**BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024**

**ALLIED COMPUTER SCIENCE FOR B.Sc. PROGRAMMES**

**(For the candidates admitted from the academic year 2016-2017 onwards)**

**Allied Paper III**

**Principles of Information Technology**

Objective: To Provide the Basic Concepts in Information Technology

**Unit I**

Introduction to Computer – Classification of Digital Computer System– Computer Architecture – Memory Units – Auxiliary Storage Devices –Input and Output Devices.

**Unit II**

Introduction to Computer Software – Operating System – Programming Languages –General Software Features and trends.

**Unit III**

Database Management Systems – Data Processing – Introduction to Database Management System – database design.

**Unit IV**

Introduction to Telecommunication – Networking – Communication System –Distributed System – Internet – Intranet.

**Unit V**

Multimedia tools – Virtual Reality – E-Commerce – Data warehousing – Data Mining –

Applications; Geographical Information System – Computer in Business, Industry,Home, Education and Training.

**Text Book :**

1. Fundamentals of Information Technology, Alexis Leon And Mathews Leon, Vikas

Publishing House Pvt. Ltd, 2009

**Reference :**

1. Henry C.Lucas, Jr., Information Technology for Management – McGraw Hill (Part –III).

2. Williams, Sawyer, Hutchinson, Using Information Technology – McGraw Hill.

Unit 4

Introduction to Telecommunication

Communication is a process in which information is transferred from source to destination. Communications, or **telecommunication**, technology consists of electromagnetic devices and systems for communicating over long distance.

Telecommunication technologies may primarily be divided into wired and wireless methods.

The basic [telecommunication system](https://en.wikipedia.org/wiki/Communication_system) consists of three main parts that are always present in some form or another:

* A [transmitter](https://en.wikipedia.org/wiki/Transmitter) that takes information and converts it to a [signal](https://en.wikipedia.org/wiki/Signal_(electrical_engineering)).
* A [transmission medium](https://en.wikipedia.org/wiki/Transmission_medium), also called the *physical channel* that carries the signal. An example of this is the ["free space channel"](https://en.wikipedia.org/wiki/Free-space_optical_communication).
* A [receiver](https://en.wikipedia.org/wiki/Receiver_(radio)) that takes the signal from the channel and converts it back into usable information for the recipient.

Communications signals two types

[Analog signals](https://en.wikipedia.org/wiki/Analog_signal) or [digital signals](https://en.wikipedia.org/wiki/Digital_signal_(electronics)).

There are [analog communication](https://en.wikipedia.org/wiki/Analog_communication) systems and [digital communication](https://en.wikipedia.org/wiki/Digital_communication) systems. For an analog signal, the signal is varied continuously with respect to the information.

In a digital signal, the information is encoded as a set of discrete values (for example, a set of ones and zeros).

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### Telecommunication networks

A [telecommunications network](https://en.wikipedia.org/wiki/Telecommunications_network) is a collection of transmitters, receivers, and [communications channels](https://en.wikipedia.org/wiki/Communications_channel) that send messages to one another.

Some digital communications networks contain one or more [routers](https://en.wikipedia.org/wiki/Router_(computing)) that work together to transmit information to the correct user. An analog communications network consists of one or more [switches](https://en.wikipedia.org/wiki/Telephone_switch) that establish a connection between two or more users. For both types of network, [repeaters](https://en.wikipedia.org/wiki/Repeater) may be necessary to amplify or recreate the signal when it is being transmitted over long distances. This is to combat [attenuation](https://en.wikipedia.org/wiki/Attenuation) that can render the signal indistinguishable from the noise. Another advantage of digital systems over analog is that their output is easier to store in memory, i.e. two voltage states (high and low) are easier to store than a continuous range of states.

### Communication channels

The term "channel" has two different meanings. In one meaning, a channel is the physical medium that carries a signal between the transmitter and the receiver. Examples of this include the [atmosphere](https://en.wikipedia.org/wiki/Atmosphere) for sound communications, glass [optical fibers](https://en.wikipedia.org/wiki/Optical_fiber) for some kinds of [optical communications](https://en.wikipedia.org/wiki/Optical_communications), [coaxial cables](https://en.wikipedia.org/wiki/Coaxial_cable) for communications by way of the voltages and electric currents in them, and [free space](https://en.wikipedia.org/wiki/Free-space_optical_communication) for communications using [visible light](https://en.wikipedia.org/wiki/Visible_light), [infrared waves](https://en.wikipedia.org/wiki/Infrared), [ultraviolet light](https://en.wikipedia.org/wiki/Ultraviolet_light), and [radio waves](https://en.wikipedia.org/wiki/Radio_wave). Coaxial cable types are classified by RG type or "radio guide", terminology derived from World War II. The various RG designations are used to classify the specific signal transmission applications. This last channel is called the "free space channel". The sending of radio waves from one place to another has nothing to do with the presence or absence of an atmosphere between the two. Radio waves travel through a perfect [vacuum](https://en.wikipedia.org/wiki/Vacuum) just as easily as they travel through air, fog, clouds, or any other kind of gas.

The other meaning of the term "channel" in telecommunications is seen in the phrase [communications channel](https://en.wikipedia.org/wiki/Channel_(communications)), which is a subdivision of a transmission medium so that it can be used to send multiple streams of information simultaneously.

For example,

one radio station can broadcast radio waves into free space at frequencies in the neighborhood of 94.5 [MHz](https://en.wikipedia.org/wiki/MHz) (megahertz) while another radio station can simultaneously broadcast radio waves at frequencies in the neighborhood of 96.1 MHz.

Each radio station would transmit radio waves over a frequency [bandwidth](https://en.wikipedia.org/wiki/Bandwidth_(signal_processing)) of about 180 [kHz](https://en.wikipedia.org/wiki/KHz) (kilohertz), centered at frequencies such as the above, which are called the ["carrier frequencies"](https://en.wikipedia.org/wiki/Carrier_wave). Each station in this example is separated from its adjacent stations by 200 kHz, and the difference between 200 kHz and 180 kHz (20 kHz) is an engineering allowance for the imperfections in the communication system.

In the example above, the "free space channel" has been divided into communications channels according to [frequencies](https://en.wikipedia.org/wiki/Frequency), and each channel is assigned a separate frequency bandwidth in which to broadcast radio waves. This system of dividing the medium into channels according to frequency is called "[frequency-division multiplexing](https://en.wikipedia.org/wiki/Frequency-division_multiplexing)". Another term for the same concept is "[wavelength-division multiplexing](https://en.wikipedia.org/wiki/Wavelength-division_multiplexing)", which is more commonly used in optical communications when multiple transmitters share the same physical medium.

Another way of dividing a communications medium into channels is to allocate each sender a recurring segment of time (a "time slot", for example, 20 [milliseconds](https://en.wikipedia.org/wiki/Milliseconds) out of each second), and to allow each sender to send messages only within its own time slot. This method of dividing the medium into communication channels is called "[time-division multiplexing](https://en.wikipedia.org/wiki/Time-division_multiplexing)" (**TDM**), and is used in optical fiber communication. Some radio communication systems use TDM within an allocated FDM channel. Hence, these systems use a hybrid of TDM and FDM.

### Modulation

The shaping of a signal to convey information is known as [modulation](https://en.wikipedia.org/wiki/Modulation).

Modulation can be used to represent a digital message as an analog waveform. This is commonly called ["keying"](https://en.wikipedia.org/wiki/Keying_(telecommunications))—a term derived from the older use of Morse Code in telecommunications—and several keying techniques exist (these include [phase-shift keying](https://en.wikipedia.org/wiki/Phase-shift_keying), [frequency-shift keying](https://en.wikipedia.org/wiki/Frequency-shift_keying), and [amplitude-shift keying](https://en.wikipedia.org/wiki/Amplitude-shift_keying)). The "[Bluetooth](https://en.wikipedia.org/wiki/Bluetooth)" system, for example, uses phase-shift keying to exchange information between various devices. In addition, there are combinations of phase-shift keying and amplitude-shift keying which is called (in the jargon of the field) "[quadrature amplitude modulation](https://en.wikipedia.org/wiki/Quadrature_amplitude_modulation)" (QAM) that are used in high-capacity digital radio communication systems.

Modulation can also be used to transmit the information of low-frequency analog signals at higher frequencies. This is helpful because low-frequency analog signals cannot be effectively transmitted over free space. Hence the information from a low-frequency analog signal must be impressed into a higher-frequency signal (known as the "[carrier wave](https://en.wikipedia.org/wiki/Carrier_wave)") before transmission. There are several different modulation schemes available to achieve this [two of the most basic being [amplitude modulation](https://en.wikipedia.org/wiki/Amplitude_modulation) (AM) and [frequency modulation](https://en.wikipedia.org/wiki/Frequency_modulation) (FM)]. An example of this process is a disc jockey's voice being impressed into a 96 MHz carrier wave using frequency modulation (the voice would then be received on a radio as the channel "96 FM"). In addition, modulation has the advantage that it may use frequency division multiplexing (FDM).

Networking:

**Opensystem:**  
A system which is connected to the network and is ready for communication.

**Closedsystem:**  
A system which is not connected to the network and can’t be communicated with.

**ComputerNetwork:**  
It is the interconnection of multiple devices, generally termed as Hosts connected using multiple paths for the purpose of sending/receiving data or media.

There are also multiple devices or mediums which helps in the communication between two different devices which are known as **Network devices**.

Ex: Router, Switch, Hub, Bridge.

The layout pattern using which devices are interconnected is called as network topology.

Such as Bus, Star, Mesh, Ring, Daisy chain.

**OSI:**  
OSI stands for **Open Systems Interconnection**. It is a reference model that specifies standards for communications protocols and also the functionalities of each layer.

**Protocol:**  
A protocol is the set of rules or algorithms which define the way how two entities can communicate across the network and there exists different protocol defined at each layer of the OSI model. Few of such protocols are TCP, IP, UDP, ARP, DHCP, FTP and so on.

**UNIQUEIDENTIFIERSOFNETWORK**  
**Hostname:**  
Each device in the network is associated with a unique device name known as Hostname.  
Type “hostname” in the command prompt(Administrator Mode) and press ‘Enter’, this display the hostnameofyourmachine.

**IPAddress(InternetProtocoladdress):**  
 is the network address of the system across the network.  
To identify each device in the world-wide-web, Internet Assigned Numbers Authority (IANA) assigns IPV4 (Version 4) address as a unique identifier for each device on the Internet.  
Length of the IP address is 32-bits. (Hence we have 232 IP addresses available.)  
Type “ipconfig” in the command prompt and press ‘Enter’, this gives us the IP address of the device.

**MACAddress(MediaAccessControladdress):**  
Also known as physical address, is the unique identifier of each host and is associated with the NIC(NetworkInterfaceCard).

MAC address is assigned to the NIC at the time of manufacturing.  
Length of the MAC address is : 12-nibble/ 6 bytes/ 48 bits  
Type “ipconfig/all” in the command prompt and press ‘Enter’, this gives us the MAC address.

**Port:**  
Port can be referred as a logical channel through which data can be sent/received to an application. Any host may have multiple applications running, and each of this application is identified using the port number on which they are running.  
Port number is a 16-bit integer, hence we have 216 ports available which are categorized as shown below:

|  |  |
| --- | --- |
| **PORT TYPES** | **RANGE** |
| Well known Ports | 0 – 1023 |
| Registered Ports | 1024 – 49151 |
| Ephemeral Ports | 49152 – 65535 |

Numberofports:65,536  
Range:0–65535  
Type “***netstat -a***” in the command prompt and press ‘Enter’, this lists all the ports being used.

**Socket:**  
The unique combination of IP address and Port number together are termed as Socket.

**Fewmoreconcepts**

**DNSServer**  
DNSstandsfor**DomainNamesystem**.

DNS is basically a server which translates web addresses or URL (ex: www.google.com) into their corresponding IP addresses. We don’t have to remember all the IP addresses of each and every website.  
The command ‘**nslookup**’ gives you the IP address of the domain you are looking for. This also provides the information of our DNS Server.

**ARP:**  
ARPstandsfor**AddressResolutionProtocol**.  
It is used to convert the IP address to its corresponding Physical Address(i.e.MAC Address).  
ARP is used by the Data Link Layer to identify the MAC address of the Receiver’s machine.

**RARP:**  
RARP stands for **Reverse Address Resolution Protocol**.

As the name suggests, it provides the IP address of the device given a physical address as input. But RARP has become obsolete since the time DHCP has come into the picture.

This article is contributed by **Kundana Thiyari**. If you like GeeksforGeeks and would like to contribute, you can also write an article using [contribute.geeksforgeeks.org](http://www.contribute.geeksforgeeks.org/) or mail your article to contribute@geeksforgeeks.org. See your article appearing on the GeeksforGeeks main page and help other Geeks.

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Communication Systems

Information representation

Communication system block diagrams

Analog versus digital systems

Performance metrics

Types of Information

Major classification of data: analog vs. digital

◮ Analog signals

◮ speech (but words are discrete)

◮ music (closer to a continuous signal)

◮ temperature readings, barometric pressure, wind speed

◮ images stored on film

◮ Analog signals can be represented (approximately) using bits

◮ audio: 8, 16, 24 bits per sample

◮ digitized images (can be compressed using JPEG)

◮ digitized video (can be compressed to MPEG)

◮ Bits: text, computer data

◮ Analog signals can be converted into bits by quantizing/digitizing

Analog Messages

◮ Early analog communication

◮ telephone (1876) ◮ phonograph (1877)

◮ film soundtrack (1923, Lee De Forest, Joseph Tykoci´nski-Tykociner)

◮ Key to analog communication is the amplifier (1908, Lee De Forest, triode vacuum tube)

◮ Broadcast radio (AM, FM) is still analog

◮ Broadcast television was analog until 2009

Digital Messages

◮ Early long-distance communication was digital

◮ semaphores, white flag, smoke signals, bugle calls, telegraph

◮ Teletypewriters (stock quotations)

◮ Baudot (1874) created 5-unit code for alphabet. Today baud is a unit meaning one symbol per second.

◮ Working teleprinters were in service by 1924 at 65 words per minute

◮ Fax machines: Group 3 (voice lines) and Group 4 (ISDN)

◮ In 1990s the accounted for majority of transPacific telephone use. Sadly, fax machines are still in use.

◮ First fax machine was Alexander Bains 1843 device required conductive ink

◮ Pantelegraph (Caselli, 1865) set up telefax between Paris and Lyon

◮ Ethernet, Internet

Communication System Block Diagram (Basic)

◮ Source encoder converts message into message signal (bits)

◮ Transmitter converts message signal into format appropriate for channel transmission (analog/digital signal)

◮ Channel conveys signal but may introduce attenuation, distortion, noise, interference

◮ Receiver decodes received signal back to message signal

◮ Source decoder decodes message signal back into original message

Communication System Block Diagram (Advanced)

Encoder Channel Encrypt Modulator Decrypt Demodulator Decoder Channel Source Encoder Sink Source Source Decoder Channel Noise

◮ Source encoder compresses message to remove redundancy

◮ Encryption protects against eavesdroppers and false messages

◮ Channel encoder adds redundancy for error protection

◮ Modulator converts digital inputs to signals suitable for physical channel

Distributed systems

are characterized by their structure: a typical distributed system will consist of some large number of interacting devices that each run their own programs but that are affected by receiving messages, or observing shared-memory updates or the states of other devices. Examples of distributed systems range from simple systems in which a single client talks to a single server to huge amorphous networks like the Internet as a whole.

What is the Internet?

The internet is the largest computer network in the world, connecting millions of computers. A network is a group of two or more computer systems linked together.

There are two main types of computer networks:

Local Area Network (LAN):

A LAN is two or more connected computers sharing certain resources in a relatively small geographic location, often in the same building.

Examples include home networks and office networks.

The World Wide Web (WWW)

When most people think of the internet, the first thing they think about is the World Wide W eb. Nowadays, the terms "internet" and "World Wide Web" are often used interchangeably— but they're actually not the same thing.

The internet is the physical network of computers all over the world.

The World Wide Web is a virtual network of web sites connected by hyperlinks (or "links"). Web sites are stored on servers on the internet, so the World Wide Web is a part of the internet.

HTML

The backbone of the World Wide Web is made of HTML files, which are specially-formatted documents that can contain links, as well as images and other media. All web browsers can read HTML files. In addition to HTML, it's also very common for websites to use technologies like CSS (Cascading Style Sheets) and JavaScript to do more advanced things.

An **intranet** is a private network that can only be accessed by authorized users. The prefix "intra" means "internal" and therefore implies an **intranet** is designed for internal communications. "Inter" (as in Internet) means "between" or "among." Since there is only one Internet, the word "Internet" is capitalized