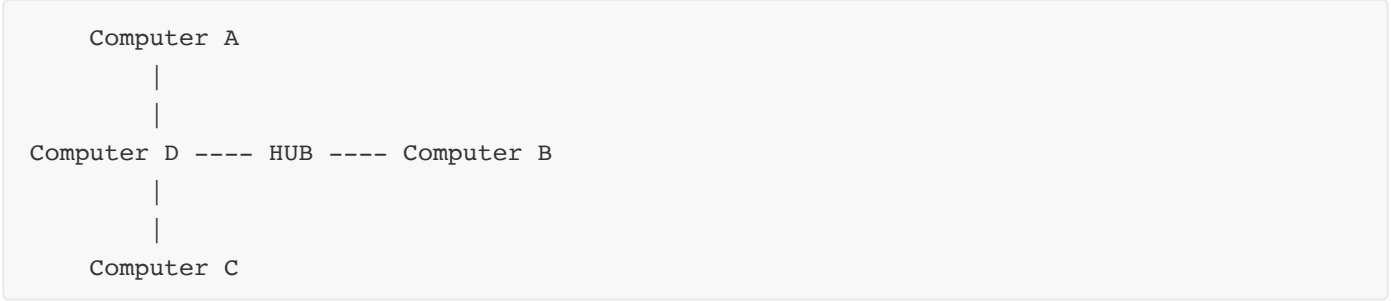
Question 1(a) [3 marks]

Explain star topology in detail.

Answer:
Star topology connects all devices to a central hub or switch. Each device has dedicated point-to-point connection with central device.

Diagram:



Key Features:

- **Central Hub**: All connections pass through central device
- **Dedicated Links**: Each node has separate connection
- **Easy Management**: Simple to add/remove devices

Mnemonic: "Star Shines Central" - All devices connect to central point

---

Question 1(b) [4 marks]

Explain client-server network.

Answer:
Client-server is network architecture where clients request services from centralized servers. Server provides resources and services to multiple clients.

Table: Client vs Server

Client	Server
Requests services	Provides services
Limited resources	Powerful hardware
Depends on server	Independent operation

Key Components:

- **Client**: Requests data/services from server
- **Server**: Provides centralized resources and processing

- **Network**: Medium for communication between client-server

Mnemonic: "Client Calls, Server Serves"

Question 1(c) [7 marks]

Write a functional description of all layer of TCP/IP model.

Answer:
TCP/IP model has four layers providing end-to-end communication over networks.

Table: TCP/IP Model Layers

Layer	Function	Protocols
Application	User interface, network services	HTTP, FTP, SMTP
Transport	End-to-end delivery, error control	TCP, UDP
Internet	Routing, logical addressing	IP, ICMP, ARP
Network Access	Physical transmission	Ethernet, WiFi

Layer Functions:

- **Application Layer**: Provides network services to user applications
- **Transport Layer**: Ensures reliable data delivery between processes
- **Internet Layer**: Routes packets across multiple networks using IP
- **Network Access Layer**: Handles physical transmission of data

Mnemonic: "All Transport Internet Networks" (ATIN)

Question 1(c OR) [7 marks]

Explain the functions of Data Link Layer & Network Layer of OSI reference model.

Answer:
Data Link and Network layers provide reliable transmission and routing capabilities in OSI model.

Table: Layer Comparison

Feature	Data Link Layer	Network Layer
Main Function	Node-to-node delivery	End-to-end delivery
Addressing	MAC addresses	IP addresses
Error Control	Frame-level	Packet-level

Data Link Layer Functions:

- **Framing**: Organizes bits into frames
- **Error Control**: Detects and corrects transmission errors
- **Flow Control**: Manages data transmission rate

Network Layer Functions:

- **Routing**: Determines best path for packets
- **Logical Addressing**: Uses IP addresses for identification
- **Packet Forwarding**: Routes packets between networks

Mnemonic: "Data Links Locally, Network Routes Globally"

Question 2(a) [3 marks]

Compare repeater and hub.

Answer:
Both devices amplify signals but operate differently in network architecture.

Table: Repeater vs Hub

Feature	Repeater	Hub
Ports	2 ports	Multiple ports
Function	Signal amplification	Signal distribution
Collision Domain	Single	Single shared

Key Differences:

- **Port Count**: Repeater has 2 ports, hub has multiple
- **Usage**: Repeater extends distance, hub connects multiple devices

Mnemonic: "Repeater Extends, Hub Connects"

Question 2(b) [4 marks]

Explain wireless LAN.

Answer:
Wireless LAN uses radio waves for network communication without physical cables.

Diagram:

```
  Laptop     Desktop
    |   \   /   |
    |    \ /    |
    |   Access  |
    |   Point   |
    |     |     |
    Mobile   Printer
```

Key Components:

- **Access Point**: Central wireless communication device
- **Wireless Clients**: Devices with WiFi capability
- **Radio Frequencies**: 2.4GHz and 5GHz bands commonly used

Advantages:

- **Mobility**: Users can move freely within coverage area
- **Easy Installation**: No physical cable installation required

Mnemonic: "Wireless Waves Connect"

Question 2(c) [7 marks]

Explain FDDI & CDDI.

Answer:
FDDI and CDDI are ring-based network technologies providing high-speed data transmission.

Table: FDDI vs CDDI Comparison

Feature	FDDI	CDDI
Medium	Fiber optic	Copper (UTP)
Speed	100 Mbps	100 Mbps
Distance	200 km	100 meters
Cost	High	Lower

FDDI Features:

- **Dual Ring**: Primary and secondary rings for fault tolerance
- **Token Passing**: Deterministic access method
- **Self-Healing**: Automatic recovery from failures

CDDI Features:

- **Copper Medium**: Uses unshielded twisted pair cables

- **Same Protocol**: Identical to FDDI except transmission medium
- **Cost Effective**: Lower implementation cost than FDDI

Ring Structure:

```
    Station A
        |
Station D --+-- Station B
        |
    Station C
```

Mnemonic: "FDDI Fiber Fast, CDDI Copper Cheap"

Question 2(a OR) [3 marks]

How does a firewall protect data.

Answer:
Firewall acts as security barrier between trusted internal network and untrusted external networks.

Protection Methods:

- **Packet Filtering**: Examines packet headers for security rules
- **Access Control**: Blocks unauthorized access attempts
- **Traffic Monitoring**: Monitors all incoming and outgoing traffic

Mnemonic: "Firewall Filters Foes"

Question 2(b OR) [4 marks]

Explain the structure of FDDI and give its advantages.

Answer:
FDDI uses dual counter-rotating rings for high-speed, fault-tolerant networking.

Structure Components:

- **Primary Ring**: Main data transmission path
- **Secondary Ring**: Backup path for fault recovery
- **Dual Attachment Stations**: Connect to both rings
- **Single Attachment Stations**: Connect to one ring only

Advantages:

- **High Speed**: 100 Mbps transmission rate
- **Fault Tolerance**: Automatic recovery using secondary ring
- **Long Distance**: Supports up to 200 km networks

Mnemonic: "FDDI Dual Rings Deliver Reliability"

Question 2(c OR) [7 marks]

Explain and distinguish Ethernet, Fast Ethernet, Gigabit Ethernet.

Answer:
Evolution of Ethernet standards providing increasing bandwidth and improved performance.

Table: Ethernet Comparison

Feature	Ethernet	Fast Ethernet	Gigabit Ethernet
Speed	10 Mbps	100 Mbps	1000 Mbps
Standard	802.3	802.3u	802.3z/ab
Cable	Coax/UTP	UTP/Fiber	UTP/Fiber
Distance	500m (coax)	100m (UTP)	100m (UTP)

Key Differences:

- **Bandwidth**: Each generation increases speed by factor of 10
- **Media Support**: Newer standards support more cable types
- **Backward Compatibility**: Higher standards support lower speeds

Applications:

- **Ethernet**: Legacy systems, basic connectivity
- **Fast Ethernet**: Desktop connections, small networks
- **Gigabit Ethernet**: Server connections, backbone networks

Mnemonic: "Ethernet Evolves: 10-100-1000"

Question 3(a) [3 marks]

Explain types of DSL.

Answer:
DSL provides high-speed internet over existing telephone lines using different frequency bands.

Table: DSL Types

Type	Full Form	Speed
ADSL	Asymmetric DSL	Up to 8 Mbps down
SDSL	Symmetric DSL	Equal up/down
VDSL	Very-high-bit-rate DSL	Up to 52 Mbps

Characteristics:

- **ADSL**: Different upload/download speeds for home users
- **SDSL**: Same speed both directions for business use

Mnemonic: "DSL: Asymmetric, Symmetric, Very-fast"

Question 3(b) [4 marks]

Explain ARP & RARP.

Answer:
ARP and RARP provide address resolution between IP and MAC addresses.

Table: ARP vs RARP

Feature	ARP	RARP
Purpose	IP to MAC	MAC to IP
Used by	All devices	Diskless workstations
Direction	Logical to Physical	Physical to Logical

ARP Process:

- **Request**: Broadcast "Who has IP address X?"
- **Reply**: Target responds with MAC address
- **Caching**: Stores mapping in ARP table

RARP Process:

- **Request**: "What is my IP address?"
- **Server Response**: RARP server provides IP address

Mnemonic: "ARP: Address Resolution Protocol, RARP: Reverse ARP"

Question 3(c) [7 marks]

Describe circuit switching and packet switching.

Answer:
Two fundamental approaches for establishing communication paths in networks.

Table: Circuit vs Packet Switching

Feature	Circuit Switching	Packet Switching
Path Setup	Dedicated path	No dedicated path
Resource Usage	Reserved throughout	Shared dynamically
Delay	Constant	Variable
Examples	Telephone	Internet

Circuit Switching:

- **Path Establishment**: Dedicated circuit created before communication
- **Resource Reservation**: Bandwidth reserved for entire session
- **Guaranteed Service**: Consistent performance throughout connection

Packet Switching:

- **Store and Forward**: Packets stored temporarily at intermediate nodes
- **Dynamic Routing**: Each packet can take different path
- **Resource Sharing**: Network resources shared among multiple connections

Diagram: Packet Switching

```
Source --- Router1 --- Router2 --- Destination
    \          |          /
     \         |         /
      \--- Router3 ---/
```

Mnemonic: "Circuit Commits, Packet Partitions"

Question 3(a OR) [3 marks]

Describe DHCP & BOOTP protocol.

Answer:
Both protocols automatically assign IP addresses to network devices.

Table: DHCP vs BOOTP

Feature	DHCP	BOOTP
Address Type	Dynamic/Static	Static only
Lease Time	Temporary	Permanent
Configuration	Automatic	Manual setup

Functions:

- **DHCP**: Dynamic address assignment with lease management
- **BOOTP**: Bootstrap protocol for diskless workstations

Mnemonic: "DHCP Dynamic, BOOTP Bootstrap"

Question 3(b OR) [4 marks]

Explain IPv4 & IPv6 in detail.

Answer:
Internet Protocol versions providing addressing and routing capabilities.

Table: IPv4 vs IPv6

Feature	IPv4	IPv6
Address Size	32 bits	128 bits
Address Format	Dotted decimal	Hexadecimal
Address Space	4.3 billion	340 undecillion
Header Size	20-60 bytes	40 bytes

IPv4 Features:

- **Address Format**: 192.168.1.1 (4 octets)
- **Classes**: A, B, C, D, E address classes
- **NAT Required**: Address shortage requires NAT

IPv6 Features:

- **Address Format**: 2001:db8::1 (8 groups of 4 hex digits)
- **No NAT Needed**: Abundant address space
- **Built-in Security**: IPSec support mandatory

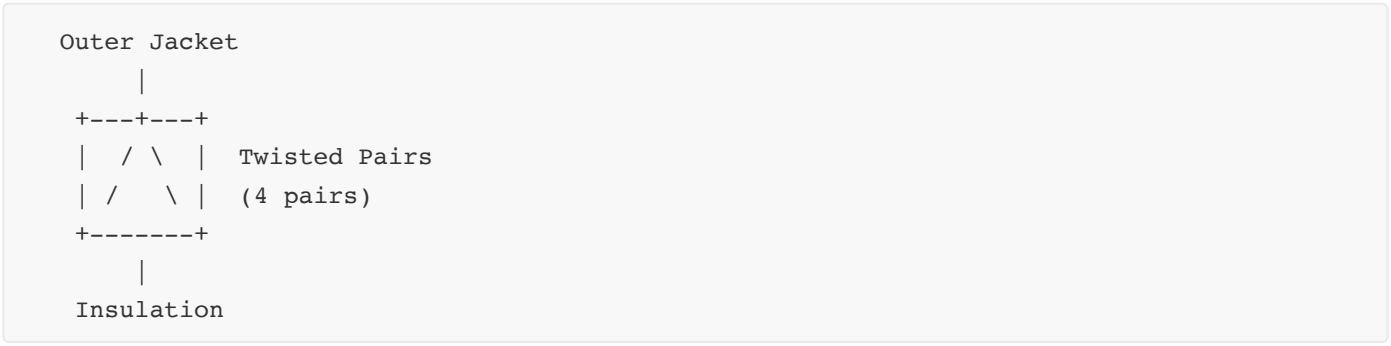
Mnemonic: "IPv4 Four Octets, IPv6 Six-teen Bytes"

Question 3(c OR) [7 marks]

Draw and explain constructional details of twisted pair cable, coaxial cable, and fiber optic cable with label.

Answer:
Three main types of guided transmission media with different construction and characteristics.

Twisted Pair Cable:



Coaxial Cable:

Fiber Optic Cable:

Construction Details:

- **Twisted Pair**: Copper wires twisted to reduce interference
- **Coaxial**: Central conductor surrounded by dielectric and shield
- **Fiber Optic**: Glass core with cladding for total internal reflection

Characteristics:

- **Twisted Pair**: Low cost, easy installation, limited bandwidth
- **Coaxial**: Better shielding, higher bandwidth than twisted pair

- **Fiber Optic**: Highest bandwidth, immune to electromagnetic interference

Mnemonic: "Twisted Copper, Coax Shielded, Fiber Light"

Question 4(a) [3 marks]

Name any three data link layer protocol and explain any one in detail.

Answer:
Common data link layer protocols: HDLC, PPP, Ethernet.

HDLC (High-Level Data Link Control):

- **Frame Structure**: Flag, Address, Control, Data, FCS, Flag
- **Error Control**: Uses sequence numbers and acknowledgments
- **Flow Control**: Sliding window protocol for efficient transmission

Key Features:

- **Bit-oriented**: Works with bit streams rather than characters
- **Full-duplex**: Simultaneous bidirectional communication

Mnemonic: "HDLC Handles Data Link Control"

Question 4(b) [4 marks]

Explain TCP and UDP protocol.

Answer:
Transport layer protocols providing different levels of service reliability.

Table: TCP vs UDP

Feature	TCP	UDP
Connection	Connection-oriented	Connectionless
Reliability	Reliable	Unreliable
Speed	Slower	Faster
Header Size	20+ bytes	8 bytes

TCP Features:

- **Connection Setup**: Three-way handshake establishes connection
- **Error Recovery**: Retransmits lost packets automatically
- **Flow Control**: Prevents sender from overwhelming receiver

UDP Features:

- **No Connection**: Sends data without establishing connection
- **Best Effort**: No guarantee of delivery or order
- **Low Overhead**: Minimal header for fast transmission

Mnemonic: "TCP Trustworthy, UDP Unreliable but Quick"

Question 4(c) [7 marks]

Describe VoIP with example.

Answer:
Voice over Internet Protocol transmits voice communications over IP networks instead of traditional telephone systems.

VoIP Components:

- **IP Phone**: Hardware device for VoIP calls
- **Softphone**: Software application for computer-based calls
- **Gateway**: Connects VoIP to traditional phone networks
- **PBX**: Private branch exchange for business phone systems

VoIP Process:

1. **Voice Capture**: Microphone converts voice to analog signal
2. **Digitization**: ADC converts analog to digital samples
3. **Compression**: Codec compresses audio data
4. **Packetization**: Voice data divided into IP packets
5. **Transmission**: Packets sent over IP network
6. **Reconstruction**: Receiving end reassembles and plays audio

Example Applications:

- **Skype**: Consumer VoIP service for personal calls
- **WhatsApp Calling**: Mobile VoIP application
- **Business PBX**: Corporate phone systems using VoIP

Advantages:

- **Cost Effective**: Lower long-distance call costs
- **Feature Rich**: Video calling, conferencing, call forwarding
- **Scalability**: Easy to add new users

Disadvantages:

- **Internet Dependency**: Requires stable internet connection
- **Quality Issues**: May suffer from network congestion

- **Power Dependency**: Requires electricity unlike traditional phones

Mnemonic: "VoIP: Voice over Internet Protocol"

Question 4(a OR) [3 marks]

Explain DNS (Domain Name System).

Answer:
DNS translates human-readable domain names into IP addresses for network communication.

DNS Components:

- **Domain Names**: Hierarchical naming system (www.example.com)
- **Name Servers**: Computers that store DNS records
- **Resolvers**: Client software that queries DNS servers

DNS Process:

1. User enters domain name in browser
2. Local resolver queries DNS server
3. DNS server returns corresponding IP address

Mnemonic: "DNS: Domain Name to IP Address"

Question 4(b OR) [4 marks]

Write a short note on DSL.

Answer:
Digital Subscriber Line provides high-speed internet access over existing telephone infrastructure.

DSL Technology:

- **Frequency Division**: Uses higher frequencies than voice calls
- **Simultaneous Use**: Internet and phone can work together
- **Distance Limitation**: Performance decreases with distance from exchange

DSL Types:

- **ADSL**: Asymmetric speeds for residential users
- **SDSL**: Symmetric speeds for business applications
- **VDSL**: Very high speeds over short distances

Advantages:

- **Existing Infrastructure**: Uses existing telephone lines
- **Always On**: Continuous internet connection

- **Cost Effective**: Lower cost than dedicated lines

Mnemonic: "DSL: Digital Subscriber Line over Phone Lines"

Question 4(c OR) [7 marks]

Explain forum and blogs with example.

Answer:
Online platforms for information sharing and community interaction.

Table: Forum vs Blog

Feature	Forum	Blog
Structure	Discussion threads	Chronological posts
Interaction	Multi-user discussions	Comments on posts
Moderation	Community moderated	Author controlled
Purpose	Community support	Information sharing

Forum Characteristics:

- **Discussion Threads**: Topics organized by subject
- **User Participation**: Multiple users contribute to discussions
- **Categories**: Topics organized into different sections
- **Moderation**: Community rules and moderators maintain order

Blog Characteristics:

- **Personal Publishing**: Individual or organization publishes content
- **Chronological Order**: Posts displayed by date
- **Comments**: Readers can respond to blog posts
- **RSS Feeds**: Readers can subscribe to updates

Examples:

- **Technical Forums**: Stack Overflow for programming questions
- **Community Forums**: Reddit for diverse topics
- **Personal Blogs**: Individual websites sharing experiences
- **Corporate Blogs**: Company blogs for marketing and updates

Benefits:

- **Knowledge Sharing**: Users share expertise and experiences
- **Community Building**: Brings together people with common interests

- **Problem Solving**: Forums help users find solutions
- **Content Creation**: Blogs provide platform for publishing

Mnemonic: "Forums Foster Discussion, Blogs Broadcast Information"

Question 5(a) [3 marks]

Define the terms "encryption".

Answer:
Encryption converts plaintext data into ciphertext to protect information from unauthorized access.

Encryption Process:

- **Plaintext**: Original readable data
- **Algorithm**: Mathematical process for transformation
- **Key**: Secret parameter used in encryption algorithm
- **Ciphertext**: Encrypted unreadable data

Purpose:

- **Confidentiality**: Prevents unauthorized data access
- **Data Protection**: Secures sensitive information during transmission

Mnemonic: "Encryption: Plain to Cipher with Key"

Question 5(b) [4 marks]

Explain any two of following: (1) WWW (2) FTP (3) SMTP

Answer:

WWW (World Wide Web):

- **Hypertext System**: Documents linked through hyperlinks
- **HTTP Protocol**: HyperText Transfer Protocol for web communication
- **Web Browser**: Client software for accessing web pages
- **Web Server**: Hosts websites and serves web pages

FTP (File Transfer Protocol):

- **File Transfer**: Protocol for transferring files between computers
- **Client-Server**: FTP client connects to FTP server
- **Two Modes**: Active and passive modes for data transfer
- **Authentication**: Username and password for access control

Features:

- **WWW**: Graphical interface, multimedia support, hyperlinks
- **FTP**: Large file transfer, directory navigation, resume capability

Mnemonic: "WWW: Web World Wide, FTP: File Transfer Protocol"

Question 5(c) [7 marks]

Difference between symmetric and asymmetric encryption algorithms

Answer:
Two fundamental approaches to cryptographic key management with different characteristics.

Table: Symmetric vs Asymmetric Encryption

Feature	Symmetric	Asymmetric
Keys	Single shared key	Key pair (public/private)
Speed	Fast	Slower
Key Distribution	Difficult	Easier
Key Management	Complex for large groups	Simpler
Examples	AES, DES	RSA, ECC

Symmetric Encryption:

- **Single Key**: Same key used for encryption and decryption
- **Speed**: Fast processing due to simple algorithms
- **Key Sharing Problem**: Secure key distribution challenge
- **Session Keys**: Often used for bulk data encryption

Asymmetric Encryption:

- **Key Pair**: Public key for encryption, private key for decryption
- **Digital Signatures**: Private key signs, public key verifies
- **Key Exchange**: Solves key distribution problem
- **Computationally Intensive**: Slower than symmetric encryption

Usage Scenarios:

- **Symmetric**: Bulk data encryption, secure communications
- **Asymmetric**: Key exchange, digital signatures, authentication

Hybrid Approach:

- **Best of Both**: Asymmetric for key exchange, symmetric for data
- **SSL/TLS**: Uses both types for secure web communications

Security Considerations:

- **Symmetric**: Key compromise affects all communications
- **Asymmetric**: Private key compromise affects only one party

Mnemonic: "Symmetric Single Key, Asymmetric Key Pair"

Question 5(a OR) [3 marks]

Write brief note on Cyber Security.

Answer:
Cyber security protects digital systems, networks, and data from digital attacks and unauthorized access.

Key Components:

- **Network Security**: Protects network infrastructure from intrusions
- **Data Protection**: Safeguards sensitive information from theft
- **Application Security**: Secures software applications from vulnerabilities

Common Threats:

- **Malware**: Viruses, worms, trojans that damage systems
- **Phishing**: Fraudulent attempts to steal credentials

Mnemonic: "Cyber Security: Protect Digital Assets"

Question 5(b OR) [4 marks]

Explain hacking and its precautions.

Answer:
Hacking involves unauthorized access to computer systems, often with malicious intent.

Types of Hacking:

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

Common Hacking Methods:

- **Password Attacks**: Brute force, dictionary attacks
- **Social Engineering**: Manipulating people to reveal information
- **Malware**: Viruses, trojans, ransomware
- **Network Attacks**: Man-in-the-middle, packet sniffing

Precautions:

- **Strong Passwords**: Complex, unique passwords for all accounts
- **Regular Updates**: Keep software and systems updated
- **Firewall**: Use firewall to block unauthorized access
- **Antivirus**: Install and update antivirus software regularly

Mnemonic: "Hacking Hurts, Precautions Protect"

Question 5(c OR) [7 marks]

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

Answer:
The IT Amendment Act 2008 significantly strengthened India's cyber law framework and expanded the scope of cybercrime legislation.

Key Amendments:

- **Data Protection**: Enhanced provisions for protecting sensitive personal data
- **Cybercrime Definitions**: Expanded definitions of cybercrime including identity theft
- **Penalties**: Increased penalties for various cyber offenses
- **Cyber Terrorism**: Introduced provisions to deal with cyber terrorism

Major Provisions:

- **Section 43A**: Data protection and compensation for negligence
- **Section 66A**: Punishment for offensive messages (later struck down)
- **Section 66C**: Identity theft punishment
- **Section 66D**: Cheating by personation using computer resource

Impact on Cyber Laws:

- **Legal Framework**: Provided comprehensive legal framework for cybercrime
- **Business Compliance**: Mandated data protection measures for businesses
- **Law Enforcement**: Empowered authorities with investigation tools
- **International Cooperation**: Facilitated cooperation in cybercrime investigation

Regulatory Bodies:

- **CERT-In**: Computer Emergency Response Team for incident response
- **Cyber Cells**: Specialized police units for cybercrime investigation
- **Adjudicating Officers**: For compensation and penalty determination

Data Protection Requirements:

- **Reasonable Security**: Companies must implement reasonable security practices

- **Breach Notification**: Mandatory reporting of data breaches
- **Compensation**: Victims can claim compensation for data breaches

Challenges and Criticisms:

- **Implementation**: Difficulty in implementation across diverse digital landscape
- **Jurisdiction**: Cross-border cybercrime investigation challenges
- **Technology Gap**: Keeping pace with rapidly evolving technology

Recent Developments:

- **Digital India**: Integration with Digital India initiatives
- **Privacy Laws**: Preparation for comprehensive data protection legislation
- **Emerging Technologies**: Addressing challenges from AI, IoT, blockchain

Mnemonic: "IT Act 2008: India's Cyber Law Foundation"