UNIT 5

1. Internet basics:Internet is a global communication system that links together thousands of individual networks. It allows exchange of information between two or more computers on a network. Thus internet helps in transfer of messages through mail, chat, video & audio conference, etc. It has become mandatory for day-to-day activities: bills payment, online shopping and surfing, tutoring, working, communicating with peers, etc.

   Internet was evolved in 1969, under the project called ARPANET (Advanced Research Projects Agency Network) to connect computers at different universities and U.S. defence. Soon after the people from different backgrounds such as engineers, scientists, students and researchers started using the network for exchanging information and messages.

   In 1990s the internet working of ARPANET, NSFnet and other private networks resulted into Internet. Therefore, Internet is a global network of computer networks' . It comprises of millions of computing devices that carry and transfer volumes of information from one device to the other. Desktop computers, mainframes, GPS units, cell phones, car alarms, video game consoles, are connected to the Net.

   a. Features of internet: Major features of the Internet are listed below:
      i. **Easy to Use:** The software that is used to access the Internet or web browser is designed in such a way that is very simple and can be easily learned and used. Also, it is easy to develop.
      ii. **Flexibility:**Flexibility in terms of transfer of data. Basically, the internet network carries information in digital form in a majority of cases instead of voice information in analog form.
      iii. **Accessibility:** Internet service is a worldwide service and access to all. People located in remote or anywhere interior can also use the Internet. Therefore, information through the internet flows across the networks in a standardised manner.
      iv. **Interaction with Media and Flexibility of Communication:** Businesses are expanding with the help of the Internet. There is a high degree of interaction with the media due to internet service. Like, News, magazines, publishing houses, etc. have extended their business with the help of

Internet service. Also, communication is flexible due to internet service. With the help of text voice, video people can communicate easily.

v. **Low Cost and Security:** The maintenance and development costs of Internet service are comparatively low. Also, Internet service helped the security system both at an individual and national levels. For example CCTV cameras, etc.

b. Internet applications: An **Internet application** does something for end users. It is generally not concerned with how data is actually transmitted between the hosts. Here are some distributed applications that require well-defined application level protocols:
   - Sending and receiving email
   - Searching and browsing information archives
   - Copying files between computers
   - Conducting financial transactions
   - Navigating (in your car, smart scooter, smart bike, or other)
   - Playing interactive games
   - Video and music streaming
   - Chat or voice communication (direct messaging, video conferencing)

c. Services of internet:To access/exchange a large amount of data such as software, audio clips, video clips, text files, other documents, etc., we need internet services. You must use an Internet service to connect to the Internet. Data can be sent from Internet servers to your machine via Internet service. Some of the commonly used internet services are :

   1. Communication Services: To exchange data/information among individuals or organizations, we need communication services. Following are some of the common communication services:

   - **IRC(Internet Relay Chat):** Subscribers can communicate in real-time by connecting numerous computers in public spaces called channels.
   - **VoIP:** It stands for Voice over Internet Protocol, which describes how to make and receive phone calls over the

internet. A larger number of people believe VoIP is a viable alternative to traditional landlines. VoIP (Voice over Internet Protocol) is a technique that helps us make voice calls via the Internet rather than over a traditional (or analog) phone line. Some VoIP services may let you call only other VoIP users, while others may let you call anyone with a phone number, including long-distance, mobile, and local/international lines. If you have an internet connection you can easily call anyone without using a local phone service because VoIP solutions are based on open standards, they can be used on any computer. More than just setting up calls is what VoIP service providers do. Outgoing and incoming calls are routed through existing telephone networks by them.

- **List Server (LISTSERV):** Delivers a group of email recipients' content-specific emails.
- **E-Mail:** Used to send electronic mail via the internet. It is a paperless method for sending text, images, documents, videos, etc from one person to another via the internet.
- **User Network (USENET):** It hosts newsgroups and message boards on certain topics, and it is mostly run by volunteers.
- **Telnet:** It's used to connect to a remote computer that's connected to the internet.
- **Video Conferencing:** Video conferencing systems allow two or more people who are generally in different locations to connect live and visually. Live video conferencing services are necessary for simulating face-to-face talks over the internet. The system can vary from very simple to complex, depending on the live video conferencing vendors. A live video-based conference involves two or more individuals in separate locations utilizing video-enabled devices and streaming voice,

video, text, and presentations in real-time via the internet. It allows numerous people to connect and collaborate face to face over large distances. Tools available for this purpose are Zoom, FreeConference, Google Hangouts, Skype, etc.

2. Information Retrieval Services: It is the procedure for gaining access to information/data stored on the Internet. Net surfing or browsing is the process of discovering and obtaining information from the Internet. When your computer is linked to the Internet, you may begin retrieving data. To get data, we need a piece of software called a Web browser. A print or computer-based information retrieval system searches for and locates data in a file, database, or other collection of data. Some sites are:

- **www.geeksforgeeks.org:** Free tutorials, millions of articles, live, online, and classroom courses, frequent coding competitions, industry expert webinars, internships, and job possibilities are all available. A computer-based system for searching and locating data in a file, database, or another source.
- **www.crayola.com:** It includes advice for students, parents, and educators on how to be more creative.

3. File Transfer: The exchange of data files across computer systems is referred to as file transfer. Using the network or internet connection to transfer or shift a file from one computer to another is known as file transfer. To share, transfer, or send a file or logical data item across several users and/or machines, both locally and remotely, we use file transfer. Data files include – documents, multimedia, pictures, text, and PDFs and they can be shared by uploading or downloading them. To retrieve information from the internet, there are various services available such as:

- **Gopher:** A file retrieval application based on hierarchical, distributed menus that is simple to use.

- **FTP (File Transfer Protocol):** To share, transfer, or send a file or logical data item across several users and/or machines, both locally and remotely.
- **Archie:** A file and directory information retrieval system that may be linked to FTP

4. Web services: Web services are software that uses defined messaging protocols and are made accessible for usage by a client or other web-based programs through an application service provider's web server. Web services allow information to be exchanged across web-based applications. Using Utility Computing, web services can be provided.

5. World Wide Web: The internet is a vast network of interconnected computers. Using this network, you can connect to the world wide web (abbreviated as 'www' or 'web') is a collection of web pages. The web browser lets you access the web via the internet.

6. Directory Services: A directory service is a set of software that keeps track of information about your company, customers, or both. Network resource names are mapped to network addresses by directory services. A directory service provides users and administrators with full transparent access to printers, servers, and other network devices. The directory services are :

- **DNS (Domain Number System):** This server provides DNS. The mappings of computer hostnames and other types of domain names to IP addresses are stored on a DNS server.
- **LDAP (Lightweight Directory Access Protocol):** It is a set of open protocols that are used for obtaining network access to stored data centrally. It is a cross-platform authentication protocol for directory services and also allows users to interact with other directory services servers.

7. Automatic Network Address Configuration: Automatic Network Addressing assigns a unique IP address to every system in a network. A DHCP Server is a network server that is used to assign IP addresses, gateways, and other network information to client devices. It uses

Dynamic Host Configuration Protocol as a common protocol to reply to broadcast inquiries from clients.

8. Network Management Services: Network management services are another essential internet service that is beneficial to network administrators. Network management services aid in the prevention, analysis, diagnosis, and resolution of connection problems. The two commands related to this are:

- **ping**: The ping command is a Command Prompt command that is used to see if a source can communicate with a specific destination & get all the possible paths between them.
- **traceroute**: To find the path between two connections, use the traceroute command.

9. Time Services: Using facilities included in the operating system, you may set your computer clock via the Internet. Some services are :

- **Network Time Protocol (NTP):** It is a widely used internet time service that allows you to accurately synchronize and adjust your computer clock.
- **The Simple Network Time Protocol (SNTP):** It is a time-keeping protocol that is used to synchronize network hardware. When a full implementation of NTP is not required, then this simplified form of NTP is typically utilized.

10. Usenet: The 'User's Network' is also known as Usenet. It is a network of online discussion groups. It's one of the first networks where users may upload files to news servers and others can view them.

11. News Group: It is a lively Online Discussion Forum that is easily accessible via Usenet. Each newsgroup contains conversations on a certain topic, as indicated by the newsgroup name. Users can use newsreader software to browse and follow the newsgroup as well as comment on the posts. A newsgroup is a debate about a certain topic made up of notes posted to a central Internet site and distributed over Usenet, a global network of news discussion groups. It uses Network News Transfer Protocol (NNTP).

12. E-commerce: Electronic commerce, also known as e-commerce or e-Commerce, is a business concept that allows businesses and individuals to buy and sell goods through the internet. Example: Amazon, Flipkart, etc. websites/apps.

d. Logical and physical addresses:
   i. Logical Address:
      1. Definition: A logical address, also known as a network address or IP address, is a numeric label assigned to each device participating in a computer network that uses the Internet Protocol for communication.
      2. Function: It provides a way to uniquely identify a device on a network. Logical addresses are hierarchical and typically consist of two parts: the network portion and the host portion. In IPv4, logical addresses are written as four sets of numbers separated by dots (e.g., 192.168.1.1), while IPv6 uses a hexadecimal format (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).
      3. Example: In the URL "http://www.example.com," the logical address is the IP address associated with the domain "www.example.com."
   ii. Physical Address:
      1. Definition: A physical address, also known as a hardware address, MAC address, or Ethernet address, is a unique identifier assigned to each network interface card (NIC) or network adapter for communication at the data link layer of a network.
      2. Function: It is used to identify a device at the hardware level within a local network (e.g., Ethernet LAN). Physical addresses are usually represented as a series of hexadecimal numbers and are typically burned into the network interface card by the manufacturer.
      3. Example: A MAC address might look like this: 00:1A:2B:3C:4D:5E.

e. Internet service providers:

Internet Service Providers (ISPs) are companies or organizations that provide Internet access to customers. They offer various types of internet connections, such as broadband, DSL, cable, fiber-optic, satellite, and wireless connections. ISPs play a crucial role in connecting users to the

global network and facilitating communication and access to online services. Here are some key points about ISPs:

Connection Types:

- Broadband: This is a high-speed internet connection that is always on. Cable, DSL, fiber-optic, and satellite are common broadband technologies.
- DSL (Digital Subscriber Line): Provides high-speed internet access over traditional copper telephone lines.
- Cable: Uses the same infrastructure as cable television to deliver internet access.
- Fiber-Optic: Employs optical fibers to transmit data as pulses of light, offering very high-speed internet connections.
- Satellite: Internet access is provided via satellite signals, making it available in remote areas.

Services:

- ISPs offer various service plans with different speeds and data limits, catering to the diverse needs of residential and business customers.
- Some ISPs also provide additional services such as email accounts, web hosting, virtual private networks (VPNs), and online security features.

Global Connectivity:

- ISPs interconnect with each other to form the global Internet. They have agreements and infrastructure in place to facilitate the exchange of data across their networks.

Wireless ISPs (WISPs):

- Some ISPs provide internet access through wireless technologies, including Wi-Fi and cellular networks.

Tiered Access:

- ISPs often offer different tiers of service, allowing customers to choose plans based on their internet usage needs and budget.

Regulation and Compliance:

- ISPs are subject to regulations and policies set by governmental bodies or regulatory authorities in the regions they operate. Compliance with these regulations ensures fair and lawful provision of internet services.

Customer Support:

- ISPs typically offer customer support services to address technical issues, billing inquiries, and other concerns.

Examples of ISPs:

- Some well-known ISPs include Comcast, AT&T, Verizon, Charter Spectrum, and many others. Additionally, there are regional and local ISPs that serve specific areas.

f. Domain name system:

The Domain Name System (DNS) is a hierarchical decentralized naming system for computers, services, or any resource connected to the Internet or a private network. It translates user-friendly domain names into IP addresses, which are numerical identifiers used to locate and identify devices on a network. The DNS plays a crucial role in making the Internet more accessible by allowing users to use easily memorable domain names instead of numeric IP addresses.

Here's an overview of how the Domain Name System works:

Domain Names:

- A domain name is a human-readable label assigned to a specific IP address or a group of IP addresses. For example, "www.example.com" is a domain name.

Hierarchy:

- The DNS is organized in a hierarchical structure, with levels represented by the dots in a domain name. For instance, in "www.example.com," ".com" is the top-level domain (TLD), "example" is the second-level domain (SLD), and "www" is a subdomain.

Name Servers:

- DNS uses a distributed network of servers called name servers. These servers store information about domain names and their corresponding IP addresses.

DNS Resolution Process:

- When a user enters a domain name in a web browser, a DNS resolution process begins.
- The request starts at the user's local DNS resolver (often provided by the ISP). If the resolver has the requested information in its cache, it returns the IP address immediately.
- If the resolver doesn't have the information, it queries the root DNS servers to find the authoritative DNS server for the top-level domain (TLD).
- The TLD server directs the resolver to the authoritative DNS server for the second-level domain (SLD).
- The process continues until the authoritative DNS server for the specific domain is reached, and it provides the corresponding IP address.
- The resolver caches the information to speed up future requests.

DNS Records:

- The DNS system stores various types of records, including:
    - A (Address) Record: Maps a domain to an IPv4 address.

- AAAA (IPv6 Address) Record: Maps a domain to an IPv6 address.
- CNAME (Canonical Name) Record: Alias of one domain to another.
- MX (Mail Exchange) Record: Specifies mail servers responsible for receiving email on behalf of the domain.

DNS Security:

- DNS Security Extensions (DNSSEC) is a suite of extensions that add an additional layer of security by ensuring the integrity and authenticity of DNS data.

2. Web basics: The World Wide Web (WWW) or web is an internet based service, which uses common set of rules known as protocols, to distribute documents across the Internet in a standard way. World Wide Web, which is also known as a Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet. These websites contain text pages, digital images, audios, videos, etc. Users can access the content of these sites from any part of the world over the internet using their devices such as computers, laptops, cell phones, etc. The WWW, along with internet, enables the retrieval and display of text and media to your device.

   The World Wide Web. Or 'Web' is a part of the Internet. The Web is viewed through web browser software such as Google chrome, Internet Explorer, Mozilla Firefox etc. Using browsers one can access the digital libraries containing innumerable articles, journals, e-books, news, tutorials stored in the form of web pages on computers around the world called web servers-Today thousands of web pages/websites are added to the WWW every hour.

   The Web was invented in 1991 by Tim Berners-Lee, while consulting at CERN (European Organization for Nuclear Research) in Switzerland. The Web is a distributed information system. The Web contains multimedia. Information in the Web is connected by hyperlinks.

   a. Web Browsers:

   - Definition: Web browsers are software applications that enable users to access and navigate the World Wide Web. They interpret HTML documents, render multimedia elements, and allow users to interact with web content.
   - Key Features:
     - Rendering Engine: Interprets HTML, CSS, and other web technologies to display content.

- User Interface: Provides tools like the address bar, bookmarks, and navigation buttons.
- Add-ons/Extensions: Extend functionality with plugins or extensions.
- Security Features: Built-in tools for privacy and protection against malicious websites.

b. HTTP/HTTPS:

- HTTP (Hypertext Transfer Protocol):
  - Application layer protocol for data communication on the web.
  - Stateless protocol for transferring hypertext (text with links).
  - Uses port 80 for communication.
- HTTPS (Hypertext Transfer Protocol Secure):
  - Secure version of HTTP.
  - Encrypts data using SSL/TLS protocols.
  - Uses port 443 for secure communication.
  - Commonly used for secure transactions (e.g., online banking, e-commerce).

c. URL (Uniform Resource Locator):

- Definition: URL is a reference to a resource on the internet. It consists of several components:
  - Protocol (e.g., HTTP/HTTPS): Specifies how the browser should retrieve the resource.
  - Domain: Identifies the server hosting the resource.
  - Path: Specifies the location of the resource on the server.
- Example: In "https://www.example.com/page.html":
  - Protocol: HTTPS
  - Domain: www.example.com
- Path: /page.html

a. HTML5**:** HTML5 is the latest revision of the Hypertext Markup Language (HTML), the standard markup language for creating web pages. Developed by the World Wide Web Consortium (W3C) and the Web Hypertext Application Technology Working Group (WHATWG) to improve and extend the capabilities of HTML4.

i. Key Features:

- New Semantic Elements:
  - <header> and <footer>: Define header and footer sections of a document.
  - <nav>: Represents navigation links.
  - <article> and <section>: Define independent, self-contained content.

        - <figure> and <figcaption>: Used for embedding media with captions.
    - Multimedia Support:
        - <audio> and <video> Elements: Embed and control audio and video content directly in the page.
        - <source> Element: Specify multiple sources for media, allowing the browser to choose the appropriate one.
    - Form Controls:
        - New Input Types: date, email, url, tel, and more.
        - Validation: Built-in form validation without relying on JavaScript.
        - <datalist> Element: Provides a predefined list of options for input elements.
    - Canvas and SVG:
        - <canvas> Element: Allows dynamic rendering of graphics, charts, and animations.
        - Scalable Vector Graphics (SVG): XML-based vector image format for creating two-dimensional graphics.

ii. APIs and Features:

- Web Storage:
    - localStorage and sessionStorage: Allow web applications to store data locally on the user's device.
- Web Workers:
    - Background Processing: Enables the execution of scripts in the background, improving performance.
- WebSockets:
    - Real-time Communication: Provides a full-duplex communication channel over a single, long-lived connection.
- Geolocation API:
    - Location Information: Allows web applications to access the user's geographical location.
- Offline Web Applications:
    - Service Workers: Enable offline functionality by intercepting and handling network requests.

HTML5 represents a significant advancement in web development, providing developers with powerful tools for creating rich, interactive, and accessible web applications. Its features contribute to a more dynamic and engaging online experience while promoting standards and interoperability across different platforms and devices. As technology evolves, HTML5 continues to play a central role in shaping the future of web development. HTML5 introduces several new elements (tags) and attributes, enhancing

the capabilities of HTML for creating modern and feature-rich web pages. Here's a list of some key HTML5 tags:

Document Structure:

- <article>: Represents a self-contained piece of content that could be distributed and reused independently.
- <section>: Represents a generic section of a document.
- <nav>: Defines a section containing navigation links.
- <header>: Represents the header of a section or page.
- <footer>: Represents the footer of a section or page.
- <aside>: Represents content that is tangentially related to the content around it.

Text Elements:

- <mark>: Represents text highlighted for reference or notation purposes.
- <progress>: Represents the completion progress of a task.
- <time>: Represents a specific period in time.

Multimedia:

- <audio>: Embeds audio content in a document.
- <video>: Embeds video content in a document.
- <source>: Specifies multiple media resources for <audio> and <video>.

Forms:

- <datalist>: Contains a set of <option> elements that represent the permissible or suggested options available to users.
- <output>: Represents the result of a calculation or user action.
- New Input Types: <email>, <url>, <tel>, <date>, <time>, <number>, etc.

Interactive Elements:

- <details>: Represents a disclosure widget from which the user can obtain additional information or controls.
- <summary>: Represents a summary or caption for the content of a <details> element.
- <dialog>: Represents a dialog box or other interactive component.

Graphics:

- <canvas>: Provides a drawing space for graphics using JavaScript.
- Scalable Vector Graphics (SVG): Used for vector graphics and illustrations.

APIs and Scripting:

- <script>: Embeds or references external scripts.
- <noscript>: Provides alternative content to be displayed if a script is not supported or enabled.

Meta Information:

- <meta charset="UTF-8">: Specifies the character encoding for the document.

Semantics:

- <main>: Represents the main content of the document.
- <figure> and <figcaption>: Used to embed content, such as images or videos, with a caption.

Form Attributes:

- placeholder: Specifies a short hint that describes the expected value of an input field.
- required: Indicates that an input field must be filled out before submitting the form.
- autocomplete: Specifies whether a form or input field should have autocomplete enabled.

These are just a selection of HTML5 tags, and there are more introduced in HTML5 to enhance the structure, semantics, and functionality of web documents. It's important to note that the adoption and support for these features can vary across different browsers, so developers often use feature detection and polyfills to ensure a consistent experience across various platforms.

b. CSS:

Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable. CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, as well as a variety of other effects. CSS is easy to learn and understand but it provides a powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML or XHTML.

Advantages of CSS-

1. CSS saves time - You can write CSS once and then reuse the same sheet in multiple HTML pages. You can define a style for each HTML element and apply it to as many web pages as you want.
2. Pages load faster - If you are using CSS, you do not need to write HTML tag attributes every time. Just write one CSS rule of a tag and apply it to all the occurrences of that tag. So, less code means faster download times.
3. Easy maintenance - To make a global change, simply change the style, and all the elements in all the web pages will be updated automatically.

4. Superior styles to HTML - CSS has a much wider array of attributes than HTML, so you can give a far better look to your HTML page in comparison to HTML attributes.
5. Multiple Device Compatibility - Style sheets allow content to be optimized for more than one type of device. By using the same HTML document, different versions of a website can be presented for handheld devices such as PDAs and cellphones or for printing.
6. Global web standards – Now HTML attributes are being deprecated and it is being recommended to use CSS. So it's a good idea to start using CSS in all the HTML pages to make them compatible with future browsers.

Here's an overview of key concepts in CSS:

1. Selectors:

   Selectors are patterns used to select and style HTML elements. They can be simple, like selecting an HTML tag (p, h1, etc.), or more complex using classes (.class) or IDs (#id). Selectors help target specific elements in the HTML document.

2. Properties:

   Properties define the style that you want to apply to the selected elements. Examples include color, font-size, margin, padding, and many others. Each property has a value associated with it.

3. Values:

   Values are assigned to properties and determine how the property should be applied. For example, color: red; sets the text color to red.

4. Box Model:

   The box model is a fundamental concept in CSS. It describes how every HTML element is treated as a rectangular box with properties like margin, border, padding, and content. Understanding the box model is crucial for layout design.

5. Layout:

   CSS provides various techniques for layout design. Flexbox and Grid are two powerful layout models that allow developers to create complex and responsive designs.

6. Media Queries:

   Media queries enable the creation of responsive designs by applying different styles based on the characteristics of the device or screen size. This is crucial for making websites look good on a variety of devices, from small mobile screens to large desktop monitors.

7. Transitions and Animations:

   CSS allows the creation of smooth transitions and animations to enhance the user experience. This includes the transition property for gradual style changes and the @keyframes rule for defining animations.

8. Selectors and Combinators:

   CSS selectors can be combined and used with combinators to target specific elements based on their relationship with other elements. Common combinators include descendant (space), child (>), adjacent sibling (+), and general sibling (~) combinators.

9. Pseudo-classes and Pseudo-elements:

   Pseudo-classes (:hover, :focus, etc.) and pseudo-elements (::before, ::after, etc.) allow the styling of elements based on their state or position in the document.

10. Responsive Design:

    Responsive design is a key aspect of modern web development. It involves creating layouts that adapt to different screen sizes and devices, providing a seamless user experience.