

Core Paper II - Networking and Communication Protocols

Key Notes | Unit-Wise | With Question Analysis

UNIT 1: Intro to Internetworking

Most Important Topics (High Frequency)

1. OSI Layered Model ★★☆

Question Pattern: 2 marks (1 time), Part B (Common topic)

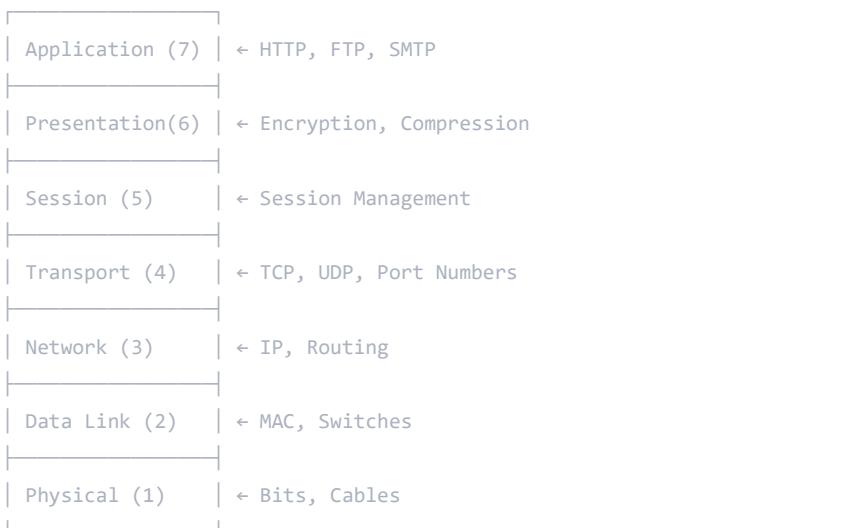
Expected Questions:

- OSI - Expand and Explain (2 marks)
- Explain Networking Models (10 marks)

Key Points:

- **Open Systems Interconnection** - 7 Layer Model
- **Layers (Bottom to Top):**
 1. **Physical Layer** - Bits transmission, cables, hubs
 2. **Data Link Layer** - Frame formation, MAC addresses, switches
 3. **Network Layer** - Routing, IP addresses, routers
 4. **Transport Layer** - TCP/UDP, port numbers, reliability
 5. **Session Layer** - Session management, dialogue control
 6. **Presentation Layer** - Encryption, compression, data formatting
 7. **Application Layer** - User interfaces, HTTP, FTP, SMTP

Diagram:



2. TCP/IP Model ★★☆

Question Pattern: 10 marks (2 times - Very Important)

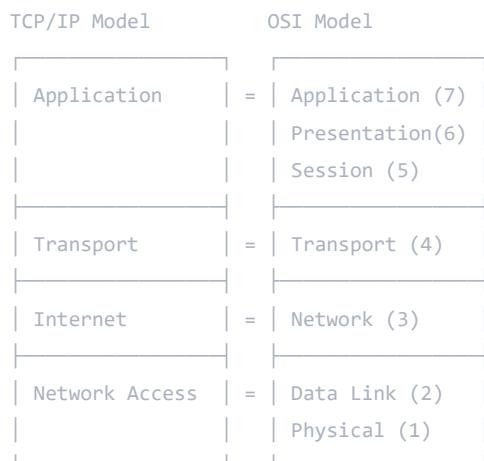
Expected Questions:

- Write a note on TCP/IP Model use a diagram to explain (10 marks)
- Write a detail note on IP Model (10 marks)

Key Points:

- **4 Layer Model** (simpler than OSI)
- **Layers:**
 1. **Network Access Layer** - Physical + Data Link (OSI 1+2)
 2. **Internet Layer** - Network Layer (OSI 3) - IP Protocol
 3. **Transport Layer** - Transport Layer (OSI 4) - TCP/UDP
 4. **Application Layer** - Session + Presentation + Application (OSI 5+6+7)

Diagram:



3. MAC Address ★★☆

Question Pattern: 2 marks (1 time), Part B (1 time)

Expected Questions:

- MAC address (2 marks)
- Enumerate the importance of MAC Address with reference to cybercrimes (6 marks)

Key Points:

- **Media Access Control Address**
- **48-bit (6 bytes)** unique identifier
- **Format:** XX:XX:XX:XX:XX (hexadecimal)
- **First 3 bytes:** OUI (Organizationally Unique Identifier)
- **Last 3 bytes:** Device-specific identifier

Importance:

- Unique device identification
- Network security and access control
- Cybercrime investigation and tracking
- Wake-on-LAN functionality

4. Internet Protocol (IP) **Question Pattern:** 2 marks (1 time), Part B (1 time)**Expected Questions:**

- Internet Protocol (2 marks)
- Explain Internet Protocol (6 marks)

Key Points:

- **Layer 3 protocol** for routing packets
- **Connectionless** and **best-effort** delivery
- **Two versions:** IPv4 (32-bit) and IPv6 (128-bit)

Functions:

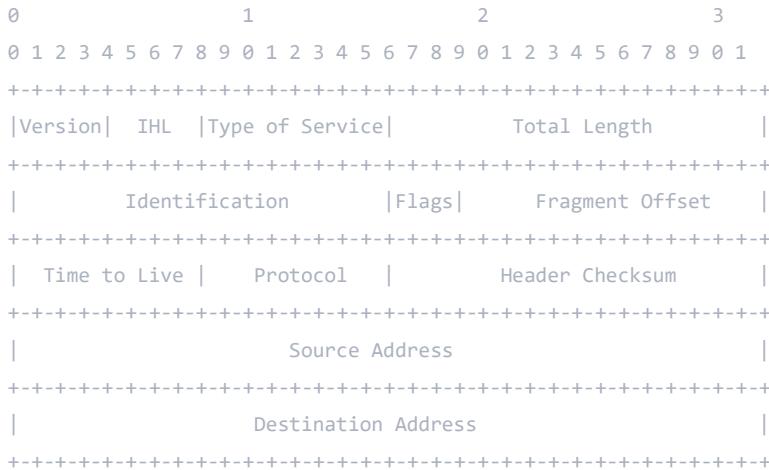
- Addressing and routing
- Packet fragmentation and reassembly
- Error reporting through ICMP

5. IP Header and Header Lengths **Question Pattern:** 2 marks (1 time), Part B (1 time)**Expected Questions:**

- Header Length (2 marks)
- Elucidate header and give the importance of header lengths (6 marks)

Key Points:

- **IPv4 Header:** Minimum 20 bytes, Maximum 60 bytes
- **Header Length Field:** 4 bits, indicates header length in 32-bit words
- **Important Fields:**
 - Version, IHL, Type of Service, Total Length
 - Identification, Flags, Fragment Offset
 - TTL, Protocol, Header Checksum
 - Source and Destination IP addresses

IPv4 Header Diagram:**6. IP Identification** ★ ★**Question Pattern:** 2 marks (2 times), Part B (1 time)**Expected Questions:**

- IP Identification (2 marks)
- Explain IP Identification (6 marks)

Key Points:

- **16-bit field** in IP header
- **Purpose:** Uniquely identify fragments of a single IP datagram
- **Usage:** When packet is fragmented, all fragments carry same identification value
- **Reassembly:** Destination uses this field to reassemble fragments correctly

7. IP Flags ★ ★**Question Pattern:** 2 marks (2 times)**Expected Questions:**

- IP flags (2 marks)

Key Points:

- **3-bit field** in IP header
- **Bit 0:** Reserved (must be 0)
- **Bit 1 (DF):** Don't Fragment flag
- **Bit 2 (MF):** More Fragments flag
- **Usage:** Controls fragmentation behavior

8. IP Fragmentation and Reassembly ★★

Question Pattern: 10 marks (1 time)

Expected Questions:

- Explain IP fragmentation and Reassembly Structure (10 marks)

Key Points:

Need: When packet size exceeds MTU (Maximum Transmission Unit)

Process:

- Router fragments large packets
- Each fragment has same identification
- Fragment offset indicates position
- MF flag set for all except last fragment

Reassembly: Done at destination using identification and offset

9. Transport Layer Protocols ★★

Question Pattern: 10 marks (1 time)

Expected Questions:

- Explain Transport Layer Protocol (10 marks)

Key Points:

- **Layer 4** of OSI model **Main**

Protocols: TCP and UDP

- **Functions:**
- End-to-end communication
- Error detection and correction
- Flow control and congestion control
- Port-based addressing

10. Port Numbers ★★

Question Pattern: Part B (1 time)

Expected Questions:

- Elucidate Port Numbers (6 marks)

Key Points:

- **16-bit numbers** (0-65535)

Categories:

- **Well-known ports:** 0-1023 (HTTP:80, HTTPS:443, FTP:21, SSH:22)
- **Registered ports:** 1024-49151
- **Dynamic ports:** 49152-65535
- **Purpose:** Identify specific services/applications on a host

11. TCP Flags ★★

Question Pattern: 2 marks (1 time)

Expected Questions:

TCP Flags (2 marks)

Key Points:

- **9 flags** in TCP header (6 commonly used)

Important Flags:

- **SYN:** Synchronize sequence numbers (connection establishment)
- **ACK:** Acknowledgment field significant
- **FIN:** Finish (connection termination)
- **RST:** Reset connection
- **PSH:** Push function
- **URG:** Urgent pointer field significant

12. TCP 3-Way Handshake ★★

Question Pattern: 2 marks (1 time)

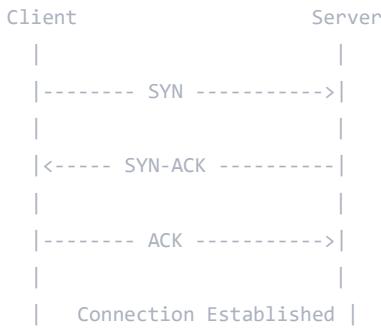
Expected Questions:

- TCP 3 way Handshake (2 marks)

Key Points:

- **Step 1:** Client sends SYN
- **Step 2:** Server responds with SYN-ACK
- **Step 3:** Client sends ACK

Purpose: Establishes reliable connection

Diagram:**13. Segmentation** ★★**Question Pattern:** Part B (1 time)**Expected Questions:**

- Elucidate on segmentation (6 marks)

Key Points:

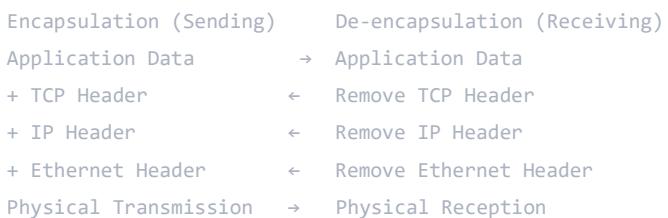
- **Process:** Breaking large data into smaller segments
- **Purpose:** Fit within network MTU limits
- **Benefits:** Better error recovery, efficient bandwidth usage
- **TCP:** Handles segmentation and reassembly automatically

14. Encapsulation and De-encapsulation ★★**Question Pattern:** Part B (1 time), 2 marks (mentioned)**Expected Questions:**

- Compare Encapsulation and De-encapsulation (6 marks)
- Payload (2 marks)

Key Points:

- **Encapsulation:** Adding headers at each layer (top-down)
- **De-encapsulation:** Removing headers at each layer (bottom-up)
- **Payload:** Actual data being transmitted
- **Diagram:**



UNIT 2: IP ROUTING AND IP ADDRESSING

Most Important Topics (High Frequency)

1. Static and Dynamic Routing

Question Pattern: Part B (1 time), 10 marks (1 time) **E**

Expected Questions:

- Compare Static and Dynamic Routing (10 marks)
- Explain Dynamic Routing (6 marks)

Static Routing:

- **Manual configuration** of routes
- **Advantages:** Simple, secure, no bandwidth overhead
- **Disadvantages:** Not scalable, no automatic failover
- **Use cases:** Small networks, stub networks

Dynamic Routing:

- **Automatic route discovery** using protocols
- **Advantages:** Scalable, automatic failover, adapts to changes
- **Disadvantages:** Complex, consumes bandwidth and CPU
- **Protocols:** RIP, OSPF, EIGRP, BGP

2. IP Routing Protocols

Question Pattern: Part B (1 time)

Expected Questions:

- Describe IP routing protocols (6 marks)

Classification:

- **Interior Gateway Protocols (IGP):** Within autonomous system
 - Distance Vector: RIP
 - Link State: OSPF
 - Hybrid: EIGRP
- **Exterior Gateway Protocols (EGP):** Between autonomous systems Path Vector: BGP

3. RIPv1 and RIPv2

Question Pattern: 2 marks (2 times), Part B (1 time)

Expected Questions:

- RIPv1 (2 marks)
- RIPv2 (2 marks)

- Describe RIPv1 (6 marks)

RIPv1:

- **Distance Vector Protocol**
- **Metric:** Hop count (max 15)
- **Classful routing** (no subnet mask)
- **Updates:** Broadcast every 30 seconds
- **Limitations:** No VLSM support, slow convergence

RIPv2:

- **Enhanced version** of RIPv1
- **Classless routing** (includes subnet mask)
- **Authentication support**
- **Multicast updates** (224.0.0.9)
- **VLSM and CIDR support**

4. OSPF **Question Pattern:** 2 marks (2 times)**Expected Questions:**

- OSPF- Expand (2 marks)
- OSPF (2 marks)

Key Points:

- **Open Shortest Path First**
- **Link State Protocol**
- **Metric:** Cost (based on bandwidth)
- **Fast convergence**
- **Hierarchical design** with areas
- **Supports VLSM and CIDR**

5. EIGRP **Question Pattern:** 2 marks (1 time), Part B (1 time)**Expected Questions:**

- EIGRP (2 marks)
- Explain EIGRP (6 marks)

Key Points:

- **Enhanced Interior Gateway Routing Protocol**
- **Cisco proprietary** (now open standard)
- **Hybrid protocol** (distance vector + link state features)
- **Metric:** Composite (bandwidth, delay, reliability, load)
- **DUAL algorithm** for loop-free routing

6. Network Address Translation (NAT) ★★

Question Pattern: Part B (1 time), 10 marks (1 time)

Expected Questions:

- Discuss Network Address Translation (6 marks)
- Describe Network Address Translation (10 marks)

Key Points:

Purpose: Translate private IP to public IP

Types:

- **Static NAT:** One-to-one mapping
- **Dynamic NAT:** Pool of public IPs
- **PAT (Port Address Translation):** Many-to-one with ports
 - **Benefits:** IP address conservation, security

7. IP Classes ★★

Question Pattern: 10 marks (1 time)

Expected Questions:

- Describe IP Classes (10 marks)

Classful Addressing:

- **Class A:** 1.0.0.0 to 126.0.0.0 (/8) - Large networks
- **Class B:** 128.0.0.0 to 191.255.0.0 (/16) - Medium networks
- **Class C:** 192.0.0.0 to 223.255.255.0 (/24) - Small networks
- **Class D:** 224.0.0.0 to 239.255.255.255 - Multicast
- **Class E:** 240.0.0.0 to 255.255.255.255 - Reserved

8. Private IP ★★

Question Pattern: 2 marks (3 times), 10 marks (1 time)

Expected Questions:

- Private IP (2 marks)
- Elucidate on Private IP (10 marks)
- Differentiate Private and Public IP (10 marks)

Private IP Ranges:

- **Class A:** 10.0.0.0/8 (10.0.0.0 to 10.255.255.255)
- **Class B:** 172.16.0.0/12 (172.16.0.0 to 172.31.255.255)
- **Class C:** 192.168.0.0/16 (192.168.0.0 to 192.168.255.255)

Characteristics:

- **Not routable** on internet

- **Internal use only**
- **NAT required** for internet access

9. *Public IP* ★ ★

Question Pattern: 2 marks (1 time)

Expected Questions:

- Public IP (2 marks)

Key Points:

- **Globally unique** IP addresses
- **Routable** on internet
- **Assigned by ISPs**
- **Limited availability** (IPv4)

10. *Reserved IP* ★ ★

Question Pattern: 2 marks (2 times)

Expected Questions:

- Reserved IP (2 marks)

Important Reserved Ranges:

- **0.0.0.0/8** - This network
- **127.0.0.0/8** - Loopback addresses
- **169.254.0.0/16** - Link-local (APIPA)
- **224.0.0.0/4** - Multicast
- **240.0.0.0/4** - Reserved for future use

11. *APIPA* ★ ★

Question Pattern: 2 marks (1 time)

Expected Questions:

- APIPA- Expand (2 marks)

Key Points:

- **Automatic Private IP Addressing**
- **Range:** 169.254.0.0/16
- **Purpose:** Auto-assign IP when DHCP unavailable
- **Limitation:** Local network communication only

12. *Classful and Classless Routing* ★ ★

Question Pattern: Part B (1 time)

Expected Questions:

- Elucidate Classful and Classless routing (6 marks)

Classful Routing:

- **No subnet mask** in routing updates
- **Natural class boundaries**
- **Examples:** RIPv1, IGRP
- **Limitation:** Wastes IP addresses

Classless Routing:

- **Includes subnet mask** in updates

Variable Length Subnet Masking (VLSM)**Examples:** RIPv2, OSPF, EIGRP**Benefits :** Efficient IP Utilization***UNIT 3: SUBNETTING IP Network*****Most Important Topics (High Frequency)****1. SUBNETTING ★ ★ ★****Question Pattern:** 10 marks (3 times - Very Important)**Expected Questions:**

- What is Subnetting? Explain Class A, B, and C sub netting (10 marks)
- What is Subnetting? Explain Class C Subnetting (10 marks)
- Write a detail note on Subnetting IP network Class A (10 marks)

Subnetting Basics:

- **Purpose:** Divide large network into smaller subnetworks
- **Benefits:** Better organization, reduced broadcast traffic, improved security
- **Subnet Mask:** Identifies network and host portions

Class A Subnetting (Default /8):

- **Default mask:** 255.0.0.0
- **Example:** 10.0.0.0/8 → 10.1.0.0/16, 10.2.0.0/16, etc.
- **Subnets possible:** $2^{(b)} - 2$

Class B Subnetting (Default /16):

- **Default mask:** 255.255.0.0
- **Example:** 172.16.0.0/16 → 172.16.1.0/24, 172.16.2.0/24, etc.

Class C Subnetting (Default /24):

- **Default mask:** 255.255.255.0
- **Example:** 192.168.1.0/24 → 192.168.1.0/26, 192.168.1.64/26, etc.

Subnetting Formula:

Number of Subnets = 2^n (where n = borrowed bits)

Number of Hosts = $2^h - 2$ (where h = host bits)

2. Classless Inter-Domain Routing (CIDR) ★★

Question Pattern: 10 marks (1 time)

Expected Questions:

- Explain Classless Inter-Domain Routing (10 marks)

Key Points:

- **Eliminates** traditional class boundaries
- **CIDR notation:** Network/prefix length (e.g., 192.168.1.0/24)
- **Benefits:**
 - Efficient IP address allocation
 - Reduced routing table size
 - Route aggregation/summarization
 - **Supernetting:** Combining multiple networks

3. Subnet Mask and Wildcard Mask ★★

Question Pattern: 2 marks (1 time)

Expected Questions:

- Wild card mask (2 marks)

Subnet Mask:

- **Purpose:** Separates network and host portions
- **Format:** Contiguous 1s followed by 0s
- **Example:** 255.255.255.0 (/24)

Wildcard Mask:

- **Inverse** of subnet mask
- **Used in:** Access Control Lists (ACLs), OSPF area definitions
- **Format:** 0s for network bits, 1s for host bits
- **Example:** 0.0.0.255 (inverse of 255.255.255.0)

4. Frame Relay ★★

Question Pattern: 2 marks (1 time)

Expected Questions:

- Frame relay (2 marks)

Key Points:

- **WAN technology** for connecting remote sites
- **Packet-switched** network
- **Virtual circuits** for communication
- **Cost-effective** alternative to leased lines
- **Variable bandwidth** allocation

5. *Data Link Connection Identifiers (DLCI)* ★★

Question Pattern: Part B (2 times)

Expected Questions:

- Explain Data link connection identifiers (6 marks)
- Give the need for DLCI (6 marks)

Key Points:

- **10-bit identifier** in Frame Relay
- **Local significance:** Identifies virtual circuit locally
- **Range:** 16-1007 (usable range)
- **Purpose:** Map to specific destination
- **Configuration:** Set by service provider

6. *Committed Information Rate (CIR)* ★★★

Question Pattern: 2 marks (3 times)

Expected Questions:

- CIR (2 marks)
- CIR - Expand and give its importance (at least 2) (2 marks)

Key Points:

- **Committed Information Rate**
- **Guaranteed bandwidth** in Frame Relay
- **Measured in:** bps (bits per second)

Importance:

- Service level guarantee
- Billing basis
- Traffic shaping reference
- Network planning parameter

7. Permanent Virtual Circuits (PVCs)

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- Permanent Virtual Circuit (2 marks)
- Describe Permanent Virtual Circuits (6 marks)
- Explain Permanent Virtual Circuit (10 marks)

Write the advantages of PVC's (6 marks)

Key Points:

- **Pre-established** virtual circuits
- **Always available** connection
- **No call setup** required

Advantages:

- Predictable performance
- Lower latency
- Simplified configuration
- Cost-effective for permanent connections

Disadvantages:

- Less flexible than SVCs
- Resources always allocated

8. Multiprotocol Label Switching (MPLS)

Question Pattern: Part B (1 time)

Expected Questions:

- Explain Multiprotocol Label Switching (6 marks)

Key Points:

- **Label-based** forwarding mechanism
- **Operates** between Layer 2 and Layer 3
- **Components:**
 - Label Switch Routers (LSRs)
 - Label Distribution Protocol (LDP)
 - Forwarding Equivalence Classes (FECs)
- **Benefits:** Improved performance, traffic engineering, VPN support

9. Edge Routers and Label Switching

Question Pattern: 2 marks (2 times)

Expected Questions:

- Edges routers (2 marks)
- Label Switching (2 marks)

Edge Routers:

- **Provider Edge (PE):** Connect customer sites to MPLS network
- **Customer Edge (CE):** Customer's router connecting to PE
- **Label Edge Router (LER):** Adds/removes MPLS labels
- **Label Switching:**
 - **Fixed-length labels** attached to packets
 - **Label swapping** at each LSR
 - **Faster forwarding** than IP lookup

10. Data Terminal Equipment (DTE) and Data Communication Equipment (DCE)

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- DCE (2 marks)
- Explain Data Terminal Equipment (6 marks)
- Explain Data Communication Equipment (10 marks)

DTE (Data Terminal Equipment):

- **End-user device** (computer, router)
- **Generates** and receives data
- **Examples:** PC, router, terminal
- **Interface:** Usually uses DCE for WAN connectivity

DCE (Data Communication Equipment):

- **Communication device** (modem, CSU/DSU)
- **Provides** clocking and signal conversion
- **Examples:** Modem, CSU/DSU, switches
- **Functions:** Signal conversion, clocking, error detection

11. Clock Speed

Question Pattern: 2 marks (2 times)

Expected Questions:

- Clock speed (2 marks)

Key Points:

- **Timing reference** for synchronous communication
- **Provided by DCE** to DTE

- **Measured in:** bps or Hz
- **Purpose:** Synchronize data transmission
- **Configuration:** Set on serial interfaces

UNIT 4: VIRTUAL LANs

MOST IMPORTANT TOPICS (HIGH FREQUENCY)

1. VIRTUAL LANs (VLANs) ★ ★ ★

Question Pattern: 2 marks (1 time), various related topics

Expected Questions:

- Virtual LAN (2 marks)
- Virtual Space are Safe- Argue with relevant illustration (10 marks - 2 times)

Key Points:

- **Logical grouping** of devices regardless of physical location
- **Broadcast domain** separation
- **Benefits:**
 - Improved security
 - Better bandwidth utilization
 - Simplified management
 - Cost reduction
- **Types:** Data VLAN, Voice VLAN, Management VLAN, Default VLAN

2. ACCESS LINKS AND TRUNK LINKS ★ ★ ★

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- Access Links (2 marks)
- Write a note on Trunk link (6 marks)
- Write a note access link (6 marks)
- Write in detail on Access links and Trunk links (10 marks)

Access Links:

- **Single VLAN** membership
- **Untagged frames** (native VLAN traffic)
- **Connect:** End devices to switches
- **Purpose:** Provide access to network
- **Trunk Links:**
 - **Multiple VLANs** carried over single link
- **Tagged frames** with VLAN ID
- **Connect:** Switch to switch, switch to router

- **Protocols:** 802.1Q, ISL (deprecated)

Diagram:

3. SWITCH PORT MODES

Question Pattern: 2 marks (2 times), Part B (1 time)

Expected Questions:

- Switch port Mode (2 marks)
 - Switch Port (2 marks)
 - Explain switch port Modes (6 marks)

Port Modes:

- **Access Mode:** Single VLAN, untagged
 - **Trunk Mode:** Multiple VLANs, tagged
 - **Dynamic Auto:** Passive negotiation
 - **Dynamic Desirable:** Active negotiation
 - **Nonegotiate:** No DTP negotiation

Commands:

```
switchport mode access switchport  
mode trunk switchport mode dynamic  
auto switchport mode dynamic  
desirable
```

4. VLAN TRUNKING PROTOCOL (VTP) ★ ★ ★

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- VLAN Trunking (2 marks)
 - Elucidate the VTP Domain (6 marks)
 - Discuss in detail the VTP Domain (10 marks)

VTP Modes:

- **Server Mode:** Create, modify, delete VLANs; synchronize
 - **Client Mode:** Cannot modify VLANs; receive updates
 - **Transparent Mode:** Forward updates; maintain local VLAN database

VTP Domain:

- **Administrative boundary** for VLAN information
- **Same domain name** required for synchronization
- **Security:** VTP password for authentication

5. SERVER, CLIENT AND TRANSPARENT MODES ★ ★

Question Pattern: 10 marks (1 time)

Expected Questions:

- Write in detail on Client and Transparent modes (10 marks)

Detailed Explanation:

- **Server Mode:**
 - Default mode on switches
 - Can create, modify, delete VLANs
 - Advertises VLAN information
 - Synchronizes with other switches
- **Client Mode:**
 - Cannot modify VLAN configuration
 - Receives and forwards VTP advertisements
 - VLAN configuration not saved locally
- **Transparent Mode:**
 - Independent VLAN database
 - Forwards VTP advertisements
 - Does not participate in VTP synchronization
 - Local VLAN changes only

6. CONFIGURATION REVISION NUMBERS ★ ★

Question Pattern: 2 marks (1 time), 10 marks (1 time)

Expected Questions:

- Configuration (2 marks)
- Write in detail Configuration Revision Numbers (10 marks)

Key Points:

- **32-bit number** tracking VLAN database changes
- **Increments** with each VLAN modification
- **Higher revision number** takes precedence
- **Synchronization mechanism** in VTP
- **Reset to 0:** When switch changes from client/server to transparent

7. INTER-VLAN COMMUNICATIONS ★ ★

Question Pattern: Part B (1 time)

Expected Questions:

- Elucidate Inter Vlan Communications (6 marks)

Methods:

- **Router-on-a-Stick:** Single physical interface with subinterfaces
- **Layer 3 Switch:** Built-in routing capability
- **Separate Router Interface:** Physical interface per VLAN

Configuration Example:

```
interface GigabitEthernet0/0.10
encapsulation dot1Q 10
ip address 192.168.10.1 255.255.255.0

interface GigabitEthernet0/0.20
encapsulation dot1Q 20
ip address 192.168.20.1 255.255.255.0
```

8. BROADCAST DOMAIN ★★**Question Pattern:** Part B (1 time)**Expected Questions:**

- Explain Broadcast Domain (6 marks)

Key Points:

- **Logical division** where broadcast frames are propagated
- **Bounded by:** Routers and Layer 3 devices
- **VLAN creates** separate broadcast domains
- **Benefits:** Reduced broadcast traffic, improved performance
- **Size consideration:** Optimal size for network efficiency

9. COLLISION DOMAIN ★★★**Question Pattern:** 2 marks (3 times)**Expected Questions:**

- Collision Domain (2 marks)

Key Points:

- **Physical network Segment** where collisions can occur
- **Ethernet shared medium** concept
- Bounded by : **Switches, bridges**

- **Modern networks:** Each switch port = separate collision domain
- **Full Duplex:** Eliminates collisions entirely

UNIT 5: COMMUNICATION PROTOCOLS

MOST IMPORTANT TOPICS (HIGH FREQUENCY)

1. ADDRESS RESOLUTION PROTOCOL (ARP) ★ ★ ★

Question Pattern: 2 marks (1 time), Part B (3 times)

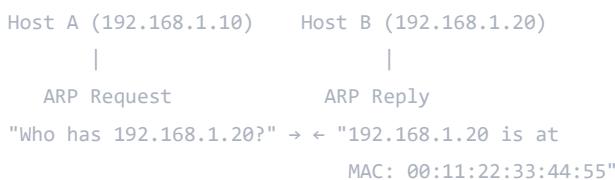
Expected Questions:

- Address Resolution Protocol (2 marks)
- Explain ARP (6 marks - 2 times)
- Elucidate Address Resolution Protocol (6 marks)

Key Points:

- **Layer 2 protocol** operating at Data Link layer
- **Process:**
 - ARP Request (broadcast)
 - ARP Reply (unicast)
 - ARP table caching
- **Types:** ARP Request, ARP Reply
- **ARP Table:** Cache of IP-to-MAC mappings

ARP Process Diagram:



2. REVERSE ADDRESS RESOLUTION PROTOCOL (RARP) ★ ★

Question Pattern: 2 marks (1 time), Part B (1 time)

Expected Questions:

- RARP (2 marks)
- Elucidate Reverse Address Resolution Protocol (6 marks)

Key Points:

- **Purpose:** Map MAC addresses to IP addresses
- **Opposite** of ARP
- **Used by:** Diskless workstations, embedded devices
- **Replaced by:** DHCP and BOOTP
- **Process:** MAC-to-IP address resolution

3. INTERNET CONTROL MESSAGE PROTOCOL (ICMP) ★★

Question Pattern: 2 marks (1 time) **Expected Questions:**

- ICMP - Expand and give its importance (at least 2) (2 marks)

Key Points:

- **Internet Control Message Protocol**
- **Purpose:** Error reporting and network diagnostics
- **Importance:**
 - Network troubleshooting (ping, traceroute)
 - Error notification (destination unreachable)
 - Network congestion control
 - Path MTU discovery
- **Common Messages:** Echo Request/Reply, Destination Unreachable, Time Exceeded

4. Transmission Control Protocol (TCP) ★★★

Question Pattern: 2 marks (2 times)

Expected Questions:

- TCP - Expand and explain its important (at least 2) (2 marks)
- Expand and explain TCP (2 marks)

Key Points:

- **Transmission Control Protocol**
- **Connection-oriented** and **reliable** protocol
- **Importance:**
 - Reliable data delivery
 - Flow control and congestion control
 - Error detection and correction
 - Ordered data delivery
- **Features:** 3-way handshake, acknowledgments, retransmission

5. User Datagram Protocol (UDP) ★★★

Question Pattern: 2 marks (2 times), Part B (2 times)

Expected Questions:

- User datagram protocol (2 marks)
- User Datagram (2 marks)
- Explain User Datagram Protocol (6 marks)

- Discuss Uses of Datagram Protocol (6 marks)

Key Points:

- **Connectionless** and **unreliable** protocol
Faster than TCP (no connection overhead)
- **Uses:**
 - Real-time applications (video, audio streaming)
 - DNS queries
 - DHCP
 - Simple network management
- **Header:** Only 8 bytes (vs TCP's 20+ bytes)

TCP vs UDP Comparison:

TCP	UDP
Connection-oriented	Connectionless
Reliable	Unreliable
Slower	Faster
20+ byte header	8 byte header
HTTP, FTP, SMTP	DNS, DHCP, Video streaming

6. ASCII

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- ASCII- Expand and give its importance (at least 2) (2 marks)
- Write a note on ASCII (6 marks)
- Explain in detail the ASCII (10 marks)
- Explain the need for ASCII (6 marks)

Key Points:

- **American Standard Code for Information Interchange**
- **7-bit character encoding** (128 characters)
- **Range:** 0-127 (decimal)
- **Importance:**
 - Universal character representation
 - Data exchange between systems
 - Foundation for other encodings
 - Text processing and communication
- **Categories:** Control characters (0-31), printable characters (32-126)

- **ASCII Table (Key Characters):**

Decimal	Character	Description
0	NUL	Null
10	LF	Line Feed
13	CR	Carriage Return
32	Space	Space character
48-57	0-9	Digits
65-90	A-Z	Uppercase letters
97-122	a-z	Lowercase letters

7. Hypertext Transfer Protocol (HTTP) ★★☆

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- HTTP are outdated- Argue (2 marks)
- Write a note on HTTP (6 marks)
- Explain Hypertext Transfer Protocol (10 marks)

Key Points:

- **Application layer protocol** for web communication
- **Port 80 (HTTP), Port 443 (HTTPS)**
- **Request-Response model**
- **Methods:** GET, POST, PUT, DELETE, HEAD, OPTIONS
- **Status Codes:**
 - 2xx: Success (200 OK)
 - 3xx: Redirection (301 Moved Permanently)
 - 4xx: Client Error (404 Not Found)
 - 5xx: Server Error (500 Internal Server Error)
- **HTTP vs HTTPS:**
 - **HTTP:** Plain text, insecure
 - **HTTPS:** Encrypted with SSL/TLS, secure

8. File Transfer Protocol (FTP) ★★☆

Question Pattern: 2 marks (2 times), Part B (mentioned)

Expected Questions:

- FTP (2 marks - 2 times)

Key Points:

- **Application layer protocol** for file transfer
- **Two connections:** Control (Port 21), Data (Port 20)
- **Modes:** Active and Passive
- **Commands:** USER, PASS, LIST, RETR, STOR
- **Authentication:** Username and password required

9. Simple Mail Transfer Protocol (SMTP) ★★☆

Question Pattern: 2 marks (2 times), Part B (1 time), 10 marks (1 time)

Expected Questions:

- SMTP - Expand (2 marks)
- Write a note on SMTP (6 marks)
- Explain Simple Mail Transfer Protocol (10 marks)

Key Points:

- **Simple Mail Transfer Protocol**
- **Port 25** (standard), **587** (submission), **465** (secure)
- **Push protocol** for sending emails
- **SMTP Commands:** HELO, MAIL FROM, RCPT TO, DATA, QUIT
- **Process:** Client connects → Authentication → Send email → Disconnect

10. Post Office Protocol Version 3 (POP3) ★★☆

Question Pattern: 2 marks (1 time), Part B (1 time), 10 marks (1 time)

Expected Questions:

- POP3 (2 marks)
- Give the importance of POP3 (6 marks)
- Explain Post Office Protocol Version 3 (10 marks)

Key Points:

- **Port 110** (POP3), **995** (POP3S)
- **Download and delete** model
- **Offline email access**
- **Commands:** USER, PASS, LIST, RETR, DELE, QUIT
- **Limitations:** Single device access, limited server storage

11. Internet Message Access Protocol (IMAP) ★★☆

Question Pattern: Part B (1 time), 10 marks (1 time)

Expected Questions:

- Give the importance of IMAP (6 marks)
- Explain Internet Message Access Protocol. (6 marks)
- Write a note Internet Message Access Protocol (10 marks)

Key Points:

- **Port 143 (IMAP), 993 (IMAPS)**
- **Server-based** email management
- **Multi-device synchronization**
- **Folder hierarchy** support
- **Partial message retrieval**
- **Advantages over POP3:** Multiple device access, server-side search
- **POP3 vs IMAP Comparison:**

POP3	IMAP
Download & Delete	Server-based storage
Single device	Multiple devices
Offline access	Online/Offline sync
Limited server space	Server storage managed
Port 110/995	Port 143/993

12. Telnet ★★**Question Pattern:** 2 marks (1 time)**Expected Questions:**

- Telnet (2 marks)

Key Points:

- **Terminal emulation protocol**
- **Port 23**
- **Remote command-line access**
- **Insecure:** Plain text transmission
- **Replaced by:** SSH (Secure Shell)

13. Domain Name System (DNS) ★★★**Question Pattern:** 2 marks (2 times), Part B (1 time)**Expected Questions:**

- DNS (2 marks)
- DNS Flags (2 marks)
- Explain Domain Name System (6 marks)

Key Points:

- **Port 53 (UDP/TCP)**
- **Hierarchical naming system**
- **Record Types:**

- A: IPv4 address
- AAAA: IPv6 address
- CNAME: Canonical name
- MX: Mail exchanger
- NS: Name server
- PTR: Pointer (reverse lookup)

- **DNS Hierarchy:**

```

Root (.)
└── Top-Level Domain (.com, .org, .edu)
└── Second-Level Domain (example.com)
└── Subdomain (www.example.com, mail.example.com)
  
```

14. Simple Network Management Protocol (SNMP) ★★

Question Pattern: 2 marks (1 time)

Expected Questions:

- SNMP (2 marks)
- **Key Points:**
 - Port 161 (agent), 162 (manager – traps)
 - Network monitoring and Management
 - Components: Manager , Agents , MIB
 - Operations; GET , SET, TRAP, INFORM
 - Versions: SNMPv1, SNMPv2c, SNMPv3 (secure)

ALL THE BEST - ram