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Internet and its Applications

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Preface

The Internet is the defining infrastructure of the twenty-first century. From basic communication and entertainment to global commerce, scientific research, healthcare, and education, almost every dimension of modern human activity now depends, to some degree, on the Internet and its applications. For undergraduate students in Computer Science, Information Technology, and related fields at Manonmaniam Sundaranar University, Tirunelveli, a thorough and practical understanding of the Internet is both an academic requirement and a professional necessity.

This textbook — Internet and Its Applications, 2026 Edition — has been carefully revised and expanded to provide complete, error-free coverage of the five units prescribed in the Manonmaniam Sundaranar University syllabus. Every chapter has been rewritten in clear, simple, and accessible English, making complex concepts easy to understand even for students encountering these topics for the first time. The content uses structured explanations, rich comparison tables, step-by-step procedures, definition boxes, and practical examples throughout all five units.

How This Book is Organized

The textbook is structured into five self-contained units, each corresponding to the MSU syllabus:

- **Unit 1 — Internet Concepts:** Introduces the Internet, its history, types of connections (Dial-Up, DSL, ADSL, Cable, Fiber), ISDN, and the concept of Intranets connecting a LAN to the Internet.
- **Unit 2 — E-Mail Concepts:** Covers the full lifecycle of electronic mail — how email works, email addressing, basic commands, sending and receiving files, controlling email volume, and securing email communications.
- **Unit 3 — Internet Services:** Explores real-time communication through online chatting, video conferencing, email mailing lists, and Usenet newsgroups.
- **Unit 4 — Web Concepts and Browsers:** Explains the World Wide Web, its core elements, the client-server model, URLs, HTTP/HTTPS protocols, web browsers, and the histories of Netscape Navigator and Microsoft Internet Explorer.
- **Unit 5 — Search Engines:** Covers how search engines work, web directories, effective searching techniques, early internet tools (Bigfoot, InfoSpace, WhoWhere, Yahoo), subscriptions, websites, web resources, and practical online applications for news, finance, health, entertainment, and daily life.

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This 2026 edition has been fully updated to reflect current technology and industry standards. All content has been written originally to maintain plagiarism levels below 10%, in compliance with academic integrity standards required for ISBN publications.

It is my sincere hope that this textbook serves as a reliable and engaging companion throughout your studies and beyond.

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UNIT — 1

INTERNET CONCEPTS

1.1 Introduction to the Internet

The Internet is the largest and most influential computer network ever created. It connects billions of devices — computers, smartphones, tablets, servers, and smart appliances — spread across every country on Earth. Using a universal set of communication rules called Transmission Control Protocol / Internet Protocol (TCP/IP), all these devices can send and receive data reliably, regardless of their physical location, hardware, or operating system.

The Internet is not a single network but rather a 'network of networks.' Thousands of smaller networks — maintained by universities, governments, corporations, and Internet Service Providers (ISPs) — are all interconnected to form the global Internet. No single organization controls or owns the Internet; it is a shared global resource managed collectively by millions of stakeholders.

Key Definition

The Internet is a global system of interconnected computer networks that use TCP/IP protocols to link devices worldwide. It enables communication services such as the World Wide Web, email, file transfer, online chat, streaming, and much more.

1.1.1 History and Evolution of the Internet

The Internet grew over several decades through research, government investment, and academic collaboration. Below is a chronological summary of its most important milestones:

Year / Period	Key Development
1969	ARPANET established by the US Department of Defense — the first packet-switching network connecting four universities.
1971	Ray Tomlinson invents email; introduces the '@' symbol to separate username from host in email addresses.
1973	ARPANET extended internationally — first overseas connections to the UK and Norway.
1974	TCP/IP protocol suite proposed by Vint Cerf and Bob Kahn — becomes the technical foundation of the Internet.

Year / Period	Key Development
1983	ARPANET officially adopts TCP/IP; this date is often called the 'birthday' of the modern Internet.
1984	Domain Name System (DNS) introduced, replacing numeric IP addresses with human-readable names.
1989	Tim Berners-Lee proposes the World Wide Web at CERN, Switzerland.
1991	World Wide Web goes public; HTML, HTTP, and URLs introduced to the world.
1993	Mosaic browser released — first graphical web browser; makes the Web accessible to the general public.
1994	Yahoo! launched as a web directory; Netscape Navigator browser released; Amazon founded.
1998	Google founded by Larry Page and Sergey Brin at Stanford University.
2000s	Broadband Internet, social media (Facebook 2004, YouTube 2005), and smartphones revolutionize internet use.
2007	Apple iPhone launched, beginning the mobile internet era.
2010s	Mobile internet users surpass desktop users; cloud computing, IoT, and streaming services become mainstream.
2020s	5G networks, AI integration, Web 3.0, metaverse, and edge computing continue to reshape the Internet.

1.1.2 Internet vs. World Wide Web

A common misconception is that the Internet and the World Wide Web are the same thing. They are not. The Internet is the underlying infrastructure; the Web is one of many services that run on top of it.

Feature	Internet	World Wide Web (WWW)
What it is	Global network infrastructure of cables, routers, servers, and protocols	A collection of websites and webpages accessible over the Internet
Invented by	Multiple researchers; ARPANET (1969), TCP/IP (1974)	Tim Berners-Lee, 1989 (made public 1991)
Technology used	Physical hardware + TCP/IP protocols	HTTP/HTTPS, HTML, CSS, JavaScript, URLs
Analogy	The road and highway system	The vehicles (cars, buses) traveling on the roads
Examples	Email, FTP, VoIP, online gaming, streaming	Google.com, Wikipedia.org, YouTube.com

1.1.3 Core Components of the Internet

The Internet is composed of physical and logical components working in coordination:

- **End Devices (Hosts)**
  Any device connected to the Internet — desktop computers, laptops, smartphones, IoT sensors, smart TVs. These are the endpoints that generate and consume data.
- **Routers**
  Specialized networking devices that forward data packets between networks. A router reads the destination IP address in each data packet and determines the best path for it to travel across the Internet.
- **Network Switches**
  Connect multiple devices within a single local network (LAN), routing data only to the intended device using MAC addresses, reducing unnecessary traffic.
- **Modems**
  Devices that convert digital computer data into signals appropriate for transmission over telephone lines, coaxial cable, or fiber-optic cable, and vice versa.
- **Servers**
  Powerful computers that host resources, services, and data — websites (web servers), files (file servers), emails (mail servers), databases (database servers).
- **Internet Backbone**
  The core high-capacity data routes of the Internet, made up of fiber-optic cables that span continents and high-speed satellite links. Operated by major telecommunications companies.
- **DNS (Domain Name System)**
  A distributed database that translates human-readable domain names (e.g., www.msuniv.ac.in) into the numeric IP addresses computers use for routing.

1.1.4 How the Internet Works — Packet Switching

The Internet transmits data using a method called packet switching. Instead of sending an entire file or message as one continuous stream, the data is broken into small chunks called packets. Each packet contains a portion of the data, plus a header with the source address, destination address, and packet sequence number.

Each packet travels independently through the network, potentially taking different routes. When all packets arrive at the destination, they are reassembled in the correct order using the sequence numbers. This approach provides several advantages:

- Efficient use of network resources — many packets from different sources share the same links.
- Fault tolerance — if one route fails, packets can take alternative paths.
- Scalability — the network can handle millions of simultaneous connections.

> ***Step-by-Step: Accessing a Website***
>
> *1. You type www.example.com in your browser. 2. Your browser queries a DNS server, which returns the IP address (e.g., 93.184.216.34). 3. Your browser sends an HTTP/HTTPS request to the web server at that IP. 4. The server sends back the webpage as data packets. 5. Your browser reassembles the packets and displays the webpage. This entire process typically completes in under one second.*

1.1.5 Uses of the Internet

Application Area	Description	Examples
Communication	Sending messages, making calls, social networking	Email, WhatsApp, Zoom, Instagram, LinkedIn
Information Access	Finding data, news, research on any topic	Google, Wikipedia, news portals, e-journals
Education & E-Learning	Online courses, digital libraries, academic resources	NPTEL, Coursera, Khan Academy, edX
E-Commerce	Buying and selling goods and services online	Amazon, Flipkart, Meesho, IRCTC, Paytm
Banking & Finance	Transactions, bill payment, investment management	Net banking, UPI, NEFT, RTGS, Zerodha
Entertainment	Streaming, gaming, music, podcasts	Netflix, YouTube, Spotify, JioSaavn, Steam
Healthcare	Telemedicine, health info, appointment booking	Practo, Apollo 24/7, WebMD, eSanjeevani
Government Services	e-Governance, public info, tax filing, records	DigiLocker, MCA portal, Income Tax e-filing
Remote Work	Working from home using collaboration tools	Zoom, Slack, Google Workspace, Microsoft Teams
Research	Scientific collaboration, data sharing, publishing	PubMed, Google Scholar, ResearchGate

1.1.6 The Future of the Internet

The Internet is continuously evolving. Key trends shaping its future include:

- **5G Networks:** Fifth-generation mobile networks offer speeds up to 100x faster than 4G, ultra-low latency, and support for massive IoT deployments.
- **Internet of Things (IoT):** Connecting billions of everyday objects — appliances, vehicles, industrial sensors — to the Internet for smart automation.
- **Artificial Intelligence (AI):** AI algorithms increasingly power search engines, recommendation systems, virtual assistants, and cybersecurity tools.
- **Web 3.0:** The next generation of the Web, featuring decentralized architecture using blockchain, AI-driven semantic understanding, and greater user data ownership.
- **Edge Computing:** Processing data closer to the source (the 'edge' of the network) rather than in centralized data centers, reducing latency for real-time applications.

1.2 Internet Connection Concepts

An Internet connection is the means by which a device connects to the global Internet. The quality of this connection — its type, speed, latency, and reliability — directly determines the user's online experience. Understanding the different types of Internet connections and the key technical terms associated with them is essential for anyone working with networked systems.

1.2.1 Types of Internet Connections

Internet connectivity can be delivered through several different technologies, each with distinct characteristics:

A. Dial-Up Connection

Dial-up was the first widely available consumer Internet access method. It uses a standard telephone line and a dial-up modem that calls the ISP's access number to establish a connection. The telephone line is occupied during the Internet session, so voice calls cannot be made simultaneously.

Attribute	Dial-Up Details
Maximum Speed	56 Kbps (kilobits per second) — V.92 standard
Connection Type	On-demand (must dial in each session)
Medium	PSTN copper telephone lines
Phone Availability	Line is occupied during Internet use
Current Status	Largely obsolete; used only in remote areas without alternatives
Typical Use	Basic email and simple web browsing

B. DSL — Digital Subscriber Line

DSL provides high-speed Internet over existing copper telephone lines by using higher frequency bands, keeping the voice channel free for simultaneous telephone use. No dialing is required — the connection is always-on.

- ADSL (Asymmetric DSL): Download speed higher than upload speed. Typical download: 1–24 Mbps. Suits most home users.
- ADSL2+: Enhanced ADSL offering up to 24 Mbps download. Better performance over longer line distances.
- VDSL (Very-high-speed DSL): Offers speeds up to 100 Mbps but only over short distances from the exchange.

C. Cable Internet

Cable Internet uses the same coaxial cable infrastructure used for cable television to deliver broadband Internet access. A cable modem connects the home network to the cable provider's network. Bandwidth is shared among users on the same cable segment, which can affect speeds during peak hours.

- Typical download speeds: 10 Mbps to 1 Gbps
- Uses DOCSIS (Data Over Cable Service Interface Specification) technology
- Generally faster than DSL but speed may vary with neighborhood usage

D. Fiber Optic Internet

Fiber optic Internet transmits data as pulses of light through ultra-thin glass or plastic fibers. It provides the fastest speeds, highest reliability, and lowest latency of any current consumer technology.

- Speeds range from 100 Mbps to 10 Gbps
- Not affected by electromagnetic interference
- Two variants: FTTH (Fiber to the Home) and FTTB (Fiber to the Building)
- Available in India from Jio Fiber, Airtel Xstream, BSNL FTTH, ACT Fibernet

E. Mobile Internet (3G / 4G / 5G)

Mobile Internet uses cellular radio networks to deliver Internet access to mobile devices and fixed wireless installations.

Generation	Speed	Key Features
2G (GPRS/EDGE)	Up to 384 Kbps	Basic data; text and simple web pages only
3G (HSPA)	1 Mbps – 14 Mbps	Video calls, social media, moderate streaming

Generation	Speed	Key Features
4G LTE	20 Mbps – 150 Mbps	HD streaming, fast browsing, VoIP; current standard
5G	100 Mbps – 10 Gbps	Ultra-fast, ultra-low latency; IoT, AR/VR, smart cities

F. Satellite Internet

Satellite Internet delivers connectivity via communication satellites in orbit. It is the primary option for rural and remote areas without cable or fiber infrastructure, though it typically has higher latency than terrestrial connections.

- Traditional geostationary satellites: 600–900 ms latency
- Low Earth Orbit (LEO) constellations (e.g., Starlink): 20–60 ms latency, speeds 50–500 Mbps

G. Wi-Fi

Wi-Fi is a wireless local area networking technology that uses radio waves (IEEE 802.11 standards) to provide Internet access within a limited area. A Wi-Fi router connects to a broadband Internet service and broadcasts a wireless signal, allowing multiple devices to connect simultaneously without cables.

1.2.2 Key Internet Connection Terms

Term	Definition	Measurement Unit
Bandwidth	Maximum theoretical data transfer rate of a connection	Mbps, Gbps
Download Speed	Actual rate of data flow from Internet to device	Mbps
Upload Speed	Actual rate of data flow from device to Internet	Mbps
Latency (Ping)	Round-trip time for data to travel to server and back	Milliseconds (ms)
Throughput	Actual data transfer rate achieved in practice (usually below bandwidth)	Mbps
Jitter	Variation in latency over time; high jitter degrades VoIP and video quality	ms
ISP	Internet Service Provider — the company that sells Internet access	N/A
Data Cap	Monthly usage limit imposed by ISP; excess may be throttled or charged	GB or TB
IP Address	Unique numerical identifier assigned to every Internet-connected device	IPv4 or IPv6
DNS	Domain Name System — translates domain names to IP addresses	N/A

1.2.3 IPv4 vs. IPv6

Every device on the Internet must have a unique IP address. Two versions are currently in use:

Feature	IPv4	IPv6
Address length	32 bits	128 bits
Format	Dotted decimal: 192.168.1.100	Hexadecimal groups: 2001:0db8::1
Total addresses	~4.3 billion	~340 undecillion (3.4×10^{38})
Status	Nearly exhausted; still dominant	Increasingly deployed; future standard
Example	203.94.161.52	2401:4900:1b20:f2b7::1

1.2.4 Security in Internet Connections

- **Firewall:** Monitors and filters network traffic based on predefined security rules. Both hardware firewalls (built into routers) and software firewalls (installed on devices) help block unauthorized access.
- **Encryption:** Scrambles data so that only intended parties can read it. HTTPS uses TLS/SSL encryption to protect data exchanged between browsers and web servers.
- **VPN (Virtual Private Network):** Creates an encrypted tunnel between a device and a VPN server, masking the user's IP address and protecting data from interception, especially on public Wi-Fi networks.
- **Strong Passwords and 2FA:** Protect router admin panels and ISP account portals with complex passwords and two-factor authentication.

1.3 Connecting to Dial-Up Internet with ISP Accounts

Although broadband has largely replaced dial-up in urban and semi-urban areas, understanding how dial-up works provides valuable historical context and remains relevant for remote areas where it may still be the only available option. Dial-up uses the Public Switched Telephone Network (PSTN) and a modem to call the ISP's access number and establish an Internet session.

1.3.1 What You Need

Requirement	Description
Dial-Up Modem	A hardware device that converts digital data to analog audio signals for transmission over phone lines. Can be internal (inside the computer) or external (connected via USB or serial port).
Telephone Line	A standard PSTN landline connected to the modem using an RJ-11 telephone cable.

Requirement	Description
ISP Dial-Up Account	A subscription with a dial-up ISP providing a dial-up number, username, and password.
Dial-Up Software	Built into Windows and macOS; may also be provided by the ISP as a setup utility.

1.3.2 Setting Up a Dial-Up Connection on Windows 10 / 11

1. Open the Control Panel and go to Network and Internet → Network and Sharing Center.
2. Click 'Set up a new connection or network'.
3. Select 'Connect to the Internet' and click Next.
4. Choose 'Dial-up' from the options presented.
5. Enter the ISP's dial-up phone number in the 'Dial-up phone number' field.
6. Enter your ISP-provided Username and Password.
7. Give the connection a descriptive name and click Create.
8. To connect, click the network icon in the system tray and select your dial-up connection.

1.3.3 Setting Up a Dial-Up Connection on macOS

9. Open System Preferences → Network.
10. Click the '+' button to create a new network interface.
11. Choose PPP (Point-to-Point Protocol) or Modem from the Interface dropdown.
12. Enter the provider name, account name (username), password, and telephone number.
13. Click Apply, then Connect.

1.3.4 The Dialing Process

Once configured, the dial-up modem physically dials the ISP's access number. During the connection negotiation, users hear the characteristic modem sounds — dial tone, dialing beeps, static, and a handshake screech — as the two modems negotiate transmission parameters (compression, error correction, line speed). The connection is established in approximately 30–60 seconds.

> **Important Limitation**
> Dial-up has a maximum theoretical speed of 56 Kbps. In practice, typical speeds are 28–48 Kbps due to line noise and network conditions. This is far too slow for video streaming, large downloads, or VoIP. It is suitable only for basic text email and simple, low-graphic web pages.

1.3.5 Comparison of Connection Speeds

Connection Type	Max Download Speed	Suitable Activities
Dial-Up	56 Kbps	Basic email; simple text web pages
ISDN (BRI)	128 Kbps	Basic browsing; small file downloads
ADSL	Up to 24 Mbps	Web browsing, streaming, email, social media
Cable Internet	Up to 1 Gbps	HD/4K streaming, gaming, large downloads
4G Mobile	20 – 150 Mbps	All general internet activities on mobile
Fiber Optic	100 Mbps – 10 Gbps	Multiple HD streams, cloud work, ultra-fast downloads

1.3.6 Troubleshooting Dial-Up Issues

Problem	Likely Cause	Solution
Cannot connect	Wrong dial-up number; phone line disconnected	Verify number with ISP; check all cable connections
Connection drops frequently	Line noise or interference	Move modem away from other electronics; test phone line
Very slow speed	Modem older than V.90; line static	Upgrade modem; contact ISP about line quality
Authentication fails	Wrong username or password	Re-enter credentials; contact ISP to reset
Busy signal	ISP's modems at capacity	Retry later; ask ISP about access capacity

1.4 High-Speed Internet Connections: ISDN, ADSL, and Cable Modem

As Internet usage expanded in the 1990s and 2000s, the limitations of dial-up became unacceptable for most users and businesses. Three technologies emerged as the primary solutions: ISDN (Integrated Services Digital Network), ADSL (Asymmetric Digital Subscriber Line), and Cable Modem Internet. Each uses a different physical medium and offers a different performance profile.

1.4.1 ISDN — Integrated Services Digital Network

ISDN was the first mainstream digital alternative to analog dial-up. It digitizes the PSTN telephone network, allowing faster, cleaner data transmission over existing copper telephone lines. Unlike analog modems, ISDN does not introduce line noise through audio conversion.

Types of ISDN

Type	Target User	B-Channels	D-Channel	Max Speed
BRI (Basic Rate Interface)	Homes and small offices	2 x 64 Kbps B-channels	16 Kbps	128 Kbps (bonded)
PRI (Primary Rate Interface) — North America	Large businesses	23 B-channels	64 Kbps	1.544 Mbps (T1)
PRI (Primary Rate Interface) — Europe/India	Large businesses	30 B-channels	64 Kbps	2.048 Mbps (E1)

B-channels (Bearer channels) carry user data and voice. The D-channel (Delta channel) carries signaling and control information. In BRI, both B-channels can be bonded together to achieve 128 Kbps total.

Advantages of ISDN

- More reliable than analog dial-up with no line noise.
- Can carry voice and data simultaneously on the same line.
- Faster connection setup than dial-up (under 1 second).

Disadvantages of ISDN

- Slower than modern ADSL, Cable, or Fiber.
- Requires special ISDN terminal adapters (TA) instead of standard modems.
- More expensive to deploy and maintain than DSL.
- Being decommissioned in most countries due to faster alternatives.

1.4.2 ADSL — Asymmetric Digital Subscriber Line

ADSL is a DSL technology that delivers high-speed, always-on Internet over ordinary copper telephone lines. The word 'asymmetric' indicates that download speed (data received by the user) is significantly faster than upload speed (data sent by the user). This asymmetry suits most home users, who consume far more data than they upload.

ADSL works by splitting the copper telephone line's frequency spectrum: voice calls use the low-frequency band (0–4 kHz), while ADSL data uses the higher-frequency bands. A device called a splitter (or microfilter) separates these signals at the phone socket, allowing voice and Internet to operate simultaneously without interference.

Parameter	ADSL	ADSL2+	VDSL2
Max Download Speed	8 Mbps	24 Mbps	100 Mbps
Max Upload Speed	1 Mbps	3 Mbps	50 Mbps

Parameter	ADSL	ADSL2+	VDSL2
Distance Limitation	~5 km from exchange	~5.5 km from exchange	~1 km from exchange
Medium	Copper telephone lines	Copper telephone lines	Copper telephone lines

Key Feature — Always-On Connection

Unlike dial-up and ISDN, ADSL does not require dialing in for each session. The connection is active 24/7 as long as the ADSL modem is powered on. This makes ADSL far more convenient for continuous Internet access.

1.4.3 Cable Internet (Cable Modem)

Cable Internet delivers broadband access over the same coaxial cable infrastructure used for cable television. A cable modem installed at the subscriber's premises communicates with a Cable Modem Termination System (CMTS) at the cable provider's headend.

The DOCSIS (Data Over Cable Service Interface Specification) standard governs cable Internet. DOCSIS 3.1, the current standard, supports download speeds exceeding 1 Gbps and upload speeds up to 100 Mbps. A key limitation of cable Internet is that the bandwidth of a cable segment is shared among all subscribers in a neighborhood — speeds may be lower during peak usage hours (typically evenings and weekends).

Feature	Specification
Physical medium	Coaxial cable (same as cable TV)
Connection type	Always-on (no dialing required)
Download speed	10 Mbps – 1 Gbps+ (DOCSIS 3.1)
Upload speed	1 Mbps – 100 Mbps
Bandwidth	Shared among neighborhood users
Current DOCSIS version	3.1 (gigabit-capable); 4.0 in development

1.4.4 Comprehensive Comparison: ISDN vs. ADSL vs. Cable Modem

Feature	ISDN	ADSL	Cable Modem
Physical medium	Copper telephone (PSTN)	Copper telephone (DSL)	Coaxial cable
Max download speed	128 Kbps (BRI) / 2 Mbps (PRI)	Up to 24 Mbps (ADSL2+)	Up to 1 Gbps (DOCSIS 3.1)
Max upload speed	128 Kbps (BRI)	Up to 3 Mbps	Up to 100 Mbps

Feature	ISDN	ADSL	Cable Modem
Bandwidth type	Symmetric	Asymmetric (download >> upload)	Asymmetric (shared download)
Always-on?	No (dial-in required)	Yes	Yes
Voice + Data simultaneously?	Yes (separate channels)	Yes (splitter separates)	Yes (separate channels)
Availability	Limited; being decommissioned	Widely available in India	Available in urban areas
Typical monthly cost	High	Moderate	Moderate
Best suited for	Legacy enterprise use	Homes and small businesses	Homes, gamers, HD streamers

1.5 Intranet: Connecting a LAN to the Internet

An Intranet is a private organizational network that uses the same underlying technologies as the Internet — TCP/IP protocols, web servers, web browsers, and HTML — but restricts access to authorized users within the organization. Universities, hospitals, government departments, and corporations commonly deploy intranets for internal communication and resource sharing.

> **Definition**
> An Intranet is a private network, confined within an organization, that uses Internet technologies to share internal information, applications, and resources among its members. It operates behind a firewall, isolated from the public Internet.

1.5.1 LAN, Intranet, Extranet, and Internet — Comparison

Feature	LAN	Intranet	Extranet	Internet
Scope	Single building/campus	Organization-wide	Selected partners	Global — public
Access	Internal devices only	Authorized staff only	Controlled external users	Anyone worldwide
Ownership	Organization	Organization	Multiple organizations	No single owner
Security	Physical + switch security	Firewall + authentication	Firewall + VPN + auth	Low (public network)
Example	Office Wi-Fi network	University student portal	Supplier ordering system	Google, Wikipedia

1.5.2 Key Components for Connecting a LAN to the Internet

Router: The router is the central device that connects the LAN to the Internet. It receives traffic from internal devices, translates private IP addresses to a public IP address using NAT (Network Address Translation), and forwards data to and from the Internet. The router also assigns private IP addresses to internal devices via DHCP.

Modem: The modem converts digital data from the router into signals appropriate for the ISP's physical medium (DSL, cable, fiber) and vice versa. For fiber connections, the modem function is replaced by an Optical Network Terminal (ONT).

Firewall: A firewall is a security system that examines all traffic passing between the LAN and the Internet, blocking unauthorized inbound connections while allowing legitimate outbound traffic. Firewalls can be hardware devices, software applications, or both. Most enterprise deployments use a dedicated hardware firewall between the router and the Internet connection.

Gateway: The gateway is the point of entry/exit between the organization's internal network and the Internet. In most small and medium installations, the router functions as the gateway.

Switch: Switches connect multiple devices within the LAN and direct data efficiently to the correct device using MAC (Media Access Control) addresses. Enterprise networks often use managed switches that can be configured for VLANs (Virtual LANs) to segment traffic.

Access Points (APs): Wireless Access Points extend the wired LAN to wireless devices (laptops, smartphones, tablets) by broadcasting a Wi-Fi signal. Large organizations deploy multiple APs for campus-wide wireless coverage.

1.5.3 Steps to Connect a LAN to the Internet

14. Choose an Internet Service Provider (ISP) and select an appropriate bandwidth plan (DSL, cable, fiber, or leased line).
15. Connect the ISP-provided modem to the WAN port of the router.
16. Configure the router: set up SSID and Wi-Fi password, enable NAT, configure DHCP IP range, set up the firewall, and configure port forwarding if required.
17. Connect managed switches to the LAN ports of the router for distributing connectivity to workstations.
18. Deploy wireless access points for Wi-Fi coverage throughout the premises.
19. Configure DHCP on the router to automatically assign IP addresses to connected devices.
20. Test connectivity from multiple devices using both wired and wireless connections.

1.5.4 LAN-to-Internet Security Best Practices

Security Practice	Implementation Details
Strong Wi-Fi Encryption	Use WPA3 (or WPA2 minimum); avoid WEP which is completely insecure.
Change Default Credentials	Always change the router's default admin username and password immediately after setup.
Network Segmentation (VLANs)	Separate guest Wi-Fi, employee Wi-Fi, and servers on different VLANs to limit breach impact.
DMZ (Demilitarized Zone)	Place public-facing servers in a DMZ segment, isolated from the internal LAN.
Regular Firmware Updates	Apply router, switch, and firewall firmware updates promptly to patch security vulnerabilities.
VPN for Remote Access	Staff accessing the intranet remotely must use VPN for encrypted, authenticated connectivity.
Intrusion Detection / Prevention	Deploy IDS/IPS systems to monitor and block malicious traffic patterns.
MAC Address Filtering	Restrict wireless access to known device MAC addresses as an additional layer of control.

1.5.5 Benefits of an Intranet for Organizations

Benefit	Explanation
Centralized information	Company policies, announcements, directories, forms all stored in one accessible location.
Improved collaboration	Staff share project files, collaborate on documents, and use internal messaging tools.
Cost savings	Reduces printing and distribution costs; replaces physical notice boards and internal memos.
Security and privacy	Confidential data stays within the protected internal network, not on the public Internet.
Fast access to internal services	Accessing servers on the intranet is faster than accessing equivalent cloud services.
Streamlined workflows	Internal web applications automate leave requests, expense claims, attendance, and procurement.

UNIT — 2

E-MAIL CONCEPTS

2.1 E-Mail Concepts: What It Is and How It Works

Electronic mail — universally abbreviated as e-mail or email — is one of the oldest and most widely used services on the Internet. It enables users to compose, transmit, receive, and store digital messages across a network. Email combines the reliability and formality of traditional postal correspondence with near-instantaneous delivery, making it the preferred medium for professional digital communication in business, academia, and government worldwide.

The first email message was sent by Ray Tomlinson in 1971 over ARPANET. Tomlinson also introduced the '@' symbol to separate a user's name from the host computer name in an email address — a convention unchanged for over five decades.

Email Address Format

An email address consists of two parts separated by '@': the local part (username) and the domain. Example: student@msuniv.ac.in — where 'student' is the username, 'msuniv' is the institution, 'ac' indicates academic, and 'in' is the India country code TLD.

2.1.1 What Is E-Mail?

Email is a method of exchanging digital messages between individuals or groups using their electronic devices through the Internet or other computer networks. An email message can contain plain text, rich HTML formatting, embedded images, hyperlinks, and file attachments (documents, spreadsheets, PDFs, images, audio, video).

2.1.2 Components of an Email System

Component	Role	Examples
Email Client (MUA)	Mail User Agent — software used to compose, send, read, and manage emails	Gmail, Outlook, Thunderbird, Apple Mail, Yahoo Mail
Mail Transfer Agent (MTA)	Transfers email from sender's server to recipient's server using SMTP	Postfix, Sendmail, Microsoft Exchange

Component	Role	Examples
Mail Delivery Agent (MDA)	Delivers incoming email to the correct mailbox on the receiving server	Dovecot, procmail
Mail Server	Computer that hosts and manages email accounts; sends/receives email on behalf of users	Google Mail servers, Microsoft Exchange Online
DNS (MX Records)	Mail Exchange (MX) records tell sending MTAs where to deliver email for a domain	MX records point to mail.msuniv.ac.in

2.1.3 How Email Works — Step by Step

21. You compose a message in your email client (e.g., Gmail) and click Send.
22. Your email client connects to your outgoing mail server via SMTP (Simple Mail Transfer Protocol) and transfers the message.
23. Your SMTP server queries the DNS for the recipient domain's MX (Mail Exchange) record to find the destination mail server's address.
24. Your SMTP server connects to the recipient's SMTP server and delivers the message.
25. The recipient's server stores the message in the recipient's mailbox.
26. The recipient opens their email client, which connects to the erver via IMAP or POP3 to retrieve and display the new message.

Speed of Email Delivery

The entire process above — from clicking Send to the message appearing in the recipient's inbox — typically takes between 1 second and a few minutes, depending on network conditions and server load. For most emails between major providers (Gmail, Outlook), delivery is nearly instantaneous.

2.1.4 E-Mail Protocols

Protocol	Full Name	Function	Default Ports
SMTP	Simple Mail Transfer Protocol	Sends outgoing mail from client to server, and between mail servers	Port 25 (server), Port 587 (client submission)
IMAP	Internet Message Access Protocol	Retrieves mail from server; keeps mail on server; syncs across devices	Port 143 (plain), Port 993 (TLS/SSL)
POP3	Post Office Protocol 3	Downloads mail to local device; typically deletes from server	Port 110 (plain), Port 995 (TLS/SSL)

Protocol	Full Name	Function	Default Ports
MIME	Multipurpose Internet Mail Extensions	Allows email to carry non-text content: attachments, HTML, images	Extension of SMTP — no separate port
S/MIME	Secure MIME	Provides end-to-end encryption and digital signing for email	Extension of MIME — uses PKI certificates

Comparison Point	IMAP	POP3
Email stored on	Server (synced to all devices)	Downloaded to device; deleted from server
Multi-device access	Yes — changes sync across all devices	No — email exists on one device only
Offline reading	Only downloaded/cached emails	Full access (all emails downloaded)
Server storage used	Yes — emails remain on server	Minimal — emails moved to device
Best for	Users with phone + laptop + tablet	Users with single device; limited server storage

2.1.5 Components of an Email Message

Header Fields

Header Field	Purpose
From:	Sender's email address (and optionally name)
To:	Primary recipient's email address(es)
Cc: (Carbon Copy)	Additional recipients who receive the message; visible to all recipients
Bcc: (Blind Carbon Copy)	Hidden recipients — they receive the email but their addresses are not shown to others
Subject:	A brief description of the email's content; critical for recipient prioritization
Date:	Date and time the email was sent (set automatically by the email client)
Reply-To:	Optional field specifying a different address to receive replies
Message-ID:	Unique identifier for the email, generated by the sending server

Body

The message body contains the actual content. It can be formatted as plain text (no styling — universal compatibility) or as HTML (styled text, colors, images, hyperlinks, tables). Most modern email clients send HTML by default with a plain-text fallback.

Attachments

Files attached to an email using MIME encoding. Common attachment types include PDF, DOCX, XLSX, JPEG, PNG, ZIP. Most email services enforce attachment size limits (typically 10–25 MB). For larger files, cloud storage links are recommended instead.

2.1.6 Types of Email Accounts

Type	Description	Examples
Webmail	Accessed through a browser; no software installation; storage on server	Gmail, Yahoo Mail, Outlook.com, Rediffmail
IMAP Email	Configured in an email client; messages stay on server; multi-device	Gmail/Outlook via IMAP in Thunderbird
POP3 Email	Downloaded to local device; removed from server; offline access	Outlook configured with POP3
Corporate/Business Email	Custom domain, enterprise security, collaboration tools	Google Workspace, Microsoft 365
Temporary Email	Short-lived disposable addresses to avoid spam	Guerrilla Mail, 10 Minute Mail, Mailinator

2.1.7 E-Mail Security Threats

Threat	Description	Protection
Spam	Unsolicited bulk email — advertising, phishing, malware distribution	Spam filters using content analysis, sender reputation scoring
Phishing	Fake emails impersonating trusted entities to steal credentials	Verify sender; hover over links; use multi-factor authentication
Malware Attachments	Malicious files (viruses, ransomware) hidden in email attachments	Antivirus scanning; never open unexpected attachments from unknown senders
Email Spoofing	Forging the 'From' address to impersonate a trusted sender	SPF, DKIM, and DMARC records on sending domain
Business Email Compromise	Sophisticated fraud targeting executives or finance departments	Verify requests for funds transfers via phone call to known number

2.2 E-Mail Addressing

Email addressing encompasses both the technical format of email addresses and the professional conventions for how to properly address recipients in email correspondence. Getting email addressing right is essential for both technical delivery accuracy and professional communication standards.

2.2.1 Technical Structure of an Email Address

Component	Description	Rules & Constraints
Local Part (Username)	Identifies the user's mailbox within the domain	Can contain: letters, digits, dots, underscores, hyphens, plus signs. Case-insensitive on most servers.
@ Symbol	Mandatory separator between local part and domain	Exactly one '@' required in every valid email address.
Domain Name	Organization or service hosting the email account	Must be a valid registered domain with an active MX record.
Top-Level Domain (TLD)	Final segment of domain indicating type/country	.com (commercial), .edu (education), .in (India), .ac.in (Indian academic institution), .gov (government)

Examples: rukaiya@msuniv.ac.in | student123@gmail.com | contact@company.org

2.2.2 Professional Email Addressing Etiquette

Situation	Recommended Salutation Style	Example
Writing to a professor or senior person	Title + Last Name	Dear Dr. Ramesh, / Respected Ma'am,
Writing to a professional organization	Formal generic greeting	Dear Sir/Madam, / To Whom It May Concern,
Writing to a known colleague	First name with professional greeting	Dear Priya, / Hello Mr. Kumar,
Writing to a friend or classmate	First name or nickname	Hi Arun, / Hey Kavitha,
Writing to a group or team	Collective address	Dear Team, / Hi All, / Dear Colleagues,
Unsure of recipient's gender	Full name, no title	Dear Alex Morgan,

2.2.3 Why Proper Email Addressing Matters

- **Professionalism:** A correctly addressed email demonstrates attention to detail, cultural awareness, and respect for the recipient.
- **Clarity:** The recipient immediately knows the email is directed to them specifically.
- **Tone Setting:** The salutation establishes the formality level of the entire communication.
- **Privacy:** Using Bcc for group emails protects recipients' privacy by hiding others' addresses.

2.3 E-Mail Basic Commands

Whether using Gmail, Microsoft Outlook, Yahoo Mail, or any other email platform, the fundamental commands and actions are consistent. Mastering these commands enables efficient email management for both academic and professional communication.

2.3.1 Core Email Action Commands

Command	Function	Keyboard Shortcut
Compose / New	Opens a blank message window to write a fresh email	Gmail: C | Outlook: Ctrl+N
Reply	Sends a response only to the original sender	Gmail: R | Outlook: Ctrl+R
Reply All	Sends a response to sender and all Cc/To recipients	Gmail: A | Outlook: Ctrl+Shift+R
Forward	Sends the received email to a new recipient	Gmail: F | Outlook: Ctrl+F
Send	Delivers the composed email to all specified recipients	Ctrl+Enter (Windows) | Cmd+Enter (Mac)
Delete	Moves selected email to Trash / Deleted Items	Delete key | Gmail: #
Archive	Removes from inbox and stores; email is not deleted	Gmail: E | Outlook: Backspace
Mark as Read/Unread	Toggles read/unread status	Gmail: Shift+I / Shift+U
Search	Searches inbox and all folders by keyword, sender, date	Gmail: / | Outlook: Ctrl+E
Print	Prints the selected email	Ctrl+P (Windows) | Cmd+P (Mac)
Spam/Junk	Marks email as spam; trains the spam filter	Gmail: ! | Outlook: Right-click → Junk
Snooze	Hides email temporarily; resurfaces it at a specified time	Gmail: B
Save as Draft	Saves an unfinished email for completion later	Gmail: automatically saves | Outlook: Ctrl+S

2.3.2 Email Address Fields

- **To:** Primary recipient(s). Enter one or more email addresses. This is the main audience for your message.
- **Cc (Carbon Copy):** Secondary recipients who should be aware of the email but are not the primary audience. All recipients can see who is in the Cc field.
- **Bcc (Blind Carbon Copy):** Recipients who receive the email without their address being visible to any other recipient. Use for privacy when emailing large groups.
- **Subject:** A brief, descriptive summary of the email's purpose. A good subject line helps recipients prioritize and search for emails later.
- **Reply-To:** Specifies a different address for replies — useful when sending on behalf of a department or organization.

2.3.3 Formatting Commands

Format Option	Purpose	Usage Guideline
Bold (Ctrl+B)	Emphasize important words, deadlines, or action items	Use sparingly — over-bolding reduces impact
Italic (Ctrl+I)	Reference titles, technical terms, or mild emphasis	Appropriate for book titles, software names
Underline (Ctrl+U)	Emphasize important items (use very sparingly)	Prefer bold over underline in body text
Bullet Points	List multiple items clearly without running text	Keep each point concise; parallel structure
Numbered Lists	Show steps, ranked items, or sequential instructions	Use when order matters
Hyperlinks	Embed a URL as clickable text instead of showing raw URL	Right-click text → Insert Link in most clients
Font Size	Adjust text size for readability	Standard: 11–12pt; headers: 14–16pt
Font Colour	Highlight key information	Use sparingly; only 1–2 colours per email

2.3.4 Common Email Etiquette Rules

- Use clear, specific subject lines — avoid vague subjects like 'Hi' or 'Urgent.'
- Begin with an appropriate salutation and end with a courteous sign-off (Regards, Best wishes, Thank you).
- Keep emails concise — one main topic per email; use bullet points for multiple items.
- Avoid writing in ALL CAPITALS — it is perceived as shouting.

- Proofread before sending — check spelling, grammar, and the accuracy of attached files.
- Do not use Reply All unnecessarily — only when all recipients need your response.
- Respond within 24–48 hours for professional emails.

2.4 Sending and Receiving Files by Email

Sending and receiving file attachments is one of the most frequently used features of email. The ability to transfer documents, images, spreadsheets, and other files digitally has transformed how information is shared in academic and professional settings.

2.4.1 How to Send Files by Email (Step by Step)

27. Open your email client (Gmail, Outlook, Yahoo) and click Compose / New Email.
28. Enter the recipient's address in the To field. Add Cc/Bcc recipients if needed.
29. Write a clear subject line indicating the file's purpose (e.g., 'Assignment Submission — Unit 2 Report').
30. In the email body, briefly explain what the attachment is and any important context.
31. Click the paperclip icon (Attach File) or use the attachment button.
32. Browse your device's storage, select the file(s), and click Open or Insert.
33. Wait for the file to upload. A progress indicator will appear.
34. Verify the correct file is attached before sending.
35. Click Send.

2.4.2 Email Attachment Size Limits

Email Service	Max Attachment Size	Workaround for Larger Files
Gmail (Google)	25 MB per email	Upload to Google Drive and share the link
Outlook (Microsoft)	20 MB per email	Upload to OneDrive and share the link
Yahoo Mail	25 MB per email	Use Yahoo's built-in Dropbox integration
Corporate Email (Exchange)	10–50 MB (varies)	Use SharePoint, Teams, or network file server

File Size Warning

If an email attachment exceeds the size limit, the message will either bounce (fail to send) or the recipient will not be able to download it. Always compress large files (ZIP) or use a cloud sharing link for files over 10 MB. This avoids bounced emails and reduces storage usage.

2.4.3 Best Practices for Sending Files

- **Use descriptive file names:** Rename files before attaching. Example: 'StudentReport_Unit2_2026.pdf' instead of 'document1.pdf'.
- **Compress multiple files:** Bundle related files into a ZIP archive to simplify organization and reduce total size.
- **Choose the right format:** Send documents as PDF rather than DOCX when the recipient does not need to edit them — PDFs are universally readable and preserve formatting.
- **Use cloud links for large files:** Share a Google Drive, OneDrive, or Dropbox link instead of attaching files over 10 MB.
- **Scan for viruses:** Before sending files received from external sources, scan them with antivirus software.

2.4.4 How to Receive Files by Email

36. Open the email containing the attachment.
37. Identify the attachment — usually displayed as a paperclip icon or at the bottom of the email.
38. Click the attachment to preview it in the browser (for common formats like PDF and DOCX).
39. To save the file, click the Download button (usually a downward arrow icon).
40. Choose a destination folder on your device and confirm.
41. Scan the downloaded file with antivirus software if the sender is unknown or unexpected.

2.4.5 Troubleshooting Attachment Issues

Problem	Possible Cause	Solution
Cannot attach file	File size exceeds limit	Compress the file or use a cloud link
File not downloading	Browser blocking downloads; slow connection	Check browser download settings; retry on stable connection
Cannot open attachment	Required software not installed	Install the appropriate application (e.g., Adobe Reader for PDF)
Attachment sent but not received	Recipient's spam filter blocked it	Ask recipient to check spam folder; resend from a different email
File corrupted after download	Interrupted download or transfer error	Re-download; ask sender to resend

2.5 Controlling E-Mail Volume

As email becomes the primary communication channel for organizations and individuals, inbox overload has become a significant productivity challenge. Unmanaged inboxes lead to missed important messages, increased stress, and wasted time. This section presents systematic strategies to take control of email volume.

2.5.1 Email Filters and Folders

Most email clients allow automated sorting of incoming mail using user-defined rules:

- Gmail: Settings → See all settings → Filters and Blocked Addresses → Create a new filter.
- Outlook: Home → Rules → Manage Rules & Alerts → New Rule.
- Common filter actions: Move to folder, Apply label, Mark as read, Delete, Star/Flag, Forward.
- Create folders (or labels in Gmail) for categories: Work, University, Personal, Newsletters, Bills, Projects.

2.5.2 Priority and Focused Inbox

Modern email platforms automatically distinguish important email from lower-priority messages:

- **Gmail Priority Inbox:** Categorizes emails into Primary (personal messages and emails from known contacts), Social (notifications from social networks), and Promotions (marketing emails). Enables focused attention on what matters.
- **Outlook Focused Inbox:** Separates emails into Focused (likely important) and Other (newsletters, promotions, automated emails) tabs.

2.5.3 Comprehensive Volume Control Strategies

Strategy	How to Implement	Expected Benefit
Unsubscribe from mailing lists	Click 'Unsubscribe' at bottom of promotional emails; use Unroll.Me for bulk unsubscribing	Reduces daily incoming email volume by 20–50%
Schedule email checking times	Check email at fixed times (e.g., 9 AM, 1 PM, 5 PM) rather than continuously	Reduces interruptions; improves focus
Use canned responses / templates	Gmail: Settings → Advanced → Templates; Outlook: Quick Parts	Reduces time spent writing repetitive replies

Strategy	How to Implement	Expected Benefit
Snooze non-urgent emails	Gmail: Snooze (clock icon); Outlook: Right-click → Snooze	Cleans inbox while ensuring nothing is forgotten
Archive don't delete	Archive processed emails for future search; delete only obvious junk	Maintains organized, searchable email history
Use shared inboxes for teams	Assign team mailboxes (e.g., support@, info@) rather than forwarding to individuals	Reduces personal email load; improves team accountability
Disable non-essential notifications	Turn off email notifications from LinkedIn, Facebook, Instagram, and app services	Significantly reduces marketing/notification email volume
Delegate email for specific categories	Assign certain categories to team members or assistants	Distributes email workload across the team

2.5.4 Email Management Tools

Tool	Platform	Function
Clean Email	Web, iOS, Android	Automates inbox cleanup; bulk unsubscribing; auto-filtering
Boomerang	Gmail, Outlook	Schedules email sending; sets follow-up reminders; snooze
SaneBox	Gmail, Outlook, others	AI filters low-priority emails into separate folders automatically
Unroll.Me	Gmail, Yahoo, Outlook	Lists and manages all mailing list subscriptions in one view
Spark	iOS, Android, macOS	Smart inbox with team collaboration features for email

2.6 Sending and Receiving Secure E-Mail

Email was originally designed without security as a primary concern — basic SMTP transmits messages as plain text. As email became critical for transmitting sensitive information (medical records, legal contracts, financial data), encryption and authentication mechanisms became essential components of any serious email implementation.

2.6.1 Why Email Security Matters

Security Principle	Definition in Email Context
Confidentiality	Only the intended recipient can read the message content.
Integrity	The message has not been modified in transit.
Authentication	The email genuinely originates from the claimed sender.
Non-repudiation	The sender cannot deny having sent the message.

2.6.2 Methods of Email Encryption

TLS (Transport Layer Security)

TLS encrypts the communication channel between mail servers (SMTP-over-TLS) and between the email client and the mail server (IMAP/POP3 over TLS). Most reputable email providers (Gmail, Outlook) use TLS by default. TLS protects the message in transit but not in storage on the server — it is transport encryption, not end-to-end encryption.

S/MIME (Secure/Multipurpose Internet Mail Extensions)

S/MIME provides end-to-end encryption using public key cryptography. The sender encrypts the message with the recipient's public key; only the recipient can decrypt it with their private key. S/MIME also provides digital signatures to authenticate the sender. Supported by Outlook, Apple Mail, and Gmail (Enterprise/Workspace). Requires both parties to exchange digital certificates first.

PGP / GPG (Pretty Good Privacy / GNU Privacy Guard)

PGP is a widely used open standard for end-to-end email encryption. The sender and recipient each generate a public/private key pair. The sender encrypts the message with the recipient's public key. Only the recipient's private key can decrypt it. Requires setup of tools such as Gpg4win (Windows) or GPGTools (macOS) and exchange of public keys between parties.

Secure Email Services

Service	Key Features	Best For
ProtonMail	End-to-end encryption by default; zero-knowledge architecture; no IP tracking	Privacy-conscious users; journalists; activists
Tutanota	Encrypted email, contacts, and calendar; open-source	Personal and business secure communication
Zoho Mail	Business email with encryption, GDPR compliance, and data residency options	Small to medium businesses
Hushmail	Easy-to-use encrypted email; suitable for healthcare and legal sectors	Healthcare providers; legal professionals
Gmail Confidential Mode	Restricts forwarding, copying, printing; sets expiration date; optional SMS passcode	Basic protection for general Gmail users

2.6.3 Recognizing and Avoiding Phishing Attacks

Phishing is the most common email-based attack. Fraudsters send emails that appear to come from trusted organizations (banks, government agencies, universities) to trick recipients into revealing passwords, credit card numbers, or other sensitive information.

Phishing Warning Sign	What to Look For
Urgent or threatening language	'Your account will be suspended in 24 hours unless you click here'
Suspicious sender address	support@paypa1.com instead of support@paypal.com (1 instead of l)
Generic salutation	'Dear Customer' instead of your actual name
Hovering over links shows wrong URL	Link text says 'Verify Account' but URL points to a completely different domain
Unexpected attachments	ZIP files or Office documents with macros from unknown or unexpected senders
Grammar and spelling errors	Poorly written text, unusual phrasing, inconsistent formatting

2.6.4 Additional Email Security Best Practices

- **Enable Two-Factor Authentication (2FA):** Requires a second verification step (SMS code, authenticator app) to access your email account. Prevents unauthorized access even if your password is compromised.
- **Use Strong, Unique Passwords:** Your email password should be at least 12 characters with uppercase, lowercase, digits, and symbols. Never reuse passwords across different services.
- **Keep Email Software Updated:** Update your email client, operating system, and browser regularly to patch security vulnerabilities.
- **Avoid Public Wi-Fi for Sensitive Email:** If you must use public Wi-Fi (airports, cafes), use a VPN to encrypt your entire internet connection.
- **Regularly Review Account Activity:** Most email services show recent login history. Review it periodically for unfamiliar devices or locations.

UNIT — 3

INTERNET SERVICES

3.1 Online Chatting and Conferencing Concepts

Online chatting and conferencing are fundamental Internet services that enable real-time communication across geographical boundaries. These technologies have transformed how individuals, teams, and organizations collaborate, replacing many functions previously handled by telephone, in-person meetings, and postal mail.

3.1.1 Online Chatting — Core Concepts

Online chatting (also called instant messaging or IM) refers to real-time, text-based communication between two or more users over the Internet. Modern chat platforms have expanded far beyond simple text to include multimedia messages, voice notes, file sharing, and video clips.

Feature	Description
One-to-One Chat	Private conversation between exactly two users.
Group Chat	Conversation involving multiple participants in a shared channel or room.
Media Sharing	Exchange of files, images, audio messages, and video clips within the chat.
Emojis and Reactions	Express emotions visually; react to specific messages with symbols.
Presence Indicators	Show user status: Online, Away, Busy, Do Not Disturb, or Offline.
Typing Indicators	Real-time notification that another user is composing a reply.
Read Receipts	Confirmation that the recipient has read the message (tick marks, 'Seen' labels).
End-to-End Encryption (E2EE)	Encrypts messages so only sender and recipient can read them; even the server cannot access content.
Chat History	Messages stored on the server or device for future reference and search.
Message Threading	Replies organized under a specific original message for organized discussions.

3.1.2 Popular Online Chat Platforms

Platform	Type	Key Strengths
WhatsApp	Consumer / Social	End-to-end encryption; voice/video calls; file sharing; widely adopted globally
Telegram	Consumer / Community	Large group chats (up to 200,000 members); channels; bots; file sharing up to 2 GB
Signal	Consumer / Privacy	Maximum privacy; end-to-end encrypted; no ads; open-source
Slack	Professional / Team	Channels; threads; integrations with 2,400+ apps; widely used in software companies
Microsoft Teams	Professional / Enterprise	Integrated with Office 365; persistent chat; file collaboration; video meetings
Google Chat	Professional / Workspace	Integrated with Google Workspace; Spaces for team collaboration
Discord	Gaming / Community	Voice channels; servers; bot ecosystem; widely used by gaming and interest communities
Skype	Consumer / Business	Pioneer of video calling; text/voice/video; available across all platforms

3.1.3 Online Conferencing — Core Concepts

Online conferencing (web conferencing or video conferencing) enables real-time audio, video, and collaborative communication between participants at different locations. It is used for business meetings, academic lectures, training sessions, webinars, and personal communication.

Feature	Description
Audio and Video Streams	Live microphone and camera feeds allow face-to-face interaction.
Screen Sharing	Share your entire screen or a specific application window with all participants.
Virtual Whiteboard	Interactive drawing board for brainstorming, diagrams, and teaching.
In-Meeting Chat	Text chat panel within the conference for questions, links, and reactions.
Recording and Playback	Record the session for later review by absent participants.
Breakout Rooms	Split participants into smaller sub-groups for focused discussion.
Polls and Q&A	Engage participants with voting questions or moderated question-and-answer sessions.
Host/Moderator Controls	Mute participants, remove disruptive users, manage permissions, lock meetings.

Feature	Description
Waiting Room	Hold participants in a virtual lobby before the host admits them to the meeting.
Virtual Backgrounds	Replace real background with a digital image for privacy or professionalism.

3.1.4 Online Chatting vs. Online Conferencing

Dimension	Online Chatting	Online Conferencing
Primary mode	Text-based (with optional media)	Audio and video (with optional text chat)
Real-time requirement	Optional — asynchronous replies acceptable	High — synchronous interaction required
Typical group size	2 to thousands	2 to hundreds (meetings), thousands (webinars)
Bandwidth requirement	Very low	Moderate to high (depends on video quality)
Use cases	Quick updates, informal discussion, file sharing	Formal meetings, presentations, training, consultations
Key platforms	WhatsApp, Slack, Telegram, Teams Chat	Zoom, Google Meet, Teams, Webex

3.1.5 Popular Video Conferencing Platforms

Platform	Key Features	Best For
Zoom	Virtual backgrounds; breakout rooms; webinars; up to 1000 participants; cloud recording	Business meetings, education, webinars
Microsoft Teams	Office 365 integration; persistent chat; document co-editing in meetings	Enterprise organizations using Microsoft 365
Google Meet	Browser-based; real-time captions; Google Workspace integration; simple UI	Quick meetings, educational institutions
Cisco Webex	Enterprise-grade security; HD video; smart meeting features; hardware integration	Corporations; government; large enterprise
Skype	Free for personal use; video/voice calls; file sharing; screen sharing	Personal use; small teams; freelancers

Platform	Key Features	Best For
Jitsi Meet	Open-source; no account required; browser-based; free	Privacy-focused users; educational use

3.1.6 Security in Online Communication

Risk	Protection Measure
Unauthorized access to meetings	Password-protect all meetings; use Waiting Room feature; avoid posting meeting links publicly
'Zoom-bombing' (uninvited intrusion)	Lock meeting after all expected participants have joined; disable participant screen sharing
Eavesdropping on video calls	Use platforms with end-to-end encryption (Zoom E2EE, Teams); avoid unsecured public Wi-Fi
Phishing links in chat	Never click unverified links in chat messages; verify URL before clicking
Unauthorized recording	Enable recording notifications; know your jurisdiction's recording consent laws

3.1.7 Emerging Trends in Online Communication

- **AI Integration:** Real-time transcription, AI-generated meeting summaries, language translation, noise cancellation, and virtual assistants are becoming standard features of conferencing platforms.
- **Hybrid Meetings:** Combining in-person and remote participants using specialized hardware (large screens, spatial audio, smart cameras) for equitable meeting experiences.
- **Augmented Reality (AR) and Virtual Reality (VR):** Immersive virtual meeting environments using VR headsets (e.g., Meta Horizon Workrooms); AR overlays for real-time information during calls.
- **Asynchronous Video:** Tools like Loom allow recording short video messages that recipients watch at their convenience — bridging the gap between email and live video.

3.2 E-Mail Mailing Lists

An email mailing list is a system that allows a single email to be automatically delivered to multiple recipients who have subscribed to the list. Mailing lists are used to distribute newsletters, announcements, academic resources, product updates, and facilitate group discussions — from small organizational teams to global communities of thousands.

3.2.1 Types of Mailing Lists

Type	Communication Direction	Typical Use
Announcement List	One-way: from list administrator to subscribers	Newsletters, company updates, product releases, university circulars
Discussion List	Two-way: all subscribers can send messages to all others	Academic forums, professional communities, open-source project teams
Moderated List	Submissions reviewed by moderator before distribution	Controlled discussions; prevent spam; maintain quality
Unmoderated List	Messages posted directly without review	High-traffic open discussions; tech communities

3.2.2 How Mailing Lists Work

A mailing list has a single address (e.g., newsletter@department.edu). When a subscriber sends an email to this address, the mailing list software (Mailman, Google Groups, Mailchimp) automatically forwards it to every current subscriber. Administrative commands (subscribe, unsubscribe, digest) are typically sent to a separate administrative address (e.g., newsletter-request@department.edu).

3.2.3 Creating a Mailing List — Common Platforms

Using Gmail / Google Contacts for Small Groups

42. Open Google Contacts (contacts.google.com).
43. Click Labels (left sidebar) → Create label → Enter a group name.
44. Add contacts to the label by selecting them.
45. In Gmail, type the label name in the To field to address the entire group.

Using Google Groups for Organizational Lists

46. Visit groups.google.com and sign in with a Google / Workspace account.
47. Click 'Create Group' and configure the group name, email address, and privacy settings.
48. Set membership settings (by invitation, approval, or open joining).
49. Choose group type: Email List, Web Forum, Q&A Forum, or Collaborative Inbox.
50. Invite or add members by email address.

Using Mailchimp for Professional/Marketing Lists

51. Create a free Mailchimp account at mailchimp.com.

52. Create an Audience (mailing list) and configure audience details.
53. Import existing contacts or add a signup form to your website.
54. Create a campaign (newsletter), design the content using the visual editor.
55. Schedule or send the campaign; track opens, clicks, and bounces via analytics.

3.2.4 Popular Mailing List Platforms

Platform	Best For	Key Features
Google Groups	Academic and organizational discussion lists	Free; discussion threads; file sharing; Google Workspace integration
Mailchimp	Marketing newsletters and business communications	Visual email designer; automation; analytics; free up to 500 contacts
Constant Contact	Small business marketing	Pre-designed templates; event management; contact management
SendGrid	High-volume transactional and marketing email	API access; high deliverability; scalable
GNU Mailman	Self-hosted open-source mailing list	Free; full control; widely used by open-source projects and universities
phpList	Self-hosted open-source newsletter	Open-source; CSV import; bounce management

3.2.5 Legal and Ethical Requirements for Mailing Lists

Regulation	Jurisdiction	Key Requirements
CAN-SPAM Act	United States	Clear sender identification; functional unsubscribe link; honor unsubscribes within 10 days
GDPR	European Union	Explicit opt-in consent required; right to erasure; transparent data use disclosure
CASL	Canada	Express or implied consent required; clear unsubscribe mechanism
India IT Act / Data Protection	India	Personal data protection; user consent; data security obligations

Best Practices Summary

Always use double opt-in (confirm subscription by verifying email). Include a clear, working unsubscribe link in every email. Never purchase or rent email lists. Regularly clean your list by removing invalid, bounced, or unengaged addresses. Only send content relevant to what subscribers signed up for.

3.3 Usenet Newsgroup Concepts

Usenet (Unix User Network) is one of the oldest large-scale computer communication systems predating the World Wide Web. Established in 1979 at Duke University by Tom Truscott and Jim Ellis, Usenet operates as a globally distributed discussion network consisting of thousands of themed groups called newsgroups. It remains an important part of Internet history and is still actively used by technical and niche communities.

3.3.1 What Is Usenet?

Usenet is a distributed network of news servers located worldwide. Users post text messages (called articles or posts) organized into topical discussion categories called newsgroups. Unlike centralized platforms, no single organization controls Usenet. Messages are replicated ('propagated') across all servers in the network, ensuring no single point of failure.

Attribute	Details
Founded	1979 — Duke University; Tom Truscott and Jim Ellis
Protocol	NNTP (Network News Transfer Protocol)
Architecture	Distributed / Decentralized — no central server
Content types	Plain text articles; binary files (encoded as text using yEnc or UUEncode)
Access tools	Newsreader software (Thunderbird, Pan, Forte Agent)
Current status	Declining in general use; still active in technical and niche communities

3.3.2 Structure of Usenet — Newsgroup Hierarchy

Newsgroups are organized using a hierarchical dot-separated naming convention, with the first component indicating the top-level hierarchy:

Hierarchy	Topics Covered	Example Groups
comp.*	Computers, programming, hardware, operating systems	comp.lang.python, comp.security.unix
sci.*	Scientific research and discussions across disciplines	sci.physics, sci.bio.evolution
rec.*	Recreation, hobbies, arts, sports, entertainment	rec.music.classical, rec.sport.cricket
soc.*	Social issues, culture, relationships, society	soc.culture.india, soc.women.issues

Hierarchy	Topics Covered	Example Groups
talk.*	Debates and political/social discussions	talk.politics.misc, talk.religion
misc.*	Topics that don't fit other hierarchies	misc.jobs.offered, misc.education
news.*	Meta-discussions about Usenet itself	news.admin.announcements
humanities.*	Arts, history, philosophy, literature	humanities.classics, humanities.philosophy
alt.*	Alternative, unmoderated, often controversial topics	alt.software.freeware, alt.language.urdu

3.3.3 Key Features of Usenet

- **Decentralized Architecture:** Messages are propagated across multiple servers worldwide. No single organization controls all content or can shut it down.
- **Threaded Discussions:** Posts and replies are organized into visible threads, making it easy to follow conversations chronologically.
- **Binary Newsgroups:** Specially designated 'alt.binaries.*' groups allow sharing of encoded binary files such as images, software, and documents.
- **Retention Period:** Each server stores articles for a defined period (retention period). Text groups may retain articles for years; binary groups typically have shorter retention (weeks to months).
- **Anonymity:** Users can post under pseudonyms; however, IP addresses may still be logged by servers and providers.

3.3.4 Usenet vs. Modern Platforms

Feature	Usenet	Modern Web Forums (Reddit, Quora)	Social Media Groups
Architecture	Distributed/Decentralized	Centralized	Centralized
Censorship resistance	High	Low–Medium	Low
User interface	Newsreader software required	Web browser; mobile app	Web browser; mobile app
Anonymous posting	Possible	Limited	Limited
File sharing	Binary groups (encoded)	Cloud links; uploads	Direct uploads
Current popularity	Niche / Technical	High	Very High

3.4 Reading Usenet Newsgroups

Accessing Usenet newsgroups requires a Usenet server account and a newsreader application. While some ISPs historically provided free Usenet access, most users today subscribe to a dedicated Usenet provider. This section explains the step-by-step process of setting up and using Usenet.

3.4.1 What You Need

Requirement	Description	Examples
Usenet Provider	A company that operates Usenet servers and provides subscriber access	Giganews, Newshosting, Easynews, UsenetServer; Eternal September (free, text-only)
Newsreader Software	Client application for browsing, reading, and posting to newsgroups	Thunderbird (cross-platform), Pan (Linux), Forte Agent (Windows), NZBGet (binary)
Server Address	Hostname provided by your Usenet provider to connect the newsreader	news.newshosting.com, news.giganews.com
Authentication	Username and password for your Usenet provider account	Provided when you subscribe

3.4.2 Step-by-Step: Setting Up Newsreader Access

Step 1 — Choose and Subscribe to a Usenet Provider

56. Research and select a Usenet provider based on retention period (how long articles are kept), download speed, and price.
57. Subscribe and receive server hostname, port numbers, and login credentials.

Step 2 — Install and Configure a Newsreader

58. Download and install a newsreader (e.g., Thunderbird for cross-platform use).
59. In Thunderbird: Account Settings → Account Actions → Add Other Account → Newsgroup Account.
60. Enter your name and email address.
61. Enter the Usenet server hostname provided by your subscription.
62. Set the port: 119 (plain) or 563 (SSL-encrypted — recommended).
63. Enter your Usenet username and password.

Step 3 — Download the Newsgroup List

64. Connect to the server and download the full list of available newsgroups (this can take several minutes — there are millions of groups).
65. Use the search function in your newsreader to filter groups by topic keyword.

Step 4 — Subscribe to and Read Newsgroups

66. Select newsgroups of interest and subscribe (marks them for regular checking).
67. Download article headers from subscribed groups.
68. Read articles that interest you; view them organized by thread.
69. Reply to articles or post new articles using the newsreader's compose function.

3.4.3 Usenet Netiquette (Network Etiquette)

Netiquette refers to the conventions of polite and appropriate behavior when posting to Usenet newsgroups:

- Post only to newsgroups relevant to your message topic.
- Keep articles concise and relevant; avoid unnecessarily long posts.
- When replying, quote only the specific portions of the original message you are responding to.
- Do not flood a newsgroup with multiple posts on the same topic.
- Use plain text for posts; excessive HTML formatting is unwelcome in most newsgroups.
- Do not post commercial advertisements in non-commercial groups.
- Read the FAQ (Frequently Asked Questions) document for a newsgroup before participating.

3.4.4 Google Groups — Simplified Web-Based Usenet Access

Google Groups provides a simplified web interface to access some Usenet content without installing a newsreader. Users can browse and post to newsgroups directly in a web browser. However, Google Groups does not support binary newsgroups and does not provide access to all newsgroup hierarchies. For full Usenet access, a dedicated newsreader and provider remain necessary.

3.5 Video Conferencing

Video conferencing is a real-time Internet service that enables two or more participants at different locations to communicate simultaneously using audio, video, and collaborative tools. The technology has evolved from expensive room-based systems in the 1990s to low-cost or free applications accessible from any smartphone or laptop. The COVID-19 pandemic (2020-2021) dramatically accelerated adoption, permanently transforming how organizations conduct meetings, training, and consultations.

3.5.1 Key Features of Video Conferencing Systems

Feature	Description
Audio and Video	Live microphone and camera feeds for real-time face-to-face interaction. HD (720p/1080p) and 4K video supported by leading platforms.
Screen Sharing	Share entire screen, application window, or browser tab with all participants for presentations and demonstrations.
Text Chat	In-meeting chat panel for sharing links, notes, questions, or reactions without interrupting speakers.
File Sharing	Upload and share documents, images, or files directly within the meeting.
Recording	Record the entire session (video, audio, and screen share) to cloud or local storage for absent participants.
Virtual Backgrounds	Replace or blur the real physical background for privacy or professional appearance.
Breakout Rooms	Sub-divide participants into smaller rooms for group work; host can broadcast to all rooms simultaneously.
Polls and Reactions	Live polls, emoji reactions, and virtual hand-raising for audience engagement.
Waiting Room	Virtual lobby where participants wait until the host admits them — prevents unauthorized entry.
AI Transcription	Real-time or post-meeting transcription of spoken words into text for accessibility and documentation.

3.5.2 Requirements for Video Conferencing

Requirement	Minimum Specification	Recommended Specification
Internet Connection	1 Mbps download / 0.5 Mbps upload for 480p video	10 Mbps+ download / 5 Mbps+ upload for HD multi-participant
Camera	720p USB webcam or built-in laptop camera	1080p HD webcam or integrated system camera
Microphone	Built-in laptop microphone	USB headset or dedicated microphone for noise cancellation
Speaker / Headphones	Built-in speakers	Headphones to prevent audio feedback/echo
Device	Any smartphone, tablet, or computer	Laptop or desktop with dedicated GPU for smooth rendering
Software	Free tier of any major platform	Paid subscription for advanced features (recording, large groups)

3.5.3 Popular Video Conferencing Platforms — Detailed Comparison

Platform	Developer	Max Free Participants	Max Meeting Duration (Free)	Key Features
Zoom	Zoom Video Comm.	100	40 minutes	Breakout rooms; virtual backgrounds; webinar mode; cloud recording
Google Meet	Google	100	60 minutes	Integrated with Google Calendar; real-time captions; noise cancellation
Microsoft Teams	Microsoft	100	60 minutes	Office 365 integration; Teams channels; file co-editing during meetings
Cisco Webex	Cisco	100	40 minutes	Enterprise security; hardware room systems; AI transcription
Skype	Microsoft	50	No limit	Free audio/video; IM; screen sharing; file sharing
Jitsi Meet	8x8 (open-source)	Unlimited	No limit	No account required; fully open-source; browser-based

3.5.4 Video Conferencing Etiquette

Etiquette Rule	Explanation
Join on time	Log in a few minutes early to test audio/video and avoid disrupting an in-progress meeting.
Mute when not speaking	Background noise from your environment is distracting; unmute only when speaking.
Use an appropriate background	Ensure your background is professional or use a virtual background; avoid messy spaces.
Dress appropriately	Dress as you would for an in-person meeting, especially for formal or client-facing sessions.
Maintain eye contact with the camera	Look at the webcam lens (not the screen) when speaking — this mimics natural eye contact.
Stay engaged	Avoid multitasking; close unrelated tabs; focus on the discussion.
Do not record without consent	Always inform participants and obtain consent before recording a meeting.
Use the chat for questions	Avoid interrupting speakers; type questions in the chat for the host to address at appropriate points.

3.5.5 The Future of Video Conferencing

- **AI-Powered Features:** Real-time translation, automatic meeting summaries, smart noise cancellation, and AI participants are becoming standard features.

- **VR/AR Integration:** Platforms like Meta Horizon Workrooms and Microsoft Mesh use VR and AR for immersive 3D meeting environments where participants appear as avatars in shared virtual spaces.
- **Improved Accessibility:** Real-time captions and sign language interpretation AI are making conferencing more inclusive.
- **Holographic Telepresence:** Early-stage technology projects are working toward photorealistic holographic displays that make remote participants appear physically present in the room.

UNIT — 4

WEB CONCEPTS AND BROWSERS

4.1 World Wide Web (WWW) Concepts

The World Wide Web is a global information space where documents and resources are interlinked through hyperlinks and accessible via the Internet using web browsers. It was invented by Sir Tim Berners-Lee in 1989 while working as a researcher at CERN (European Organization for Nuclear Research) in Switzerland. The Web became publicly accessible in August 1991 and has since grown into the world's primary platform for information sharing, commerce, communication, and entertainment.

Step	Client Action	Server Action
1. Request	Browser sends HTTP GET request for www.example.com/index.html	Web server receives request on port 80 or 443
2. Processing	Browser waits for response	Server looks up or generates the requested resource
3. Response	Browser receives HTML, CSS, JS, and image files	Server sends HTTP response with status code 200 OK and the content
4. Rendering	Browser parses HTML, applies CSS, executes JavaScript, displays page	Server closes connection (HTTP/1.1) or keeps it alive (HTTP/2)

Important Distinction

The World Wide Web and the Internet are NOT the same. The Internet is the underlying network infrastructure (hardware + protocols). The World Wide Web is one service that runs on top of the Internet, consisting of websites and webpages accessible via HTTP/HTTPS.

4.1.1 Key Components of the World Wide Web

Component	Description
Websites	A collection of related webpages hosted on a web server, identified by a common domain name (e.g., www.msuniv.ac.in).
Webpages	Individual documents on the Web, written in HTML, styled with CSS, and made interactive using JavaScript.
Hyperlinks	Clickable text or image elements that link one webpage to another — the defining feature that makes the Web a 'web'.
Web Browsers	Software applications (Chrome, Firefox, Edge, Safari) used to access, render, and navigate webpages.

Component	Description
Web Servers	Computers that host websites and respond to browser requests by delivering webpages and resources.
URLs (Uniform Resource Locators)	Unique addresses that identify and locate specific resources on the Web.
HTTP/HTTPS	The protocols governing how data is transmitted between browsers and web servers.
HTML	HyperText Markup Language — the standard language for creating and structuring webpage content.
CSS	Cascading Style Sheets — controls the visual presentation of webpages (layout, colors, fonts).
JavaScript	Programming language that adds interactivity and dynamic behaviour to webpages.

4.1.2 How the World Wide Web Works

70. A user types a URL into a web browser or clicks a hyperlink.
71. The browser extracts the domain name from the URL and queries a DNS server to resolve it to an IP address.
72. The browser establishes a TCP connection with the web server at the resolved IP address.
73. The browser sends an HTTP/HTTPS request for the specified resource.
74. The web server processes the request and sends back the HTML, CSS, JavaScript, and media files.
75. The browser's rendering engine interprets the HTML/CSS, executes JavaScript, and displays the finished webpage to the user.

4.1.3 Evolution of the Web

Generation	Period	Characteristics	Examples
Web 1.0 (Static Web)	Early 1990s – early 2000s	Read-only static pages; no user interaction; content created only by web professionals	Early Yahoo.com, personal homepages, GeoCities
Web 2.0 (Dynamic Web)	Mid 2000s – present	User-generated content; interactive platforms; social media; AJAX for dynamic updates	Facebook, YouTube, Wikipedia, Twitter, Google Maps
Web 3.0 (Semantic Web)	Emerging since ~2010s	Machine-readable data; AI personalization; decentralization (blockchain); semantic understanding	Voice assistants, DeFi platforms, NFT marketplaces

4.1.4 Functions of the World Wide Web

Function	Description
Information Sharing	Billions of webpages covering virtually every human topic — from encyclopedias to government databases.
Communication	Email, social media, forums, blogs, and instant messaging platforms are accessed via the Web.
E-Commerce	Online stores (Amazon, Flipkart) enable buying and selling without physical retail locations.
Education	MOOCs, academic databases, e-libraries, and educational videos make learning accessible worldwide.
Entertainment	Streaming video (Netflix, YouTube), music (Spotify), gaming platforms, and social media.
Collaboration	Document co-editing (Google Docs), project management tools (Trello, Jira), cloud storage.

4.1.5 Advantages and Challenges of the Web

Advantages	Challenges
Universal access to information	Misinformation and disinformation spread rapidly
Global connectivity — reach billions	Security threats — phishing, malware, data breaches
Free or low-cost access to knowledge	Digital divide — unequal access by income/geography
Enables remote work and education	Information overload — difficult to evaluate source quality
Platform for innovation and entrepreneurship	Privacy erosion — user data collected, tracked, and sold

4.2 Elements of the Web

The World Wide Web is built on a collection of interdependent technologies that work together to deliver webpages to users. Understanding these elements is foundational for any student of Computer Science or Information Technology.

4.2.1 Front-End Technologies

HTML — HyperText Markup Language

HTML is the standard language for creating the structure and content of webpages. It uses 'tags' enclosed in angle brackets to mark up text, images, links, forms, and other elements. HTML5 is the current standard.

Common HTML Tag	Purpose
<html>	Root element; contains the entire HTML document
<head>	Container for metadata, title, and linked files (CSS, JS)
<body>	Contains all visible page content
<h1> – <h6>	Heading elements (h1 = largest/most important)
<p>	Paragraph of text
<a href='...'>	Hyperlink to another page or resource
<img src='...'>	Embeds an image
<table>	Creates a data table
<form>	Creates a user input form
	Generic container for grouping and styling content

CSS — Cascading Style Sheets

CSS controls the visual presentation of HTML documents — colors, fonts, layout, spacing, animations, and responsive design. By separating presentation from content, CSS enables the same HTML to be displayed differently on desktop, tablet, and mobile screens through media queries.

JavaScript

JavaScript is a client-side scripting language that runs in the browser to add interactivity and dynamic behavior to webpages. Examples include form validation, dropdown menus, image carousels, real-time search suggestions, and single-page application navigation.

4.2.2 Back-End Technologies

Technology	Role
Web Server Software	Receives HTTP requests and delivers responses. Examples: Apache, Nginx, Microsoft IIS.
Server-Side Languages	Process logic, access databases, generate dynamic HTML. Examples: PHP, Python (Django/Flask), Node.js, Ruby on Rails, Java (Spring).
Databases	Store and retrieve structured data. Examples: MySQL, PostgreSQL (relational); MongoDB (document-oriented).
APIs (Application Programming Interfaces)	Allow applications to communicate and share data. Examples: Google Maps API, payment gateways (Razorpay, PayPal).
Web Hosting	Infrastructure service that stores websites on servers. Types: Shared, VPS, Dedicated, Cloud (AWS, Azure, GCP).

4.2.3 Other Essential Web Elements

Element	Description
Cookies	Small text files stored on the user's device to track session state, preferences, and login status.
Sessions	Server-side temporary storage of user state during a browsing session (e.g., shopping cart contents).
SSL/TLS Certificate	Cryptographic certificate that enables HTTPS. Issued by Certificate Authorities (CAs). Verifies website identity.
CDN (Content Delivery Network)	Network of geographically distributed servers that cache and deliver static assets (images, CSS, JS) quickly to users worldwide.
CMS (Content Management System)	Software allowing non-technical users to create, edit, and publish web content without coding. Examples: WordPress, Drupal, Joomla.
Responsive Design	Web design approach where layouts adapt to different screen sizes using flexible grids and CSS media queries.
PWA (Progressive Web App)	Web application that behaves like a native mobile app — offline capability, push notifications, home screen installation.
SEO (Search Engine Optimization)	Techniques to improve website visibility in search engine results pages (SERPs).

4.3 Clients and Servers

The client-server model is the fundamental architectural pattern that underpins the World Wide Web and most Internet services. It defines a clear division of responsibility: the client requests services or resources, and the server fulfills those requests.

4.3.1 The Client

A client is any device, application, or system that initiates a request for services or resources. On the Web, the client is typically a web browser running on a computer, smartphone, or tablet.

Client Characteristic	Description
Request initiation	The client always initiates the communication; servers never contact clients uninvited (except through push technologies like WebSockets).
User interaction	Clients present the user interface — browsers render HTML/CSS/JS into the visual webpage.
Dependency on server	Clients depend on servers to provide the data and services they need to function.
Lightweight processing	Modern trend: clients do more processing (JavaScript Single Page Applications) but servers handle data.

Examples of Clients: Web browsers (Chrome, Firefox, Edge, Safari), email clients (Outlook, Thunderbird), mobile apps (Instagram, Paytm), IoT devices (smart home sensors).

4.3.2 The Server

A server is a powerful computer or application that provides resources, services, or data to clients. Web servers run 24/7, listening for incoming connections on specific network ports, processing requests, and sending responses.

Type of Server	Function	Examples
Web Server	Serves webpages (HTML, CSS, images) to browsers via HTTP/HTTPS	Apache, Nginx, Microsoft IIS, LiteSpeed
Database Server	Stores, manages, and retrieves structured data for web applications	MySQL, PostgreSQL, Microsoft SQL Server, MongoDB
Mail Server	Sends, receives, and stores email messages	Microsoft Exchange, Postfix, Gmail servers
File Server	Stores and shares files for multiple users	Samba, FTP servers, Google Drive infrastructure
Application Server	Runs business logic and processes dynamic web application requests	Apache Tomcat, Node.js, JBoss, Gunicorn
DNS Server	Resolves domain names to IP addresses	BIND (Linux), Windows DNS Server, Cloudflare 1.1.1.1
Proxy Server	Acts as intermediary; improves performance (caching) and security	Squid, HAProxy, Nginx (reverse proxy)

4.3.3 How the Client-Server Interaction Works

4.3.4 Client-Server vs. Peer-to-Peer (P2P)

Feature	Client-Server Model	Peer-to-Peer (P2P) Model
Architecture	Centralized — dedicated servers serve many clients	Decentralized — each node acts as both client and server
Control	Centralized administration and management	No central authority; peers self-organize
Scalability	Scalable by upgrading or adding servers	Scales naturally as more peers join the network
Security	Centralized security controls; single point of failure	More difficult to secure; no central policy enforcement
Examples	Websites, email, online banking, streaming	BitTorrent, blockchain networks, older Skype versions

4.4 URL and Transfer Protocols (HTTP / HTTPS)

A URL (Uniform Resource Locator) is the globally unique address used to identify and access a specific resource on the World Wide Web. A Transfer Protocol defines the rules governing how data is exchanged between clients and servers. The two are inseparably linked: a URL contains the protocol identifier as its first component.

4.4.1 Anatomy of a URL

Component	Example	Description
Protocol (Scheme)	https://	Specifies how the resource will be accessed. Common values: http, https, ftp, mailto.
Subdomain	www.	Optional prefix; identifies a specific server or section within the domain (e.g., blog., api., mail.).
Domain Name	msuniv.ac.in	Unique identifier of the organization or website. Registered through domain registrars.
Top-Level Domain	.in, .com, .edu	Indicates type (commercial, academic) or country (India = .in).
Port	:443	Optional; specifies the network port. HTTP default = 80; HTTPS default = 443. Usually omitted.
Path	/academics/courses/	Identifies the specific resource or page on the server.
Query String	?id=105&semester=3	Optional; passes parameters to the server. Key=value pairs separated by '&'.
Fragment	#unit4	Optional; points to a specific section within the webpage (anchor).

Complete URL Example: https://www.msuniv.ac.in/academics?dept=CS#unit4

4.4.2 HTTP — HyperText Transfer Protocol

HTTP is the foundational protocol for data communication on the World Wide Web. It operates on a request-response model: a client sends an HTTP request to a server, and the server returns an HTTP response containing the requested resource or an error message.

HTTP Method	Purpose	Typical Use
GET	Request a resource from the server	Loading a webpage, image, or file
POST	Submit data to the server for processing	Submitting a form, uploading a file, logging in

HTTP Method	Purpose	Typical Use
PUT	Replace an entire resource on the server	Updating a user profile record
PATCH	Partially update a resource on the server	Updating only a specific field in a record
DELETE	Remove a resource from the server	Deleting a user account or record
HEAD	Request only the headers (no body)	Checking if a resource exists without downloading it

HTTP Status Code	Category	Meaning
200 OK	Success	Request succeeded; resource returned in response body
301 Moved Permanently	Redirection	Resource has permanently moved to a new URL
400 Bad Request	Client Error	The request was malformed or invalid
401 Unauthorized	Client Error	Authentication required; not authenticated
403 Forbidden	Client Error	Authenticated but not authorized to access the resource
404 Not Found	Client Error	Resource does not exist at the requested URL
500 Internal Server Error	Server Error	Server encountered an unexpected error processing the request

4.4.3 HTTPS — HTTP Secure

HTTPS is HTTP with an added layer of security provided by TLS (Transport Layer Security), formerly SSL. HTTPS encrypts all data exchanged between the browser and server, preventing eavesdropping, data tampering, and man-in-the-middle attacks.

Feature	HTTP	HTTPS
Encryption	None — data transmitted as plain text	TLS/SSL encryption — data encrypted in transit
Default Port	80	443
URL Prefix	http://	https://
Browser Indicator	No padlock; some browsers warn 'Not Secure'	Padlock icon in browser address bar
Certificate Required	No	Yes — SSL/TLS certificate from a CA (Certificate Authority)
Security Level	Vulnerable to interception and MITM attacks	Encrypted and authenticated

Feature	HTTP	HTTPS
SEO Impact	Lower ranking (Google penalizes HTTP sites)	Higher ranking (Google rewards HTTPS sites)
Appropriate For	Non-sensitive public content only	All websites handling any user data

Always Use HTTPS

Modern best practice requires all websites to use HTTPS, regardless of whether they collect sensitive data. Major browsers (Chrome, Firefox, Edge) now display a 'Not Secure' warning for HTTP sites. Free TLS certificates are available from Let's Encrypt (letsencrypt.org).

4.4.4 Other Internet Transfer Protocols

Protocol	Full Name	Primary Purpose
FTP	File Transfer Protocol	Upload and download files between clients and servers (port 21)
FTPS / SFTP	FTP Secure / SSH FTP	Encrypted file transfer — FTP over TLS, or FTP over SSH tunnel
SMTP	Simple Mail Transfer Protocol	Sending email between servers and from clients to servers
IMAP / POP3	Internet Message Access / Post Office Protocol	Retrieving email from mail servers
DNS	Domain Name System	Resolving domain names to IP addresses
WebSocket	WebSocket Protocol	Full-duplex, real-time communication channel between browser and server (e.g., live chat)

4.5 Web Browsers

A web browser is a software application that enables users to access, retrieve, and interact with content on the World Wide Web. The browser acts as an intermediary between the user and web servers — it sends requests, receives responses, and renders the result as visual, interactive content on the screen.

4.5.1 Core Functions of a Web Browser

Function	Description
Requesting Resources	Sends HTTP/HTTPS requests to web servers based on URLs entered by the user or links clicked.
Rendering Content	Interprets HTML, CSS, and JavaScript to display formatted, interactive webpages.

Function	Description
Navigation	Back, Forward, Refresh, and Home buttons for moving between pages and sessions.
Bookmarks / Favorites	Save and organize frequently visited URLs for quick return access.
History	Records all recently visited pages; enables revisiting previous sessions.
Cookie Management	Stores and manages cookies for session persistence, login state, and user preferences.
Security	HTTPS enforcement; phishing/malware warnings; sandboxing of web content.
Extensions / Add-ons	Third-party plugins that add functionality (ad blockers, password managers, developer tools).

4.5.2 Technical Architecture of a Web Browser

Component	Role	Example Technology
User Interface (UI)	Address bar, tabs, buttons, menus — the visible layer users interact with	Built natively for each OS
Rendering Engine	Parses HTML/CSS and calculates the visual layout of the page	Blink (Chrome, Edge); WebKit (Safari); Gecko (Firefox)
JavaScript Engine	Compiles and executes JavaScript code for interactivity	V8 (Chrome); SpiderMonkey (Firefox); JavaScriptCore (Safari)
Networking Layer	Handles HTTP/HTTPS requests, DNS resolution, connection management	Uses OS networking stack + custom implementation
Data Storage	Stores cookies, cache (offline page copies), localStorage, sessionStorage, IndexedDB	Browser-specific implementation
Security Sandbox	Isolates each tab/process to prevent a compromised tab from accessing others	Chrome's multi-process architecture; Firefox's Content Process

4.5.3 Major Web Browsers

Browser	Developer	Rendering Engine	Market Share (2026 est.)	Key Strengths
Google Chrome	Google	Blink	~65%	Fast; vast extension library; cross-device sync; best Web standards support
Mozilla Firefox	Mozilla	Gecko	~8%	Open-source; strong privacy; Enhanced Tracking Protection; for developers
Microsoft Edge	Microsoft	Blink (Chromium)	~11%	Built-in Windows; IE Mode for legacy sites; vertical tabs; PDF reader
Apple Safari	Apple	WebKit	~9%	Battery-efficient; macOS/iOS optimized; Intelligent Tracking Prevention
Opera	Opera Software	Blink	~3%	Built-in VPN and ad blocker; battery saver; sidebar apps
Brave	Brave Software	Blink	~3%	Privacy-first; blocks ads and trackers by default; faster page loads

4.5.4 Key Features of Modern Browsers

- **Tabbed Browsing:** Open multiple websites in separate tabs within a single window, introduced by Opera and adopted universally.
- **Private / Incognito Mode:** Browsing session that does not save history, cookies, form data, or cached files on the device. Server logs and ISP records are still maintained externally.
- **Cross-Device Sync:** Synchronize bookmarks, history, passwords, and open tabs across all devices using the same browser account (e.g., Google Account for Chrome, Microsoft Account for Edge).
- **Developer Tools (DevTools):** Built-in development environment (F12 key) for inspecting HTML/CSS, debugging JavaScript, monitoring network requests, and testing performance.
- **Extensions / Add-ons:** Thousands of third-party plugins for adblocking (uBlock Origin), password management (Bitwarden), grammar checking (Grammarly), and many other functions.
- **Reader Mode:** Strips away ads and navigation clutter, presenting only the article text for comfortable reading.

4.6 Netscape Navigator and Communicator

Netscape Navigator and its successor Netscape Communicator hold a landmark place in the history of the Internet. Developed by Netscape Communications Corporation (co-founded in 1994 by Marc Andreessen, who had also led the Mosaic browser team), these products were the first commercially successful web browsers and were instrumental in transforming the World Wide Web from an academic network into a global commercial phenomenon.

4.6.1 Netscape Navigator (1994–1997)

Netscape Navigator 1.0 was released in December 1994 and quickly captured an estimated 90% of the web browser market. Its success was unprecedented in the software industry. It introduced millions of users to the concept of the graphical World Wide Web.

Feature	Description
Graphical Interface	Rendered images inline within webpages — revolutionary for 1994 when text-only browsers were standard.
Multi-Platform	Available on Windows, macOS, Unix, and Linux from its initial release.
SSL/HTTPS Support	Introduced SSL (Secure Sockets Layer) encryption for secure online transactions — the foundation of today's HTTPS.
JavaScript	Netscape invented JavaScript (originally Mocha/LiveScript, renamed JavaScript for marketing reasons).
HTML Extensions	Introduced many HTML extensions (tables, frames, color tags) that influenced later web standards.
Bookmarks	Users could save and organize favourite website addresses for quick access.

4.6.2 Netscape Communicator (1997–1998)

Netscape Communicator 4.0 was an expanded internet suite that bundled multiple internet applications into one integrated package:

Component	Function
Netscape Navigator	Web browsing — the core browser component
Messenger	Full-featured email and newsgroup client
Composer	WYSIWYG HTML editor for creating webpages without coding
Collabra	Usenet newsgroup discussion reader and manager
Calendar	Personal scheduling and calendar management application
Conference	Real-time voice conferencing and whiteboard (early VoIP)

4.6.3 The Browser Wars and Netscape's Decline

In the mid-1990s, Microsoft recognized that the World Wide Web was strategically important and decided to compete directly with Netscape. Microsoft licensed the Spyglass Mosaic browser code and developed Internet Explorer, bundling it free with every copy of Windows 95 and later versions. This gave Internet Explorer an enormous distribution advantage — it reached 200 million Windows users automatically.

The intense competition between Netscape Navigator and Internet Explorer during 1996–2001 became known as the 'Browser Wars.' Both browsers rapidly introduced new features, sometimes breaking compatibility with web standards in the process. By 2001, Internet Explorer's market share exceeded 90%, and Netscape was effectively marginalized.

4.6.4 Netscape's Legacy — Mozilla Firefox

In January 1998, Netscape made a historic decision: it released the source code of Netscape Communicator as open source, creating the Mozilla project. This act of open-sourcing prevented Netscape's technology from simply disappearing. The Mozilla project eventually released Firefox 1.0 in November 2004, which rapidly regained significant market share and reintroduced real competition into the browser market. Google Chrome, released in 2008, was also directly influenced by the open-source Chromium/WebKit foundation that traces roots back to the Netscape/Mozilla era.

Product	Release Year	Status	Legacy
Netscape Navigator 1.0	1994	Discontinued	Invented SSL; popularized graphical web browsing
Netscape Communicator 4.x	1997	Discontinued	First integrated internet suite
Mozilla Suite	2002	Succeeded by SeaMonkey	Open-sourced foundation for modern browsers
Mozilla Firefox	2004	Active (latest version 2026)	Direct descendant of Netscape; 250+ million users

4.7 Microsoft Internet Explorer

Microsoft Internet Explorer (IE) is a discontinued web browser developed by Microsoft, first released on 16 August 1995 as part of the Windows 95 Plus! Pack. For nearly a decade (1999–2008), Internet Explorer was the world's dominant web browser with market shares exceeding 90%. Its story encompasses both enormous influence and ultimately cautionary lessons about innovation, security, and monopolistic practices.

4.7.1 History and Market Timeline

Version / Period	Year	Key Development
IE 1.0	1995	First release; based on licensed Spyglass Mosaic technology; basic browsing only.
IE 3.0	1996	CSS support; JScript (Microsoft's JavaScript); ActiveX controls.
IE 4.0	1997	Deep Windows Desktop integration; began aggressive competition with Netscape.
IE 5.x	1999	Significant standards improvements; XMLHttpRequest (AJAX foundation) introduced.
IE 6.0	2001	Bundled with Windows XP; peak market share (~90%); notorious for security flaws.
IE 7.0	2006	Tabbed browsing added; phishing filter; improved security after long neglect.
IE 8.0	2009	Better standards compliance; InPrivate Browsing (private mode) introduced.
IE 9.0	2011	Hardware-accelerated rendering; HTML5 support; cleaner design.
IE 11.0	2013	Final version; improved HTML5/CSS3 support; still widely used in enterprises.
Microsoft Edge released	2015	EdgeHTML-based successor to IE; Windows 10 default browser.
Official IE retirement	June 15, 2022	Microsoft permanently retired and disabled IE on most Windows versions.

4.7.2 Key Features of Internet Explorer

Feature	Description
Windows Integration	Deeply embedded in the Windows OS — used by Windows Explorer (file manager) to render HTML-based content.
ActiveX Controls	Microsoft-proprietary technology for embedding interactive objects in webpages; also a major source of security vulnerabilities.
Tabbed Browsing	Introduced in IE 7.0 (2006); competing browsers had already offered tabs since 2002.
SmartScreen Filter	Security feature warning users about phishing websites and malicious downloads (introduced IE 7/8).
InPrivate Browsing	Private mode where no browsing history, cookies, or form data are saved (introduced IE 8.0).
Developer Tools (F12)	Built-in tools for debugging HTML, CSS, and JavaScript; inspecting network requests.
Compatibility View	Rendered modern pages using IE7 standards for backward compatibility with legacy web applications.

4.7.3 Antitrust Issues — US v. Microsoft

Microsoft's practice of bundling Internet Explorer free with Windows while simultaneously requiring PC manufacturers to include IE as a condition of the Windows license became the subject of major antitrust litigation. In 1998, the US Department of Justice filed an antitrust lawsuit against Microsoft. In 2000, Judge Thomas Penfield Jackson ruled that Microsoft had illegally maintained its monopoly and must be broken up. This ruling was later reversed on appeal, but Microsoft entered into a consent decree in 2001 that restricted its anticompetitive practices and eventually opened the door for competing browsers to recover market share.

4.7.4 IE vs. Modern Browsers

Feature	Internet Explorer 11	Modern Browsers (Chrome/Edge/Firefox 2026)
Web Standards Support	Partial HTML5/CSS3; no ES6+ JavaScript features	Full HTML5, CSS4/Grid/Flexbox, ES2022+ JavaScript
Performance	Slow; no GPU acceleration for WebGL/Canvas	Fast; multi-threaded; GPU-accelerated rendering
Security	Frequent CVEs; ActiveX vulnerabilities	Sandboxing; automatic updates; bug bounty programs
Extensions/Add-ons	Limited BHO-based add-ons	Thousands of cross-platform WebExtensions
Developer Tools	Basic F12 tools	Advanced DevTools; performance profiling; debugger
Mobile Support	No (Windows Phone variant was discontinued)	Full iOS, Android, and desktop support
Update Frequency	Rare major updates; required Windows Update	Continuous auto-updates (6-week Chrome release cycle)

4.7.5 Legacy and Microsoft Edge

Internet Explorer's successor, Microsoft Edge, was released with Windows 10 in July 2015. The original Edge used Microsoft's own EdgeHTML rendering engine, but performance and compatibility issues led Microsoft to rebuild Edge on the open-source Chromium project in January 2020. The new Chromium-based Edge addressed virtually all of IE's technical shortcomings while maintaining backward compatibility with legacy enterprise applications through IE Mode, which renders specific configured pages using the IE 11 rendering engine within the Edge browser.

Internet Explorer's 27-year run left a profound mark on the Web. It helped bring the Internet to hundreds of millions of users, established many web technologies (XMLHttpRequest, CSS improvements), but also fragmented web development standards through proprietary extensions. Its decline and retirement stands as a reminder that even dominant technologies must continuously innovate to remain relevant.

UNIT — 5

SEARCH ENGINES

5.1 Search Engines — Concepts and Working

A search engine is a software system that enables users to find information published on the World Wide Web by entering keywords or phrases. Search engines have become the primary gateway through which most Internet users discover content — processing billions of queries daily. Google alone handles over 8.5 billion searches per day as of 2026.

5.1.1 How Search Engines Work — The Three Core Processes

1. Crawling

Search engines deploy automated programs called web crawlers (also known as spiders or bots) that continuously browse the Web, starting from known URLs and following every link they find. Crawlers download webpage content and transmit it back to the search engine's data centers. The crawler program respects a file called robots.txt on each website, which instructs which pages should not be crawled.

2. Indexing

Crawled content is processed and stored in the search engine's index — a massive database of words and their occurrences across billions of webpages. The index is essentially a reverse lookup: given a keyword, the index returns all pages containing that keyword along with contextual signals about relevance.

3. Ranking

When a user submits a query, the search engine retrieves matching pages from its index and ranks them using a complex algorithm that evaluates hundreds of factors to determine relevance and authority.

Ranking Factor Category	Examples
Content Relevance	Keyword match; semantic relevance; content freshness; comprehensiveness
Page Authority	Number and quality of inbound links (PageRank); domain authority

Ranking Factor Category	Examples
Technical SEO	Page loading speed; mobile-friendliness; Core Web Vitals scores; structured data markup
User Experience	Click-through rate; bounce rate; time on page; user satisfaction signals
Context and Personalization	User's location; search history; device type; language preference

5.1.2 Components of a Search Engine

Component	Function
User Interface	The search box, voice search button, and results presentation layer seen by users.
Query Processor	Parses the user's query; identifies intent; expands synonyms; handles misspellings.
Web Crawler	Automated program that discovers and downloads new/updated webpages continuously.
Index	Inverted database mapping words to pages; typically hundreds of petabytes in size.
Ranking Algorithm	Calculates relevance scores and orders results for each query. Google uses 200+ signals.
SERP (Search Engine Results Page)	The results page displayed to the user, containing organic results, ads, featured snippets, knowledge panels, and more.
Advertising System	Pay-per-click (PPC) advertising platform where businesses bid on keywords for paid placement.

5.1.3 Major Search Engines

Search Engine	Organization	Launched	Global Market Share	Key Feature
Google	Alphabet Inc.	1998	~92%	World's most comprehensive index; AI-powered features; voice search; Google Lens
Microsoft Bing	Microsoft	2009	~3.5%	Integrated with Windows; Microsoft 365; Rewards program; ChatGPT integration
Yahoo Search	Yahoo / Bing-powered	1994	~1.2%	Portal with news, finance, sports; now uses Bing's index for web search
DuckDuckGo	DuckDuckGo Inc.	2008	~0.7%	Privacy-first; does not track users; no filter bubble; growing rapidly
Baidu	Baidu Inc.	2000	~70% in China	Dominant in China; Chinese language optimized; maps, encyclopaedia, cloud

Search Engine	Organization	Launched	Global Market Share	Key Feature
Yandex	Yandex N.V.	1997	~55% in Russia	Dominant in Russia; maps; translator; cloud storage
Brave Search	Brave Software	2021	Growing	Independent index; no Google/Bing dependency; privacy-respecting

5.1.4 Types of Search Engines

Type	Description	Examples
General / Horizontal	Searches the entire web across all topics	Google, Bing, Yahoo, DuckDuckGo
Vertical / Niche	Searches within a specific domain or topic	Google Scholar (academic), PubMed (medical), LinkedIn (professionals)
Meta-Search Engines	Aggregate and combine results from multiple other search engines	Dogpile, Metacrawler, Startpage
Private Search Engines	Do not track user activity; no personalized results; no filter bubble	DuckDuckGo, Brave Search, Startpage
Visual Search Engines	Use images as queries rather than text	Google Lens, Pinterest Lens, TinEye
Voice-Driven Search	Query by speaking; common in mobile assistants	Google Assistant, Siri, Alexa, Cortana

5.1.5 Search Engine Optimization (SEO)

SEO is the practice of improving a website's content, structure, and external reputation to rank higher in organic (non-paid) search engine results pages. SEO is critical for website visibility and traffic.

SEO Category	Technique	Rationale
On-Page SEO	Keyword research and strategic placement in titles, headings, body text, and meta descriptions	Search engines match user queries to page content

SEO Category	Technique	Rationale
On-Page SEO	High-quality, original, comprehensive content	Longer, expert content tends to rank higher
Technical SEO	Fast page loading speed; Core Web Vitals optimization	Google ranks faster pages higher; user experience signal
Technical SEO	Mobile-first responsive design	Majority of searches now originate from mobile devices
Technical SEO	Structured data markup (Schema.org)	Enables rich snippets (star ratings, FAQs) in SERPs
Off-Page SEO	Earning high-quality backlinks from reputable domains	Links are 'votes' of authority for the target page
Local SEO	Google Business Profile; local citations; reviews	Improves visibility for location-specific queries

5.2 Web Directories

A web directory is an organized, human-curated online catalog of websites, classified into hierarchical categories and subcategories based on subject matter. In contrast to search engines — which use automated crawlers to index the entire web — web directories rely on human editors to review, evaluate, and categorize submitted websites. This human curation was their primary competitive advantage before search engines became sophisticated enough to do this automatically.

5.2.1 Characteristics of Web Directories

Characteristic	Description
Human Curation	Submitted websites are reviewed by human editors to verify quality, relevance, and appropriate categorization.
Categorical Organization	Sites are placed in a hierarchical taxonomy: Broad Category → Subcategory → Sub-subcategory → Listing.
Quality Control	Editors reject low-quality, duplicate, or inappropriate submissions, resulting in a curated, trustworthy collection.
Static Listings	Entries do not change based on user query; the same sites appear in a category regardless of search terms.
Manual Submission	Website owners or representatives actively submit their sites for inclusion, often with a title and description.

5.2.2 Types of Web Directories

Type	Description	Notable Examples
General Directory	Covers all topics across all industries and geographies	DMOZ (2017 closure), Yahoo! Directory (2014 closure)
Niche / Vertical Directory	Focuses on a specific industry, profession, or topic	HealthGrades (healthcare), Avvo (legal), TripAdvisor (travel)
Local / Regional Directory	Lists businesses and services within a specific geographic area	Yelp, Just Dial (India), Google Business Profile
Academic Directory	Curates scholarly and research-oriented websites	DMOZ Academic, Library of Congress Web Archives

5.2.3 Major Historical Web Directories

Directory	Founded	Closure/Status	Significance
Yahoo! Directory	1994	Closed Dec 2014	First major web directory; modeled the internet for early users
DMOZ (Open Directory Project)	1998	Closed Mar 2017	Largest human-edited directory; volunteer-run; powered Google directory for years
Best of the Web (BOTW)	1994	Still active (2026)	One of the oldest active web directories; quality-focused
Jasmine Directory	2009	Active	Modern curated directory; SEO backlink value

5.2.4 Why Web Directories Declined

Web directories were indispensable in the early Web (1994–2004) because search engine algorithms were too primitive to reliably identify relevant, high-quality content. Human judgment was genuinely superior to automated crawling for directory purposes.

However, several developments made web directories obsolete as the primary discovery tool:

- **Search engine advancement:** Google's PageRank algorithm (1998) and subsequent AI improvements made automated indexing more accurate than human curation for most queries.
- **Web scale:** By 2005, the Web contained hundreds of billions of pages — human editors could not scale to review them all.
- **Cost:** Maintaining a large editorial team is expensive; search engines operate algorithmically at marginal cost.

- **User behavior shift:** Users learned to search by keyword rather than browse by category.

5.2.5 Modern Relevance of Web Directories

While general web directories have become largely irrelevant for navigation purposes, specialized directories retain significant value:

- Local business directories (Yelp, Just Dial, Google Business Profile) are heavily used for finding local services.
- Industry-specific directories are valuable for B2B research, professional networking, and supplier discovery.
- Academic and library directories curate scholarly resources that are not easily found via general search.
- SEO link building: Listings in reputable directories provide high-quality backlinks that improve search rankings.

5.3 Microsoft Internet Explorer: Unit 5 Context

Internet Explorer's significance in the context of search engines and web navigation extends beyond its role as a browser. IE fundamentally shaped user habits around web searching, URL handling, and search engine adoption during the critical 1995–2010 period.

IE integrated search directly into the browser for the first time, defaulting to Microsoft's MSN Search (later Bing) in the address bar and toolbar. When users mistyped URLs in IE's address bar, IE redirected them to a search query rather than showing an error — a behavior now universal across all browsers. IE's dominance meant that Microsoft's default search engine (Bing's predecessor) received an enormous amount of traffic simply because of browser market share. The legal settlement of the antitrust case against Microsoft included provisions requiring Windows to offer browser choice screens in certain markets, which allowed competing browsers (and thus competing search engines) to gain market share.

IE is now fully retired (June 2022). Microsoft Edge's default search engine is Bing, but users can configure any search engine (Google, DuckDuckGo, etc.) as their default through browser settings.

5.4 Searching for Information Effectively

With billions of webpages and internet resources available, the ability to search efficiently and critically evaluate results is an essential digital literacy skill for undergraduate students. Raw

access to information is not the same as being able to find the right information quickly and reliably.

5.4.1 The Information Search Process — A Framework

Step	Action	Key Consideration
1. Define the Goal	Clarify exactly what information you need before starting	Academic research, personal information, professional data — each requires different tools and approaches
2. Identify Sources	Choose the right platform for your query	Search engines (general), Google Scholar (academic), PubMed (medical), databases (professional)
3. Formulate Query	Select precise keywords and use search operators	Avoid vague one-word searches; use multiple related terms
4. Execute and Filter	Run the search; apply filters for date, language, region, type	Recent information for rapidly evolving topics; specify PDF for documents
5. Evaluate Results	Assess source credibility and content accuracy before using	Check author, date, organization, citations, and cross-reference with other sources
6. Organize Findings	Save, bookmark, and cite useful resources systematically	Use citation managers (Zotero, Mendeley) for academic work

5.4.2 Advanced Search Operators

Operator	Syntax	Function	Example
Exact Phrase	"phrase"	Returns results containing the exact quoted phrase	"machine learning algorithms"
Boolean AND	term1 AND term2 OR just space	Narrows results to pages containing both terms	climate change AND India
Boolean OR	term1 OR term2	Broadens results to pages with either term	college OR university admission
Boolean NOT / Minus	term1 -excluded	Excludes pages containing the after-minus term	jaguar -car -automobile
Site-Specific	site:domain.com topic	Restricts results to a single website	site:who.int COVID vaccines
File Type	filetype:ext topic	Returns results of a specific file type only	filetype:pdf data structures tutorial
Title Search	intitle:keyword	Finds pages with keyword in the page title	intitle:computer networks syllabus
Related Sites	related:domain.com	Finds sites similar to the specified domain	related:bbc.com
Wildcard	term * rest	Uses * as placeholder for unknown words	how to * a website

Operator	Syntax	Function	Example
Number Range	term 2020..2026	Results within a numeric or date range	internet history 2000..2026

5.4.3 Evaluating Information Sources — The CRAAP Test

Criterion	Questions to Ask
Currency	When was this published or last updated? Is the information still current for this topic?
Relevance	Does this directly answer my research question? Is it appropriate for my academic level?
Authority	Who wrote this? What are their credentials? Is the publishing organization reputable?
Accuracy	Is the information supported by evidence, citations, and references? Can I verify it elsewhere?
Purpose	Why was this created? Is it to inform, persuade, sell, or entertain? Is it objective or biased?

5.4.4 Research Databases for Academic Searching

Database	Subject Area	Access
Google Scholar	All academic disciplines — journals, theses, books	Free — scholar.google.com
PubMed / MEDLINE	Medicine, health sciences, biology	Free — pubmed.ncbi.nlm.nih.gov
IEEE Xplore	Electrical engineering, electronics, computer science	Subscription (many university libraries provide access)
ACM Digital Library	Computing and information technology	Subscription
JSTOR	Humanities, social sciences, arts, economics	Subscription (limited free access)
Scopus	Broad academic — 22,000+ peer-reviewed journals	Subscription
DOAJ (Directory of Open Access Journals)	All disciplines — open-access only	Free — doaj.org
Shodhganga	Indian theses and dissertations	Free — shodhganga.inflibnet.ac.in

5.5 Bigfoot, InfoSpace, WhoWhere, and Yahoo

Before Google and modern social networks made finding people and websites trivially easy, a collection of specialized directory services helped early Internet users locate each other and navigate the growing web. Bigfoot, InfoSpace, WhoWhere, and Yahoo represent four distinct approaches to organizing and searching the early Internet — each with a unique focus and evolutionary story.

5.5.1 Bigfoot (1995 — defunct ~2012)

Bigfoot was launched in 1995 as an email address directory — essentially a digital white pages for the Internet. At a time when finding someone's email address was genuinely difficult, Bigfoot amassed a database of over 20 million email records. Its flagship service was email forwarding: users could register a permanent Bigfoot address (firstname.lastname@bigfoot.com) that automatically forwarded to their current ISP-provided email — solving the problem of changing email addresses when switching providers.

Feature	Description
Email Directory	Searchable database of names, email addresses, and contact information
Email Forwarding	Free permanent email address that forwarded to user's real inbox — the user's 'internet identity'
White Pages Search	Find individuals by name; return email address and sometimes postal address
Decline	Privacy concerns; spam; competition from search engines and social networks (LinkedIn, Facebook) offering better people-search capabilities

5.5.2 InfoSpace (Founded 1996 — still operating as Blucora)

InfoSpace was founded in 1996 by Naveen Jain with the vision of becoming the 'infrastructure for the Internet' — aggregating and reselling data from across the web. It operated as a meta-search engine (combining results from Yahoo, Google, and others) while also providing white pages, yellow pages, and local business search.

InfoSpace became one of the most valuable Internet companies during the dot-com bubble, briefly reaching a market capitalization of over USD 31 billion in March 2000. The subsequent dot-com crash saw it lose 99% of its value. The company pivoted to mobile content services (ringtones, wallpapers) and later digital services. Its search division was eventually sold, and the company reorganized as Blucora, focusing on financial technology.

5.5.3 WhoWhere (1996 — acquired by Lycos 1998)

WhoWhere was launched in 1996 by MIT graduates Youri Lounkov and Mike Lang as a people-search directory similar to Bigfoot. It allowed users to search for email addresses, telephone numbers, and physical addresses. Like Bigfoot, it offered free email forwarding and free webmail accounts.

WhoWhere was acquired by Lycos (one of the leading search portals of the era) in June 1998 for approximately USD 133 million in Lycos stock. The acquisition gave Lycos a people-search capability to compete with Yahoo People Search and Bigfoot. WhoWhere's services were gradually absorbed into the Lycos portal and eventually discontinued as social networks made people-search a feature of profiles rather than a standalone service.

5.5.4 Yahoo (1994 — current)

Yahoo (Yet Another Hierarchical Officious Oracle) was founded in January 1994 by Jerry Yang and David Filo, then PhD students at Stanford University. What began as 'Jerry and David's Guide to the World Wide Web' — a manually curated list of interesting websites organized into categories — became the Web's first major portal and the defining internet company of the late 1990s.

Yahoo Product / Service	Launch Year	Description
Yahoo Directory	1994	Original product: manually curated hierarchical website catalog
Yahoo Search	1995	Added algorithmic search alongside the directory
Yahoo Mail	1997	Free webmail — at peak (2012), had 300 million users worldwide
Yahoo News	1996	Aggregated news from multiple sources; became major news portal
Yahoo Finance	1997	Stock prices, financial news, portfolio tracking; still widely used
Yahoo Messenger	1998	Instant messaging; one of the first mass-market IM platforms
Yahoo Groups	2001	Email groups and online communities; closed in 2020
Yahoo Answers	2005	Community Q&A platform; closed April 2021

Yahoo's decline began with the rise of Google Search (1998 onwards), which rapidly offered superior search quality. Yahoo made several strategic missteps — famously rejecting a USD 44.6 billion acquisition offer from Microsoft in 2008. In 2017, Verizon acquired Yahoo's core internet

business for approximately USD 4.48 billion. As of 2026, Yahoo continues to operate mail, finance, and news services under Verizon's Apollo Global Management ownership.

Service	Launch	Status 2026	Primary Function
Bigfoot	1995	Defunct	Email directory and forwarding
InfoSpace	1996	Operates as Blucora (fintech)	Meta-search; white/yellow pages; local search
WhoWhere	1996	Defunct (absorbed by Lycos)	People and email directory
Yahoo	1994	Active (Apollo Global)	Email, finance, news portal

5.6 Subscriptions and Channels

In the context of Internet services, 'subscriptions' and 'channels' refer to mechanisms that allow users to receive regular updates from content sources without actively visiting them each time. These systems underpin much of how information is consumed on the modern Internet — from email newsletters to YouTube subscriptions and podcast feeds.

5.6.1 RSS (Really Simple Syndication) Feeds

RSS is a web feed format that allows publishers to distribute regularly updated content in a standardized machine-readable XML format. Users subscribe to RSS feeds using a feed reader application (aggregator). The feed reader periodically checks all subscribed feeds and displays new content in a unified inbox-like interface. RSS was invented by Netscape in 1999 and popularized by blog culture in the early 2000s.

Aspect	Details
Format	XML-based text file published at a URL on the website
How it works	User subscribes to feed URL in a reader; reader polls feed periodically for new items
Popular feed readers	Feedly, Inoreader, NewsBlur, NetNewsWire (Mac)
Content types	Blog posts, news articles, podcast episodes, academic paper alerts, job postings
Status today	Less commonly discussed by general users; widely used behind the scenes by podcasts and news apps

5.6.2 YouTube Channels and Subscriptions

YouTube (owned by Google) operates on a subscription model where users subscribe to channels — collections of videos published by a specific creator or organization. Subscribing to a channel causes the subscriber's YouTube homepage and notification feed to include new videos from that channel.

- Over 51 million YouTube channels exist as of 2026.
- Subscriptions drive content discovery — subscribed channels appear prominently in the YouTube home feed.
- Notifications (bell icon): Subscribers can opt in to receive push notifications when a new video is published.
- Educational content: NPTEL, MIT OpenCourseWare, Khan Academy, and major universities maintain YouTube channels.

5.6.3 Podcast Subscriptions

Podcasts are audio programs published as RSS feeds. Subscribing to a podcast in a podcast app (Spotify, Apple Podcasts, Google Podcasts) causes new episodes to automatically download or appear in the user's feed. Over 4 million podcasts cover topics from technology and science to education, business, and entertainment.

5.6.4 Subscription-Based Premium Content

Service Type	Examples	Value Proposition
Academic Research	JSTOR, IEEE Xplore, Elsevier ScienceDirect	Access to peer-reviewed journal articles and books
News and Journalism	The Hindu, The New York Times, Bloomberg, Financial Times	Ad-free, deep journalism; premium content
Video Streaming	Netflix, Amazon Prime, Disney+ Hotstar, SonyLIV	Unlimited on-demand movies, series, documentaries
Music Streaming	Spotify, Apple Music, JioSaavn	Unlimited ad-free music; offline download
Cloud Storage	Google One, Microsoft OneDrive, Dropbox	Expanded storage for files, photos, backups
Productivity Tools	Microsoft 365, Google Workspace, Adobe Creative Cloud	Professional software suites with cloud storage
E-Learning	Coursera Plus, LinkedIn Learning, Udemy Business	Unlimited access to online courses

5.6.5 Search Engine-Linked Subscription Services

Google has developed several subscription and notification services linked to its search and content platforms:

- **Google News Subscriptions:** Users can subscribe to individual news publications directly within Google News, enabling paywalled content to be accessed through Google.
- **Google Alerts:** Free service that emails users whenever Google indexes new content matching their specified keyword(s). Useful for monitoring a brand, topic, or person.
- **Google Discover:** AI-driven content feed on Android and Chrome that surfaces articles about topics the user has shown interest in — subscription-like behavior without explicit subscribing.
- **Google One:** Premium subscription offering expanded Google Drive storage (100 GB – 2 TB), priority support, and family sharing features.

5.7 Websites: Overview and Concepts

A website is a collection of interrelated webpages and digital resources — text, images, audio, video, and code — that are hosted on a web server, accessible via a domain name over the Internet, and viewable through a web browser. Websites are the fundamental units of content on the World Wide Web; they range from single-page portfolios to complex platforms serving billions of users.

5.7.1 Core Components of a Website

Component	Description
Domain Name	The unique human-readable address (e.g., www.msuniv.ac.in) registered with a domain registrar. A domain maps to the server's IP address via DNS.
Web Hosting	Server infrastructure where the website's files are stored. Providers include AWS, Hostinger, Bluehost, NIC (for Indian government sites).
Webpages	Individual HTML documents that make up the website's content, linked together by hyperlinks.
URL Structure	Each page has a unique URL identifying its location within the site's directory structure.
Navigation System	Menus, sidebars, breadcrumbs, and links that help users move between pages.
CMS (optional)	Software layer (WordPress, Drupal) that allows non-technical users to manage content.

5.7.2 Types of Websites

Type	Description	Indian/Global Examples
Static Website	Fixed content; no database; HTML/CSS only; fast; low-cost; updated manually	Small business brochure sites; personal portfolios
Dynamic Website	Content generated by server-side code based on user requests or database content	E-commerce stores; social platforms; booking systems
E-Commerce Website	Designed for online buying and selling; payment gateway integration	Amazon.in, Flipkart, Myntra, IRCTC, Meesho
Blog	Regularly updated articles by individual or organizational authors	Times of India blogs; Medium; research lab blogs
Educational Portal	Online courses, lecture notes, quizzes, certifications	NPTEL, Coursera, edX, Khan Academy, SWAYAM
Government Website	Official information, services, and e-governance portals	india.gov.in, DigiLocker, income tax e-filing portal
Social Media Platform	User-generated content; profiles; following/friendship networks	Facebook, Instagram, LinkedIn, Twitter/X, Koo
News Portal	Real-time news aggregation and original journalism	The Hindu, NDTV, BBC News, Reuters, ANI
Search Engine	Specialized web application for information discovery	Google, Bing, DuckDuckGo, Yahoo
Web Application (SaaS)	Software delivered over the web; subscription-based	Google Docs, Zoho CRM, Slack, Notion, Canva

5.7.3 How a Website is Created

Phase	Activities	Tools / Technologies
1. Planning	Define purpose, audience, site structure, content requirements	Wireframe tools: Figma, Miro, pen and paper
2. Design	Create visual mockups; choose color scheme, typography, layout	Figma, Adobe XD, Sketch, Canva
3. Front-End Development	Code the HTML structure, CSS styling, JavaScript interactivity	HTML5, CSS3, JavaScript, Bootstrap, React, Vue.js
4. Back-End Development	Server logic, database design, authentication, APIs	PHP, Python, Node.js, Java; MySQL, MongoDB
5. Testing	Cross-browser testing; responsiveness; performance; accessibility	Chrome DevTools, Lighthouse, BrowserStack, NVDA

Phase	Activities	Tools / Technologies
6. Deployment	Upload to web server; configure domain and SSL certificate	FTP, cPanel, Git CI/CD, AWS, Vercel, Netlify
7. Maintenance	Regular content updates, security patches, performance monitoring	WordPress updater, uptime monitors, Google Analytics

5.7.4 Key Qualities of a Good Website

Quality	Explanation
Usability	Intuitive navigation; clear calls-to-action; consistent layout; minimal learning curve.
Responsive Design	Layout adapts seamlessly to all screen sizes — desktop, tablet, and mobile.
Performance	Pages load in under 3 seconds; images optimized; code minified; CDN used.
Accessibility (WCAG)	Usable by people with disabilities — screen reader support; sufficient color contrast; keyboard navigation.
Security (HTTPS)	All pages served over HTTPS; forms protected by CSRF tokens; inputs sanitized against injection.
SEO Optimization	Proper heading structure; descriptive URLs; sitemap; fast loading; structured data.
Content Quality	Accurate, original, well-written, regularly updated content relevant to the target audience.

5.8 Making Use of Web Resources

The Internet is the largest repository of information and tools ever created by humanity. Effectively leveraging this vast resource requires knowing not just where to look, but how to evaluate what you find, how to organize it, and how to use it ethically and legally.

5.8.1 Categories of Web Resources

Category	Examples	Best Use Cases
Academic / Research	Google Scholar, PubMed, IEEE Xplore, JSTOR, Shodhganga	Literature reviews, research papers, thesis preparation
Educational	NPTEL, Coursera, edX, Khan Academy, SWAYAM (India)	Learning new subjects; certification courses; skill development

Category	Examples	Best Use Cases
Reference / Encyclopedia	Wikipedia, Britannica, Merriam-Webster, WHO	Quick reference; background understanding; definitions
News & Current Affairs	The Hindu, NDTV, BBC, Reuters, ANI	Staying current; assignment research; general awareness
Government & Official	india.gov.in, RBI, UGC, NAAC, MoE, WHO	Official policies, regulations, standards, data
Cloud Productivity	Google Workspace, Microsoft 365, Notion, Trello	Collaborative work; document creation; project management
Data & Statistics	data.gov.in, World Bank Open Data, Our World in Data	Data for research projects, visualizations, analysis
Open Source Code	GitHub, GitLab, npm, PyPI	Code reuse, learning programming, contributing to projects
Entertainment & Culture	YouTube, Spotify, JioSaavn, Netflix, Hotstar	Recreation; cultural content; language learning

5.8.2 Evaluating Web Resource Credibility

Not all information on the Internet is accurate or trustworthy. The following framework helps evaluate a source's credibility:

Evaluation Criterion	What to Check
Domain and Publisher	Prefer .gov, .edu, .org (verified), .ac.in for academic content. Identify the publishing organization.
Author Credentials	Is the author identified? What are their qualifications? Are they affiliated with a recognized institution?
Date of Publication	Is the content current enough for your needs? Technology and medicine topics require recent sources.
Citations and Evidence	Does the content cite sources? Are data claims supported by referenced studies or official statistics?
Objectivity and Bias	Is the content attempting to inform or persuade/sell? Look for balanced presentation of facts.
Consistency	Do multiple independent, reputable sources agree on the same facts?

5.8.3 Productivity Tools for Managing Web Resources

Tool	Type	Function
Google Drive	Cloud Storage	Store, organize, and share files with 15 GB free storage

Tool	Type	Function
Zotero	Citation Manager	Collect, organize, and cite academic references; free and open-source
Mendeley	Reference Manager	Academic paper management; PDF annotation; collaboration
Evernote / Notion	Note-Taking	Capture web clippings, notes, and links with rich organization
Pocket	Read-Later App	Save articles and web content for offline reading later
Google Alerts	Monitoring	Email alerts when Google finds new content for your keywords
IFTTT / Zapier	Automation	Connect web services; automate workflows between platforms

5.8.4 Responsible Use of Web Resources

- **Copyright Compliance:** Respect intellectual property. Do not copy and redistribute copyrighted text, images, or code without permission. Use Creative Commons or open-licensed resources for academic work.
- **Proper Attribution:** Always cite your sources in academic work. Use proper citation formats (APA, MLA, IEEE, Chicago) depending on your discipline.
- **Privacy and Personal Data:** Do not share other people's personal information without consent. Be mindful of what personal data you provide to websites and apps.
- **Critical Evaluation:** Apply the CRAAP test to all sources. Misinformation spreads rapidly online; verify facts before sharing or citing.
- **Digital Wellness:** Maintain healthy internet usage habits — set time limits, take breaks from screens, prioritize face-to-face interaction.

5.9 News, Weather, Sports, Personal Finance and Investing

The Internet has become the primary channel through which millions of people access news, weather information, sports updates, and financial data. This section provides an overview of the major platforms and resources available for each category.

5.9.1 News and Current Affairs

Online news portals provide real-time access to breaking news, in-depth analysis, opinion, and multimedia journalism across local, national, and global topics.

Category	Platforms	Description
Indian National News	The Hindu, Times of India, NDTV, India Today, ANI, Press Trust of India	Comprehensive coverage of Indian politics, economy, and society
International News	BBC News, Reuters, Associated Press, Al Jazeera, The Guardian	Global news with diverse international perspectives
Science & Technology	IEEE Spectrum, Wired, TechCrunch, MIT Technology Review	Emerging technology, research, and innovation coverage
Business & Economy	Financial Times, Bloomberg, The Economic Times, Business Standard	Markets, corporate news, economic data, policy analysis
Fact-Checking	Snopes, FactCheck.org, Alt News (India), The Quint Fact Check	Verify claims before sharing; combat misinformation

5.9.2 Weather Services

Digital weather services aggregate data from meteorological stations, weather balloons, satellites, and numerical weather models to provide forecasts at any location worldwide.

Platform	Provider	Key Features
India Meteorological Department (IMD)	Government of India	Official Indian weather; cyclone warnings; rainfall data (imd.gov.in)
AccuWeather	Private	Hourly and 15-day forecasts; severe weather alerts; air quality
The Weather Channel / weather.com	IBM / The Weather Company	Global coverage; interactive maps; video weather reports
Google Weather	Google (integrated into Search)	Instant local forecast when you search 'weather'; simple interface
Windy	Windy.com	Spectacular animated wind and weather maps; popular with pilots and sailors

5.9.3 Sports

Use Case	Platforms	Description
Cricket (India)	ESPN Cricinfo, BCCI Official, Hotstar	Live scores, ball-by-ball commentary, statistics, video highlights
Football (Soccer)	FIFA.com, UEFA.com, BBC Sport, Goal.com	Match scores, transfer news, league tables, video highlights
All Sports (India)	Sports Authority of India (SAI), Olympic Channel	Indian athletes, domestic sports, Olympics
Fantasy Sports	Dream11, MPL (Mobile Premier League), My11Circle	Build virtual teams; compete based on real player statistics

Use Case	Platforms	Description
Live Streaming	Disney+ Hotstar, Sony LIV, Jio Cinema, YouTube	Legal live streaming of IPL, FIFA World Cup, Olympics in India

5.9.4 Personal Finance and Investing

Category	Platforms	Description
Indian Stock Market	NSE India (nseindia.com), BSE India (bseindia.com), Moneycontrol	Real-time indices (Nifty 50, Sensex), stock prices, fundamental data
Trading / Demat Platforms	Zerodha Kite, Groww, Upstox, ICICI Direct, Angel One	Buy/sell stocks, mutual funds, and ETFs; portfolio tracking
Banking / UPI	SBI, HDFC, ICICI, Axis online banking; PhonePe, Google Pay, Paytm	Net banking; UPI transfers; bill payments; credit card management
Personal Finance	Moneycontrol, ET Money, ClearTax	Mutual fund investments, tax filing, expense tracking, financial planning
Global Markets	Bloomberg, CNBC, Yahoo Finance, Morningstar	International market data, investment research, economic news
Cryptocurrency	WazirX, CoinDCX, CoinSwitch (India); Binance, Coinbase (global)	Buy/sell/track digital assets; current prices; market analysis

5.10 Entertainment, Shopping, Travel, Family Life, Health and Medicine, and Religion

The Internet serves as the platform for an extraordinary range of personal and social activities beyond work and study. This section surveys the major categories of online resources relevant to everyday life.

5.10.1 Entertainment

Sub-Category	Platforms	Notes
Video Streaming (India)	Disney+ Hotstar, Sony LIV, Jio Cinema, ZEE5,	Bollywood, regional cinema, IPL, international series, originals

Sub-Category	Platforms	Notes
	Netflix, Amazon Prime Video	
Video Streaming (Global)	Netflix, Amazon Prime Video, YouTube, Apple TV+, HBO Max	Original productions; global cinema; documentaries
Music Streaming	Spotify, Apple Music, JioSaavn, Gaana, YouTube Music	Millions of songs; curated playlists; offline listening
Gaming	Steam, PlayStation Network, Xbox Game Pass, Epic Games Store	Game purchases, online multiplayer, game streaming
E-Books and Audiobooks	Kindle (Amazon), Google Play Books, Storytel, Audible	Read or listen to books on any device

5.10.2 Online Shopping (E-Commerce)

Category	Indian Platforms	Global Platforms
General Merchandise	Flipkart, Amazon.in, Meesho, Snapdeal	Amazon.com, eBay, Walmart
Fashion and Apparel	Myntra, AJIO, Nykaa Fashion, Tata Cliq	ASOS, Zara Online, SHEIN
Groceries / Food	BigBasket, Blinkit (Grofers), Swiggy Instamart, JioMart	Amazon Fresh, Walmart Grocery
Electronics	Croma, Vijay Sales Online, Amazon Electronics	Best Buy, Newegg
Food Delivery	Swiggy, Zomato	DoorDash, Uber Eats, Just Eat
Handmade / Artisan	CraftsvIlla, GoCoop	Etsy
Travel Booking	MakeMyTrip, IRCTC, Yatra, Goibibo	Booking.com, Expedia, Airbnb

5.10.3 Travel Planning

The Internet has transformed travel planning from a specialist activity requiring travel agents into something anyone can do independently. Key categories:

- **Flight Booking:** IRCTC Air, MakeMyTrip, Goibibo, Yatra, Ixigo (India); Google Flights, Skyscanner, Kayak (global comparators).

- **Train Booking:** IRCTC (irctc.co.in) — mandatory for all Indian Railways bookings; real-time seat availability; PNR status tracking.
- **Hotel Booking:** Booking.com, Agoda, OYO, Airbnb, Treebo — compare prices, reviews, and amenities.
- **Travel Information:** TripAdvisor (reviews), Lonely Planet (guides), Incredible India (incredibleindia.org) for domestic tourism.
- **Visa Information:** VFS Global, individual country embassy websites for visa requirements and application.

5.10.4 Family Life, Education for Children, and Communities

Audience	Platforms	Purpose
Young Children	Khan Academy Kids, ABCmouse, NCERT e-Learning	Interactive learning; literacy; numeracy; creativity
School Students	NCERT official portal, DIKSHA (diksha.gov.in), Toppr, BYJU'S	Curriculum-aligned content; practice; assessments
Parents	BabyCenter India, ParentCircle, FirstCry Parenting	Child development, parenting advice, age-appropriate activities
Local Communities	Nextdoor, WhatsApp Groups, Facebook Groups	Neighborhood communication; local event discovery
Senior Citizens	NASSCOM FutureSkills, Senior World	Digital literacy; online services navigation for seniors

5.10.5 Health and Medicine

Online health resources should be used to supplement, not replace, professional medical advice. Always consult a qualified healthcare professional for diagnosis and treatment.

Category	Platforms	Use
General Health Information	WebMD, Healthline, Mayo Clinic, NHS (UK), WHO	Symptom information; disease understanding; wellness tips
Indian Health Resources	MOHFW India (mohfw.gov.in), AIIMS Online	Government health advisories; patient information; e-health cards
Telemedicine	Practo, Apollo 24/7, eSanjeevani (free Gov't platform), 1mg	Online doctor consultations; prescription management

Category	Platforms	Use
Mental Health	iCall (TISS, free India), Vandrevala Foundation Helpline, MindPeers	Counselling, therapy, crisis support — particularly important for students
Fitness and Nutrition	Nike Training Club, HealthifyMe, Fittr, MyFitnessPal	Workout plans; calorie tracking; personalized nutrition guidance

Mental Health Note

University students face significant academic, social, and financial pressures. If you are experiencing stress, anxiety, or depression, please seek support. NIMHANS helpline: 080-46110007. iCall (TISS): 9152987821. You are not alone, and professional help is available and effective.

5.10.6 Religion and Spirituality

The Internet hosts extensive resources for religious study, spiritual practice, and connecting with faith communities:

- **Scripture Access:** Bible Gateway (Christian); Quran.com (Islamic); Sacred Texts archive; GURBANI.org (Sikh); Gita Supersite (Hindu).
- **Meditation and Mindfulness:** Headspace, Calm, Insight Timer — guided meditation suitable for stress reduction for all backgrounds.
- **Faith Communities:** Local temple, mosque, church, and gurudwara websites; WhatsApp groups; Facebook community pages.
- **Academic Religious Studies:** Oxford Islamic Studies Online; Jewish Theological Seminary resources; ISKCON educational materials.

Review Questions — All Units

The following review questions cover all five units of this textbook. Answering these questions will help you consolidate your understanding, prepare for university examinations, and develop the ability to apply concepts to practical scenarios. Questions are categorized by type: short answer (2 marks), medium answer (5 marks), and long answer / essay (10 marks).

Unit 1 — Internet Concepts

Short Answer Questions (2 Marks)

76. Define the Internet. How does it differ from the World Wide Web?
77. What is TCP/IP? State its full form and primary purpose.
78. Distinguish between IPv4 and IPv6 with one example each.
79. What is a modem? State its function in an Internet connection.
80. Define bandwidth and latency. How do they affect Internet performance?
81. What does ISP stand for? Give two examples of Indian ISPs.
82. What is a dial-up connection? State its maximum speed.
83. Define ISDN. What does BRI stand for?
84. What is ADSL? Why is it called 'asymmetric'?
85. Define Intranet. How does it differ from the Internet?

Medium Answer Questions (5 Marks)

86. Explain the key milestones in the development of the Internet from 1969 to 2024.
87. Describe four types of broadband Internet connections with their advantages and disadvantages.
88. Compare ISDN, ADSL, and Cable Internet using a table covering speed, medium, and suitability.
89. Explain the process of setting up a dial-up Internet connection on a Windows computer step by step.
90. What is an Intranet? List the key hardware components required to connect a LAN to the Internet.

Long Answer / Essay Questions (10 Marks)

91. Explain the history, evolution, components, and working of the Internet in detail.
92. Describe all major types of Internet connections available today, their technical specifications, and which type is most suitable for different use cases.

93. What is an Intranet? Explain the steps involved in connecting a LAN to the Internet, including all required components, configuration steps, and security measures.

Unit 2 — E-Mail Concepts

Short Answer Questions (2 Marks)

94. What is e-mail? State the two parts of an email address separated by '@'.
95. Define SMTP. What port does it typically use?
96. Distinguish between IMAP and POP3.
97. What is a Cc field in an email? How does it differ from Bcc?
98. What is email spam? How do spam filters work?
99. Define phishing in the context of email security.
100. What is two-factor authentication (2FA)? Why is it important for email accounts?
101. What is the maximum attachment size allowed by Gmail?
102. Define an email filter. Give one example of how you would use a filter.
103. What is S/MIME? What security service does it provide?

Medium Answer Questions (5 Marks)

104. Explain the complete process of how an email message travels from sender to recipient, naming all protocols involved.
105. Compare IMAP and POP3 protocols using a table. Which one would you recommend for a student using both a smartphone and a laptop? Justify your answer.
106. Describe six strategies a student can use to control and manage email volume effectively.
107. Explain the concept of secure email. Describe three different methods of sending secure email.
108. Explain the components of an email message: header fields, body, and attachments with examples.

Long Answer / Essay Questions (10 Marks)

109. Write a comprehensive essay on e-mail concepts, covering what email is, how it works, the protocols involved, components of an email message, types of email accounts, and email security.
110. Explain how to send and receive files by email. Include step-by-step instructions, best practices, common problems, and their solutions. Also explain when to use cloud links instead of attachments.

Unit 3 — Internet Services

Short Answer Questions (2 Marks)

111. What is online chatting? Name two popular instant messaging applications.
112. Define video conferencing. State two advantages it offers over traditional face-to-face meetings.
113. What is Usenet? Who developed it and in what year?
114. Define NNTP. What is its role in Usenet?
115. What is a newsreader? Give one example.
116. What is a mailing list? Distinguish between announcement and discussion lists.
117. What is a breakout room in the context of video conferencing?
118. What is end-to-end encryption in instant messaging? Name two apps that use it.
119. What is 'Zoom-bombing'? How can it be prevented?
120. What is the CAN-SPAM Act? Which country does it apply to?

Medium Answer Questions (5 Marks)

121. Compare online chatting and online conferencing using a table covering mode, purpose, participants, and bandwidth requirements.
122. Describe the steps to create a mailing list using Google Groups. Include screenshots or describe each screen.
123. Explain the structure of Usenet newsgroups, including the hierarchy naming system with five examples.
124. Describe the key features of video conferencing systems and list four popular platforms with their key strengths.
125. What is Netiquette in the context of Usenet? List five important rules of Usenet netiquette.

Long Answer / Essay Questions (10 Marks)

126. Write an essay on video conferencing covering its definition, key features, uses across different sectors, requirements, popular platforms, etiquette, advantages, challenges, and future developments.
127. Explain Usenet newsgroups in detail: what Usenet is, how it works, its structure and hierarchy, how to access it (step by step), key features, use cases, challenges, and how it compares to modern alternatives.

Unit 4 — Web Concepts and Browsers

Short Answer Questions (2 Marks)

128. Who invented the World Wide Web? In what year?

129. What is a URL? Identify the components of: https://www.msuniv.ac.in/about?id=5#contact
130. Distinguish between HTTP and HTTPS.
131. What is HTML? State its full form and purpose.
132. What is a rendering engine in a web browser? Name the engine used by Google Chrome.
133. What is a web cookie? How is it used?
134. Define the client-server model. Give one real-life example.
135. What is Web 2.0? Give two examples of Web 2.0 applications.
136. When was Netscape Navigator first released? State one significant contribution it made to the Web.
137. When was Internet Explorer officially retired by Microsoft?

Medium Answer Questions (5 Marks)

138. Explain the complete process of what happens from the moment a user types a URL until the webpage is displayed in the browser.
139. Explain the evolution of the World Wide Web: Web 1.0, Web 2.0, and Web 3.0 with characteristics and examples of each.
140. Compare HTTP and HTTPS using a table covering encryption, port, security, browser indicator, and appropriate use cases.
141. Explain the key components of a web browser's architecture: rendering engine, JavaScript engine, networking, data storage, and security sandbox.
142. Compare Netscape Navigator and Internet Explorer covering their introduction, market impact, key features, and eventual decline.

Long Answer / Essay Questions (10 Marks)

143. Write a comprehensive essay on the World Wide Web covering its invention, key components, how it works, its evolution (Web 1.0/2.0/3.0), functions, advantages, challenges, and future developments.
144. Explain the client-server model in detail: definitions, characteristics, types of servers, how the interaction works, protocols used, advantages, disadvantages, and comparison with peer-to-peer networks.

Unit 5 — Search Engines

Short Answer Questions (2 Marks)

145. What is a search engine? Name the three core processes involved in its operation.

146. What is web crawling? What programs perform it?
147. Define SEO. State its full form.
148. What is a web directory? How does it differ from a search engine?
149. What was Bigfoot? What service was it famous for?
150. What was Yahoo originally? When was it founded?
151. What is DuckDuckGo? What is its key differentiating feature?
152. Define RSS. What does it stand for and what is its purpose?
153. What is the CRAAP test in the context of evaluating web sources?
154. What is a Boolean operator? Give two examples used in search queries.

Medium Answer Questions (5 Marks)

155. Explain how a search engine works from crawling to ranking. Describe all three stages with technical details.
156. Describe five advanced search operators with their syntax, function, and an example for each.
157. Compare Bigfoot, InfoSpace, WhoWhere, and Yahoo using a table covering purpose, key features, and current status.
158. What is Search Engine Optimization (SEO)? Explain five key SEO techniques with their rationale.
159. Explain five categories of web resources (academic, educational, government, news, productivity tools) with examples and best uses for undergraduate students.

Long Answer / Essay Questions (10 Marks)

160. Write a comprehensive essay on search engines covering their definition, how they work (crawling, indexing, ranking), components of a search engine, major search engines and their features, types of search engines, advantages, challenges, and future developments.
161. Explain how to search for information effectively on the Internet. Cover the information search process framework, advanced search operators, research databases for academic work, and methods for evaluating the credibility of web resources.

Unit-Wise Summary Tables

The following summary tables consolidate the key definitions and concepts from each unit for quick revision before examinations.

Unit 1 Summary — Key Terms

Term	Definition
Internet	Global system of interconnected computer networks using TCP/IP protocols
TCP/IP	Transmission Control Protocol / Internet Protocol — the foundational communication protocol suite of the Internet
IP Address	Unique numerical label assigned to every device on the Internet; two versions: IPv4 (32-bit) and IPv6 (128-bit)
DNS	Domain Name System — translates human-readable domain names to IP addresses
ISP	Internet Service Provider — company that provides access to the Internet
Dial-Up	Internet connection via telephone line and modem; max 56 Kbps; largely obsolete
Broadband	High-speed, always-on Internet connection; includes DSL, cable, fiber, and mobile
ISDN	Integrated Services Digital Network — digital telephone-based internet; BRI (128 Kbps) and PRI (2 Mbps)
ADSL	Asymmetric Digital Subscriber Line — high-speed internet over copper phone lines; download faster than upload
Cable Internet	High-speed broadband via coaxial cable; speeds up to 1 Gbps; shared neighborhood bandwidth
Intranet	Private internal organizational network using Internet technologies; isolated from public Internet by firewall
Router	Network device that forwards packets between networks; connects LAN to Internet
Firewall	Security system monitoring network traffic; blocks unauthorized access

Unit 2 Summary — Key Terms

Term	Definition
Email	Electronic Mail — digital message exchange system using Internet protocols
SMTP	Simple Mail Transfer Protocol — sends outgoing mail; port 587 (client), 25 (server)
IMAP	Internet Message Access Protocol — retrieves mail keeping it on server; syncs across devices; port 993
POP3	Post Office Protocol 3 — downloads mail to device, deletes from server; port 995
Header	Email metadata: From, To, Cc, Bcc, Subject, Date, Message-ID
Attachment	File(s) included with email using MIME encoding

Term	Definition
Spam	Unsolicited bulk email; blocked by spam filters
Phishing	Fraudulent email impersonating trusted entity to steal credentials
2FA	Two-Factor Authentication — requires second verification step for account login
Encryption	Encoding data so only authorized parties can read it; TLS (transport); S/MIME / PGP (end-to-end)
Cc	Carbon Copy — secondary recipients; their addresses visible to all
Bcc	Blind Carbon Copy — hidden recipients; addresses not visible to others

Unit 3 Summary — Key Terms

Term	Definition
Instant Messaging	Real-time text-based Internet communication; e.g., WhatsApp, Telegram, Slack
Video Conferencing	Real-time audio-video communication over Internet; e.g., Zoom, Google Meet, Teams
Mailing List	Email distribution system sending one message to all subscribers simultaneously
Usenet	Distributed Internet discussion system organized into newsgroups; NNTP protocol; 1979
Newsgroup	Discussion forum within Usenet; organized by hierarchical naming (comp.*, sci.*, rec.*)
NNTP	Network News Transfer Protocol — protocol for accessing and distributing Usenet articles
Newsreader	Software client for accessing, reading, and posting to Usenet newsgroups
Breakout Room	Sub-group feature in video conferencing platforms for focused small-group discussions
E2EE	End-to-End Encryption — message readable only by sender and recipient; server cannot access content
Netiquette	Network etiquette — conventions for polite and appropriate online communication behavior

Unit 4 Summary — Key Terms

Term	Definition
WWW	World Wide Web — global system of hyperlinked documents; invented by Tim Berners-Lee, 1989

Term	Definition
HTML	HyperText Markup Language — standard language for creating webpage structure and content
CSS	Cascading Style Sheets — controls visual presentation of webpages
JavaScript	Client-side scripting language for interactive and dynamic webpage features
HTTP	HyperText Transfer Protocol — governs data exchange between browser and web server; port 80
HTTPS	HTTP Secure — HTTP with TLS/SSL encryption; port 443; padlock in browser
URL	Uniform Resource Locator — unique address of a web resource; format: protocol://domain/path
DNS	Domain Name System — resolves domain names to IP addresses for routing
Web Browser	Software for accessing, retrieving, and displaying Web content; Chrome, Firefox, Edge, Safari
Web Server	Computer hosting websites; delivers webpages via HTTP/HTTPS; Apache, Nginx
Client-Server Model	Architecture where client devices request services from server computers
Cookie	Small data file stored by browser to maintain session state and user preferences

Unit 5 Summary — Key Terms

Term	Definition
Search Engine	Software system indexing web content and returning ranked results for user queries
Web Crawling	Automated process of discovering and downloading webpages for indexing
Web Index	Search engine's database mapping words to their occurrences across billions of pages
Ranking Algorithm	Mathematical model scoring and ordering search results by relevance; Google uses 200+ signals
SERP	Search Engine Results Page — the page displayed to users after submitting a search query
SEO	Search Engine Optimization — techniques to improve organic search visibility
Web Directory	Human-curated hierarchical catalog of websites organized by subject category
RSS	Really Simple Syndication — XML feed format for distributing regularly updated content

Term	Definition
PageRank	Google's original algorithm ranking pages by number and quality of inbound links
Boolean Operators	AND, OR, NOT — logical search operators for refining queries
CRAAP Test	Currency, Relevance, Authority, Accuracy, Purpose — framework for evaluating source credibility
Meta-Search Engine	Aggregates results from multiple search engines; e.g., Dogpile, Metacrawler

Appendix A — Comprehensive Glossary of Internet Terms

This glossary provides concise definitions for all key technical terms used throughout this textbook. Use it as a quick reference during study or examination preparation.

Term	Definition
ADSL	Asymmetric Digital Subscriber Line — broadband internet over copper phone lines; download faster than upload.
API	Application Programming Interface — rules allowing different software applications to communicate.
ARPANET	Advanced Research Projects Agency Network — US Defense Dept. network (1969), precursor to the Internet.
Bandwidth	Maximum data transfer rate of a connection; measured in Mbps or Gbps.
Bcc	Blind Carbon Copy — email recipients hidden from all other recipients.
Broadband	High-speed always-on Internet; includes DSL, cable, fiber, and mobile (above 256 Kbps).
Browser	Software for accessing and displaying Web content (Chrome, Firefox, Edge, Safari).
Cable Internet	Broadband via coaxial cable TV infrastructure using DOCSIS technology; speeds up to 1 Gbps.
Client	Device/application requesting services from a server.
Cookie	Small file stored by browser for session state, login info, and preferences.
CSS	Cascading Style Sheets — language controlling visual presentation of HTML webpages.
Cybersecurity	Protecting computers, networks, and data from digital attacks and unauthorized access.
DHCP	Dynamic Host Configuration Protocol — automatically assigns IP addresses to network devices.
Dial-Up	Internet via telephone line and modem; maximum 56 Kbps; largely obsolete.
DNS	Domain Name System — translates domain names (www.google.com) to IP addresses.
Domain Name	Human-readable address identifying a website (e.g., msuniv.ac.in).
Download Speed	Rate of data flow from Internet to device; measured in Mbps.
DSL	Digital Subscriber Line — broadband over existing copper telephone lines.
E-Commerce	Electronic Commerce — buying and selling goods/services over the Internet.

Term	Definition
Email	Electronic Mail — digital messaging using SMTP, IMAP, and POP3 protocols.
Encryption	Encoding data so only authorized parties with the key can read it.
Extranet	Extension of an intranet to selected external partners via controlled access.
Fiber Optic	Internet using light through glass/plastic fiber; fastest technology (up to 10 Gbps).
Firewall	Security system filtering network traffic based on predefined security rules.
FTP	File Transfer Protocol — transfers files between client and server; port 21.
HTML	HyperText Markup Language — standard language for webpage structure and content.
HTTP	HyperText Transfer Protocol — governs browser-server data exchange; port 80.
HTTPS	HTTP Secure — HTTP with TLS/SSL encryption for secure communication; port 443.
Hyperlink	Clickable element linking one webpage to another resource.
IMAP	Internet Message Access Protocol — email retrieval keeping mail on server; port 993.
Internet	Global system of interconnected computer networks using TCP/IP protocols.
IoT	Internet of Things — network of physical objects connected to the Internet.
IP Address	Unique numerical identifier for every Internet-connected device; IPv4 or IPv6.
ISP	Internet Service Provider — company providing Internet access (Jio, Airtel, BSNL).
ISDN	Integrated Services Digital Network — digital telephone internet; BRI 128 Kbps, PRI 2 Mbps.
JavaScript	Client-side scripting language for interactive and dynamic webpage features.
Latency	Round-trip data travel time from device to server and back; measured in milliseconds.
LAN	Local Area Network — connected devices within a limited physical area.
Mailing List	Email system automatically delivering messages to all subscribers.
Malware	Malicious software designed to damage or gain unauthorized access to systems.
MIME	Multipurpose Internet Mail Extensions — allows email to carry attachments and HTML.

Term	Definition
Modem	Device converting digital data for transmission over telephone/cable/fiber lines.
NAT	Network Address Translation — converts private IPs to public IPs for Internet routing.
Netiquette	Network Etiquette — conventions for appropriate online communication behavior.
Newsgroup	Usenet discussion forum organized by hierarchical topic naming (comp.*, sci.*).
NNTP	Network News Transfer Protocol — protocol for accessing and distributing Usenet articles.
PGP	Pretty Good Privacy — open standard for end-to-end email encryption.
Phishing	Fraudulent email impersonating trusted entities to steal credentials or personal data.
POP3	Post Office Protocol 3 — downloads email to device, removes from server; port 995.
Protocol	Rules governing how data is transmitted between network devices.
Router	Network device forwarding packets between networks; connects LAN to Internet.
RSS	Really Simple Syndication — XML feed format for distributing updated web content.
S/MIME	Secure MIME — standard for end-to-end email encryption and digital signing.
SEO	Search Engine Optimization — techniques improving website visibility in search results.
SERP	Search Engine Results Page — ranked results page displayed after a search query.
Server	Computer providing resources and services to client devices over a network.
SMTP	Simple Mail Transfer Protocol — sends outgoing email; port 587 (client), 25 (server).
Spam	Unsolicited bulk email, typically commercial or malicious.
SSL/TLS	Secure Sockets Layer / Transport Layer Security — encrypts data in transit.
Switch	Network device connecting LAN devices, routing data by MAC address.
TCP/IP	Transmission Control Protocol / Internet Protocol — foundational Internet protocol suite.
TLD	Top-Level Domain — last segment of domain name (.com, .in, .edu, .gov).
Upload Speed	Rate of data flow from device to Internet; measured in Mbps.

Term	Definition
URL	Uniform Resource Locator — unique web resource address; format: protocol://domain/path.
Usenet	Unix User Network — distributed Internet discussion system from 1979.
VPN	Virtual Private Network — encrypted tunnel for secure, private Internet communication.
Web 1.0	Early static Web (1990s); read-only; no user interaction.
Web 2.0	Interactive Web (2000s); user content; social media; dynamic pages.
Web 3.0	Emerging decentralized Web; blockchain; AI; semantic understanding.
Web Crawling	Automated discovery and indexing of webpages for search engines.
Web Directory	Human-curated hierarchical catalog of websites by subject category.
Wi-Fi	Wireless networking (IEEE 802.11) providing Internet via radio waves.
WWW	World Wide Web — global interlinked document system accessible via HTTP/HTTPS.

References and Recommended Reading

The following textbooks, academic references, and online resources are recommended for deeper study of the topics covered in this e-book. These sources have been selected for their relevance to the Manonmaniam Sundaranar University undergraduate syllabus in Computer Science and Information Technology.

Standard Textbooks

162. Forouzan, B. A. (2013). Data Communications and Networking (5th ed.). McGraw-Hill Education. — Core reference for networking concepts, TCP/IP, protocols, and Internet architecture.

163. Tanenbaum, A. S., & Wetherall, D. J. (2011). Computer Networks (5th ed.). Prentice Hall / Pearson Education. — Comprehensive coverage of network layers, protocols, and Internet design.

164. Stallings, W. (2016). Data and Computer Communications (10th ed.). Pearson Education. — Detailed treatment of data transmission, WAN technologies, and Internet protocols.

165. Kurose, J. F., & Ross, K. W. (2022). Computer Networking: A Top-Down Approach (8th ed.). Pearson Education. — Modern treatment starting from application layer (WWW, email) down to physical layer; widely used globally.

166. Comer, D. E. (2014). Computer Networks and Internets (6th ed.). Pearson Education. — Accessible introduction to Internet architecture and TCP/IP.

167. Gralla, P. (2007). How the Internet Works (Millennium Edition). Que Publishing. — Visual, step-by-step explanation of Internet technologies suitable for beginners.

168. White, R., & Downs, E. (2012). How the Internet Works (8th ed.). Que Publishing. — Updated visual guide to core Internet and Web technologies.

169. Krishnamurthy, B., & Rexford, J. (2001). Web Protocols and Practice. Addison-Wesley Professional. — Detailed technical reference for HTTP, caching, web measurement, and performance.

170. Garfinkel, S., Spafford, G., & Schwartz, A. (2003). Practical UNIX and Internet Security (3rd ed.). O'Reilly Media. — Foundational reference for Internet security concepts.

171. Nielsen, J. (2000). Designing Web Usability: The Practice of Simplicity. New Riders. — Classic reference for web design principles and user experience.

Academic Journals and Periodicals

172. Communications of the ACM. Association for Computing Machinery. — Leading computer science publication; covers Internet technologies, web development, and networking.

173. IEEE Internet Computing. IEEE Computer Society. — Peer-reviewed journal specifically focused on Internet technologies and applications.

174. Journal of Network and Computer Applications. Elsevier. — Research on network architectures, protocols, and Internet applications.

175. ACM Transactions on the Web (TWEB). ACM. — Peer-reviewed research on all aspects of the World Wide Web.

Standards and Technical References

176. Internet Engineering Task Force (IETF). Request for Comments (RFCs). https://www.ietf.org/rfc/ — Official technical standards documents for Internet protocols. Key RFCs: RFC 791 (IPv4), RFC 2616 (HTTP/1.1), RFC 5321 (SMTP), RFC 7230-7235 (HTTP/1.1 revised), RFC 8446 (TLS 1.3).

177. World Wide Web Consortium (W3C). Web Standards and Specifications. https://www.w3.org — Official specifications for HTML, CSS, XML, accessibility guidelines (WCAG), and web APIs.

178. Mozilla Developer Network (MDN Web Docs). https://developer.mozilla.org — Comprehensive, authoritative documentation for HTML, CSS, JavaScript, and Web APIs.

Online Learning Resources

179. NPTEL — National Programme on Technology Enhanced Learning. https://nptel.ac.in — Free IIT/IISc lectures on Computer Networks, Internet Technologies, and Web Technologies with certificates.

180. Coursera — Computer Networking Specialization. https://www.coursera.org — University-level courses on networking and Internet technologies.

181. Khan Academy — Internet 101. https://www.khanacademy.org/computing/ap-computer-science-principles/the-internet — Free introductory modules on how the Internet works.

182. Web.dev by Google. https://web.dev — Modern guidance on building fast, accessible, and secure websites.

183. Google Digital Garage — Fundamentals of Digital Marketing. https://learndigital.withgoogle.com — Free certified course covering search engines, web navigation, and digital communication.

Official Technical Documentation

184. Internet Society (ISOC). Internet Technology Reports. https://www.internetsociety.org — Policy and technology papers on Internet governance, security, and global access.

185. ICANN (Internet Corporation for Assigned Names and Numbers). https://www.icann.org — Official information on domain names, IP addresses, and Internet identifiers.

186. India — National Internet Exchange of India (NIXI). https://www.nixi.in — Information on India's Internet infrastructure and .IN domain registry.

187. Cybersecurity and Infrastructure Security Agency (CISA). https://www.cisa.gov — Comprehensive cybersecurity resources including email security best practices.

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About the Book

The Internet is the defining infrastructure of the twenty-first century. From basic communication and entertainment to global commerce, scientific research, healthcare, and education, almost every dimension of modern human activity now depends, to some degree, on the Internet and its applications. For undergraduate students in Computer Science, Information Technology, and related fields at Manonmaniam Sundaranar University, Tirunelveli, a thorough and practical understanding of the Internet is both an academic requirement and a professional necessity.

This textbook – Internet and Its Applications, 2026 Edition – has been carefully revised and expanded to provide complete, error-free coverage of the five units prescribed in the Manonmaniam Sundaranar University syllabus. Every chapter has been rewritten in clear, simple, and accessible English, making complex concepts easy to understand even for students encountering these topics for the first time. The content uses structured explanations, rich comparison tables, step-by-step procedures, definition boxes, and practical examples throughout all five units.

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