.

Solution

IPv4 vs IPv6 Comparison:

Feature	IPv4	IPv6
Address Length	32 bits	128 bits
Address Format	Decimal	Hexadecimal
Address Space	4.3 billion	340 undecillion
Header Size	20-60 bytes	40 bytes
Fragmentation	Router/Host	Host only
Security	Optional	Built-in

IPv4 Characteristics:

- **Address Example:** 192.168.1.1
- **Dotted Decimal:** Four octets separated by dots
- **Classes:** A, B, C, D, E addressing scheme
- **NAT Required:** Due to address exhaustion

IPv6 Characteristics:

- **Address Example:** 2001:0db8:85a3::8a2e:0370:7334
- **Colon Notation:** Eight groups of hexadecimal digits
- **No Classes:** Hierarchical addressing
- **Auto-configuration:** Stateless address configuration

IPv6 Advantages:

- **Larger Address Space:** Eliminates address exhaustion
- **Simplified Header:** Improved processing efficiency
- **Built-in Security:** IPsec mandatory
- **Better QoS:** Flow labeling for traffic prioritization

Migration Strategies:

- **Dual Stack:** Run both IPv4 and IPv6
- **Tunneling:** Encapsulate IPv6 in IPv4
- **Translation:** Convert between protocols

Mnemonic

“IPv6 Has More Addresses”

Question 4(a) [3 marks]

Explain File Transfer Protocol.

Solution

FTP Characteristics:

Feature	Description
Port Numbers	20 (data), 21 (control)
Protocol	TCP-based
Authentication	Username/password

FTP Operations:

- **Upload:** PUT command transfers files to server
- **Download:** GET command retrieves files from server
- **Directory:** LIST command shows file listings

FTP Modes:

- **Active Mode:** Server initiates data connection
- **Passive Mode:** Client initiates data connection

Mnemonic

“FTP Transfers Files”

Question 4(b) [4 marks]

Write note on DNS.

Solution

Domain Name System (DNS):

Component	Function
DNS Server	Resolves domain names
DNS Cache	Stores recent lookups
DNS Records	Maps names to addresses

DNS Hierarchy:

- **Root Domain:** Top-level (.)
- **Top-Level Domain:** .com, .org, .net
- **Second-Level Domain:** google.com
- **Subdomain:** www.google.com

DNS Records:

- **A Record:** Maps domain to IPv4 address
- **AAAA Record:** Maps domain to IPv6 address
- **CNAME:** Canonical name alias
- **MX:** Mail exchange server

DNS Resolution Process:

1. **Local Cache:** Check browser cache
2. **Recursive Query:** Contact DNS resolver
3. **Iterative Query:** Query authoritative servers

Mnemonic

“DNS Names Servers”

Question 4(c) [7 marks]

Explain Electronic Mail.

Solution

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph LR
    A[Email Client] --{} B[SMTP Server]}
    B --{} C[Internet]}
    C --{} D[Recipient SMTP]}
    D --{} E[POP3/IMAP Server]}
    E --{} F[Recipient Client]}
{Highlighting}
{Shaded}
```

Email System Components:

Component	Function	Protocol
User Agent	Email client	Outlook, Gmail
Mail Server	Store/forward	SMTP, POP3, IMAP
Message Transfer	Delivery	SMTP

Email Protocols:

Protocol	Purpose	Port
SMTP	Send mail	25
POP3	Retrieve mail	110
IMAP	Access mail	143

Email Message Format:

- **Header:** To, From, Subject, Date
- **Body:** Message content
- **Attachments:** Binary files

SMTP vs POP3 vs IMAP:

- **SMTP:** Outgoing mail protocol
- **POP3:** Downloads mail to local device
- **IMAP:** Synchronizes mail across devices

Email Process:

1. **Compose:** User creates message
2. **Send:** SMTP transfers to server
3. **Route:** Internet routing to destination
4. **Deliver:** Store in recipient mailbox
5. **Retrieve:** POP3/IMAP download to client

Security Features:

- **Encryption:** Secure mail transmission
- **Authentication:** Verify sender identity
- **Spam Filtering:** Block unwanted mail

Mnemonic

“SMTP Sends, POP3 Picks, IMAP Integrates”

Question 4(a OR) [3 marks]

Explain Web browser.

Solution

Web Browser Functions:

Function	Description
HTTP Client	Requests web pages
HTML Renderer	Displays web content
JavaScript Engine	Executes scripts

Browser Components:

- **User Interface:** Address bar, bookmarks, navigation
- **Rendering Engine:** HTML/CSS interpretation
- **Networking:** HTTP/HTTPS communication

Popular Browsers:

- **Chrome:** Google's browser
- **Firefox:** Mozilla's browser
- **Safari:** Apple's browser

Mnemonic

“Browser Renders Web”

Question 4(b OR) [4 marks]

Explain Mail Protocols.

Solution

Email Protocol Comparison:

Protocol	Type	Function	Port
SMTP	Outgoing	Send mail	25
POP3	Incoming	Download mail	110
IMAP	Incoming	Sync mail	143

SMTP Features:

- **Push Protocol:** Sender initiates transfer
- **Store and Forward:** Intermediate mail servers
- **Text-based:** ASCII command protocol

POP3 Features:

- **Download and Delete:** Mail removed from server
- **Offline Access:** Local mail storage
- **Single Device:** Not suitable for multiple devices

IMAP Features:

- **Server Storage:** Mail remains on server
- **Multi-device:** Access from multiple clients
- **Folder Sync:** Server-client synchronization

Mnemonic

“SMTP Sends, POP3 Pulls, IMAP Integrates”

Question 4(c OR) [7 marks]

Describe TCP and UDP protocols.

Solution

TCP vs UDP Comparison:

Feature	TCP	UDP
Connection	Connection-oriented	Connectionless
Reliability	Reliable	Unreliable
Speed	Slower	Faster
Header Size	20 bytes	8 bytes
Flow Control	Yes	No
Error Control	Yes	No

Mermaid Diagram (Code)

```
{Shaded}
{Highlighting}[]
graph LR
    A[Transport Layer] --> B[TCP -- Reliable]
    A --> C[UDP -- Fast]

    B --> B1[Web, Email, FTP]
    C --> C1[DNS, Streaming, Gaming]
{Highlighting}
{Shaded}
```

TCP Features:

- **Three-way Handshake:** SYN, SYN-ACK, ACK
- **Sequence Numbers:** Ordered packet delivery
- **Acknowledgments:** Confirms packet receipt
- **Flow Control:** Prevents buffer overflow
- **Congestion Control:** Manages network traffic

UDP Features:

- **Stateless:** No connection state maintained
- **Best Effort:** No delivery guarantee
- **Low Overhead:** Minimal header information
- **Broadcast Support:** One-to-many communication

TCP Applications:

- **Web Browsing:** HTTP/HTTPS
- **Email:** SMTP, POP3, IMAP
- **File Transfer:** FTP

UDP Applications:

- **DNS Queries:** Domain name resolution
- **Streaming:** Video/audio transmission
- **Gaming:** Real-time applications

TCP Header Fields:

- **Source/Destination Port:** Application identification
- **Sequence Number:** Packet ordering
- **Window Size:** Flow control

UDP Header Fields:

- **Source/Destination Port:** Application identification
- **Length:** Datagram size
- **Checksum:** Error detection

Mnemonic

“TCP Tries Carefully, UDP Unleashes Data”

Question 5(a) [3 marks]

Describe Network device Bridge.

Solution

Bridge Characteristics:

Feature	Description
OSI Layer	Data Link (Layer 2)
Function	Segment collision domains
Learning	MAC address table

Bridge Operations:

- **Learning:** Records MAC addresses from frames
- **Filtering:** Forwards frames only when necessary
- **Forwarding:** Sends frames to appropriate segment

Bridge Types:

- **Transparent Bridge:** Automatic learning
- **Source Routing:** Path specified in frame

Mnemonic

“Bridge Breaks Collisions”

Question 5(b) [4 marks]

Explain Social issues and Hacking also discuss its precautions.

Solution**Social Issues in Networks:**

Issue	Impact
Digital Divide	Unequal access to technology
Privacy Concerns	Personal data misuse
Cyberbullying	Online harassment

Hacking Types:

- **White Hat:** Ethical hacking for security testing
- **Black Hat:** Malicious hacking for illegal gain
- **Gray Hat:** Between ethical and malicious

Precautions:

- **Strong Passwords:** Use complex, unique passwords
- **Software Updates:** Keep systems patched
- **Firewall:** Block unauthorized access
- **Antivirus:** Detect and remove malware

Security Measures:

- **Education:** User awareness training
- **Backup:** Regular data backup
- **Monitoring:** Network traffic analysis

Mnemonic

“Secure Systems Save Societies”

Question 5(c) [7 marks]

Explain IP Security in detail.

Solution**Mermaid Diagram (Code)**

```
{Shaded}
{Highlighting}[]
graph LR
    A[IP Security {- IPSec} {-}{-}{-}] --> B[Authentication Header {-} AH]
    A --> C[Encapsulating Security Payload {-} ESP]
```


A {-}{-}{ } D[Security Association {-} SA]]

B {-}{-}{ } B1[Data Integrity]]

C {-}{-}{ } C1[Data Confidentiality]]

D {-}{-}{ } D1[Security Parameters]]

{Highlighting}

{Shaded}

IPSec Components:

Component	Function	Security Service
AH	Authentication Header	Data integrity, authentication
ESP	Encapsulating Security Payload	Confidentiality, integrity
SA	Security Association	Security parameters

IPSec Modes:

Mode	Description	Usage
Transport	Protects payload only	Host-to-host
Tunnel	Protects entire packet	Network-to-network

IPSec Protocols:

- **IKE**: Internet Key Exchange for key management
- **ISAKMP**: Internet Security Association and Key Management
- **DES/3DES/AES**: Encryption algorithms

Security Services:

- **Authentication**: Verify sender identity
- **Integrity**: Ensure data not modified
- **Confidentiality**: Encrypt data content
- **Non-repudiation**: Prevent denial of sending

IPSec Process:

1. **Policy Definition**: Define security requirements
2. **Key Exchange**: Establish shared keys using IKE
3. **SA Establishment**: Create security association
4. **Data Protection**: Apply AH/ESP to packets
5. **Transmission**: Send protected packets

Applications:

- **VPN**: Virtual Private Networks
- **Remote Access**: Secure remote connections
- **Site-to-Site**: Connect branch offices

Benefits:

- **Transparent Security**: Works at network layer
- **Strong Authentication**: Cryptographic verification
- **Flexible Implementation**: Multiple algorithms supported

Mnemonic

“IPSec Authenticates, Encrypts, Secures”

Question 5(a OR) [3 marks]

Explain wireless LAN.

Solution

Wireless LAN Characteristics:

Feature	Description
Standard	IEEE 802.11
Frequency	2.4 GHz, 5 GHz
Access Method	CSMA/CA

WLAN Components:

- **Access Point:** Central wireless hub
- **Wireless Clients:** Laptops, phones, tablets
- **SSID:** Network identifier

WLAN Standards:

- **802.11a:** 54 Mbps, 5 GHz
- **802.11g:** 54 Mbps, 2.4 GHz
- **802.11n:** 600 Mbps, MIMO

Mnemonic

“Wireless Waves Work”

Question 5(b OR) [4 marks]

Differentiate between symmetric and asymmetric encryption algorithms

Solution

Encryption Algorithm Comparison:

Feature	Symmetric	Asymmetric
Keys	Single shared key	Key pair (public/private)
Speed	Fast	Slow
Key Distribution	Difficult	Easy
Example	AES, DES	RSA, ECC

Symmetric Encryption:

- **Same Key:** Encryption and decryption use same key
- **Faster Processing:** Efficient for large data
- **Key Management:** Challenge in key distribution

Asymmetric Encryption:

- **Key Pair:** Public key encrypts, private key decrypts
- **Digital Signatures:** Non-repudiation support
- **Secure Communication:** No prior key exchange needed

Applications:

- **Symmetric:** Bulk data encryption, disk encryption
- **Asymmetric:** Key exchange, digital certificates

Mnemonic

“Symmetric Same, Asymmetric Pair”

Question 5(c OR) [7 marks]

Briefly describe the Information Technology (Amendment) Act, 2008, and its impact on cyber laws in India.

Solution

IT Act 2008 Key Provisions:

Section	Offense	Penalty
66	Computer hacking	3 years imprisonment
66A	Offensive messages	3 years + fine
66B	Identity theft	3 years + fine
66C	Password theft	3 years + fine
66D	Cheating using computer	3 years + fine

Mermaid Diagram (Code)

```

{Shaded}
{Highlighting}[]
graph TD
    A[IT Act 2008] --> B[Cyber Crimes]
    A --> C[Data Protection]
    A --> D[Digital Signatures]
    A --> E[Penalties]

    B --> B1[Hacking, Identity Theft]
    C --> C1[Sensitive Personal Data]
    D --> D1[Legal Validity]
    E --> E1[Imprisonment + Fine]
{Highlighting}
{Shaded}

```

Major Amendments:

Amendment	Description	Impact
Section 66A	Offensive content online	Criminalized cyber bullying
Section 69	Government interception	Monitoring powers
Section 79	Intermediary liability	Platform responsibilities

Key Features:

- **Extraterritorial Jurisdiction:** Applies to offenses outside India affecting Indian computers
- **Cyber Appellate Tribunal:** Specialized adjudication body
- **Compensation:** Damages up to 5 crore for data breach

Data Protection Provisions:

- **Sensitive Personal Data:** Special protection for financial, health data
- **Reasonable Security:** Organizations must implement adequate measures
- **Breach Notification:** Mandatory reporting of security incidents

Digital Signature Framework:

- **Legal Validity:** Electronic signatures legally recognized
- **Certification Authority:** Licensed bodies issue digital certificates
- **Non-repudiation:** Prevents denial of electronic transactions

Cybercrime Categories:

- **Computer Related Offenses:** Unauthorized access, data theft
- **Communication Offenses:** Obscene content, cyber stalking
- **Identity Crimes:** Impersonation, fraud

Law Enforcement Powers:

- **Search and Seizure:** Authority to examine computer systems
- **Preservation Orders:** Require data retention for investigation
- **Blocking Orders:** Remove offensive content from internet

Industry Impact:

- **Compliance Requirements:** Organizations must adopt security measures
- **Liability Framework:** Clear responsibilities for service providers
- **Business Process:** Legal framework for e-commerce, digital transactions

Challenges:

- **Technology Gap:** Law struggles to keep pace with technology
- **Jurisdiction Issues:** Cross-border cybercrime investigation
- **Privacy Concerns:** Balance between security and individual rights

Recent Developments:

- **Personal Data Protection Bill:** Comprehensive privacy legislation
- **Cybersecurity Framework:** National cyber security strategy
- **Digital India:** Government digitization initiatives

Mnemonic

“IT Act Protects Digital India”