SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

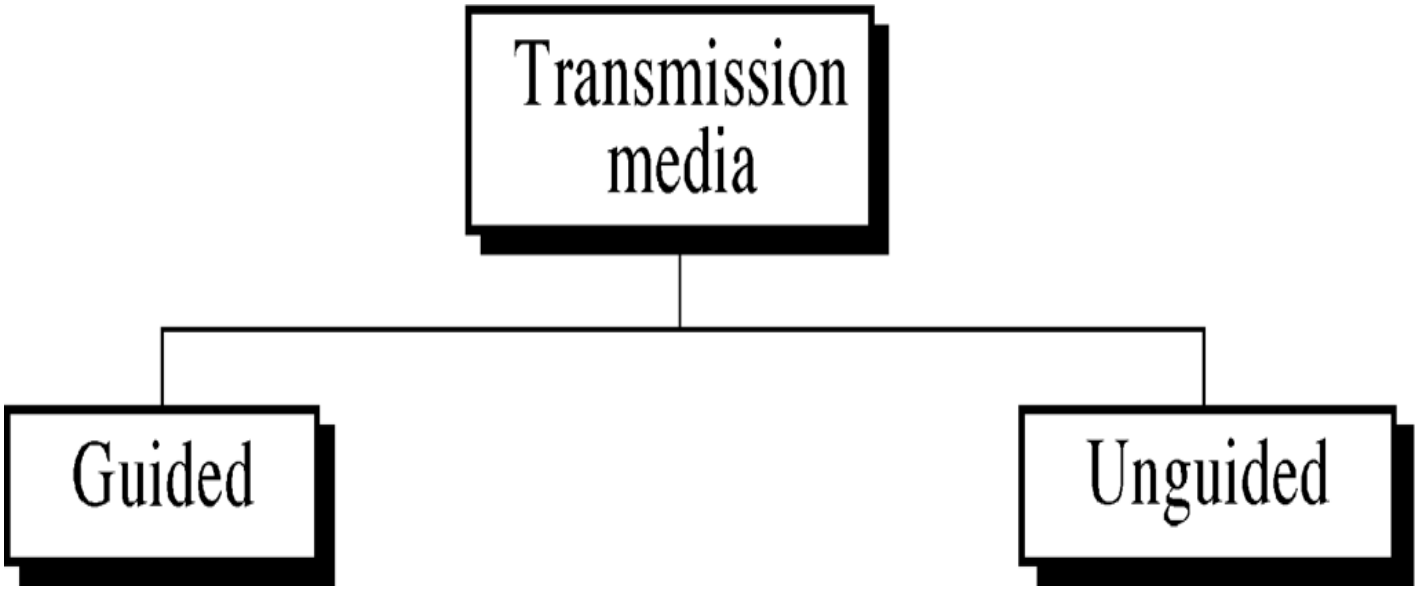
19ECT301- COMMUNICATION NETWORKS

III YEAR/ V SEMESTER

UNIT 1 – INTRODUCTION TO NETWORKS AND LAYERED ARCHITECTURE

TOPIC – TRANSMISSION MEDIA

TRANSMISSION MEDIA



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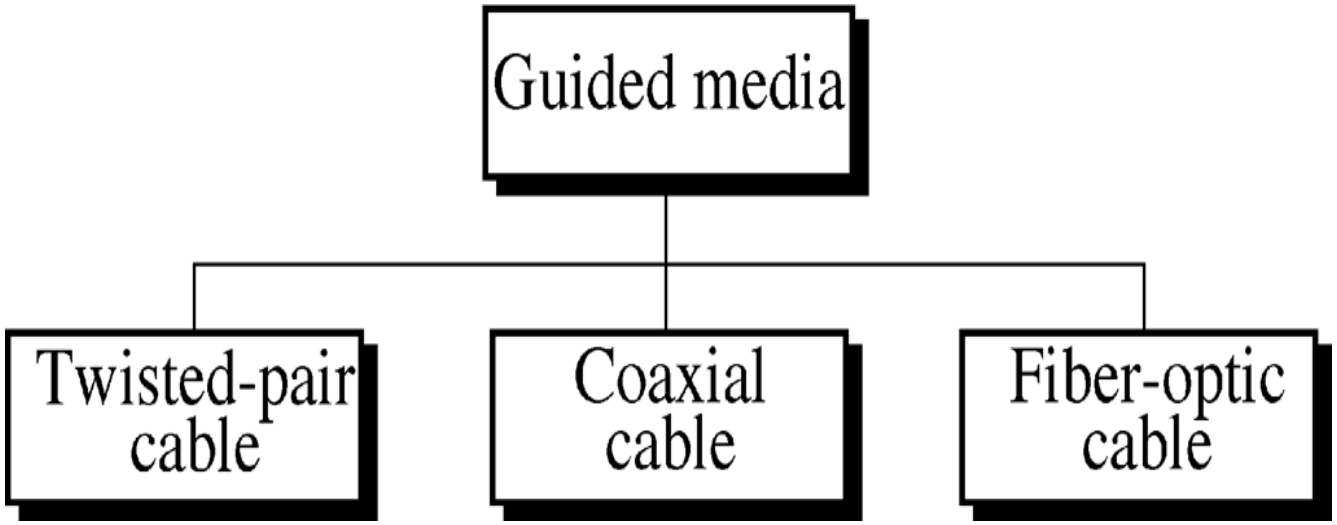
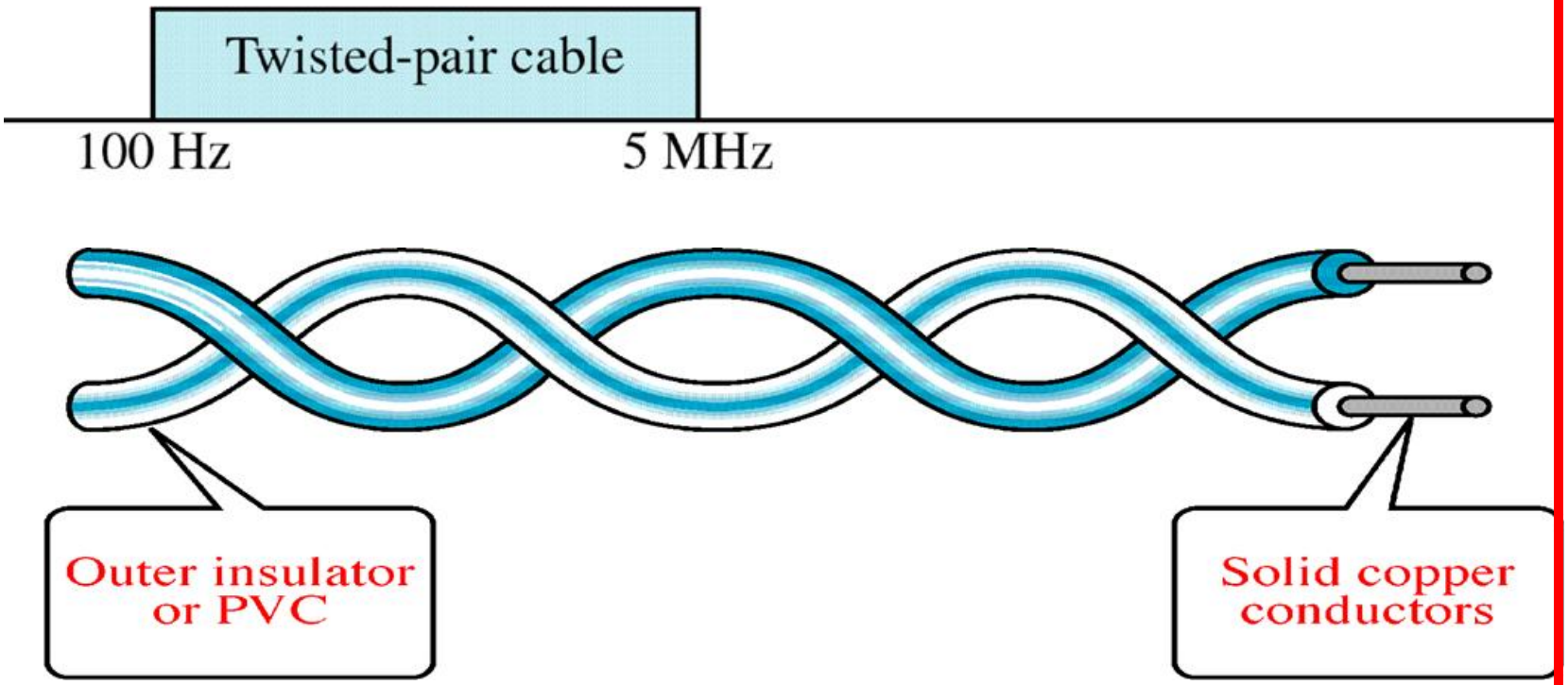


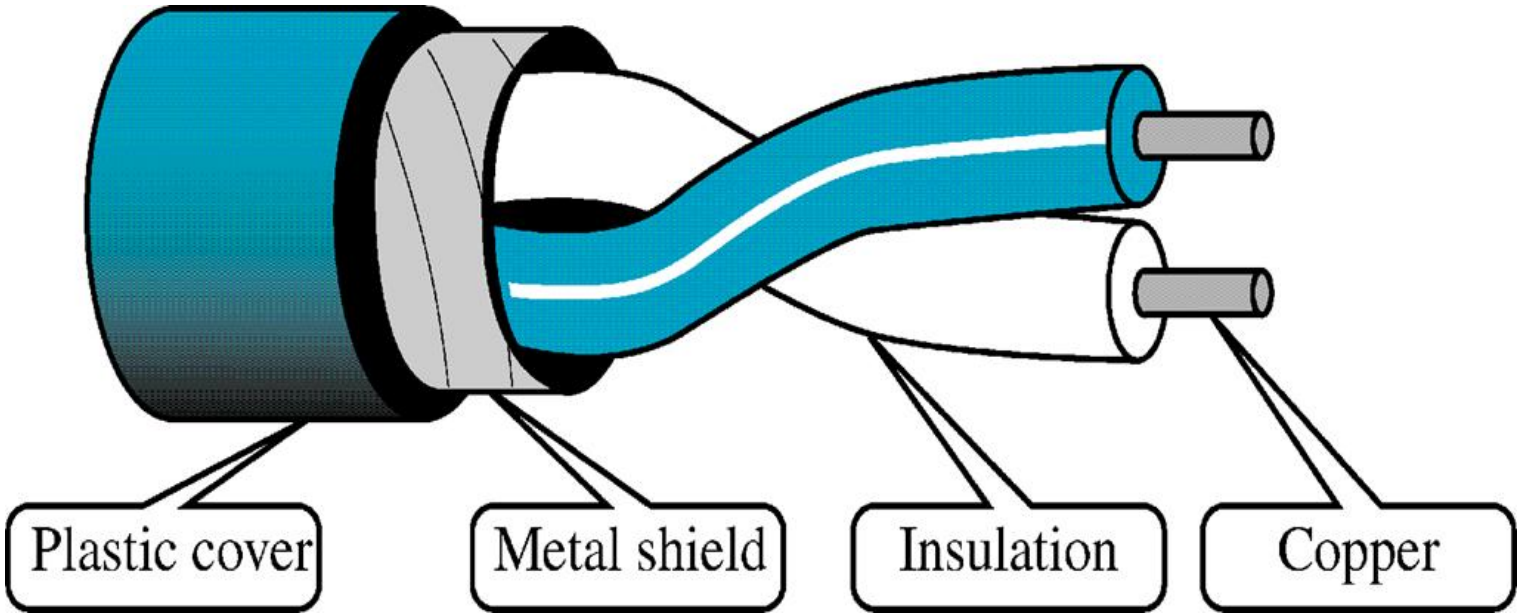
TRANSMISSION MEDIA

Twisted-Pair Cable



TRANSMISSION MEDIA

Shielded Twisted-Pair Cable



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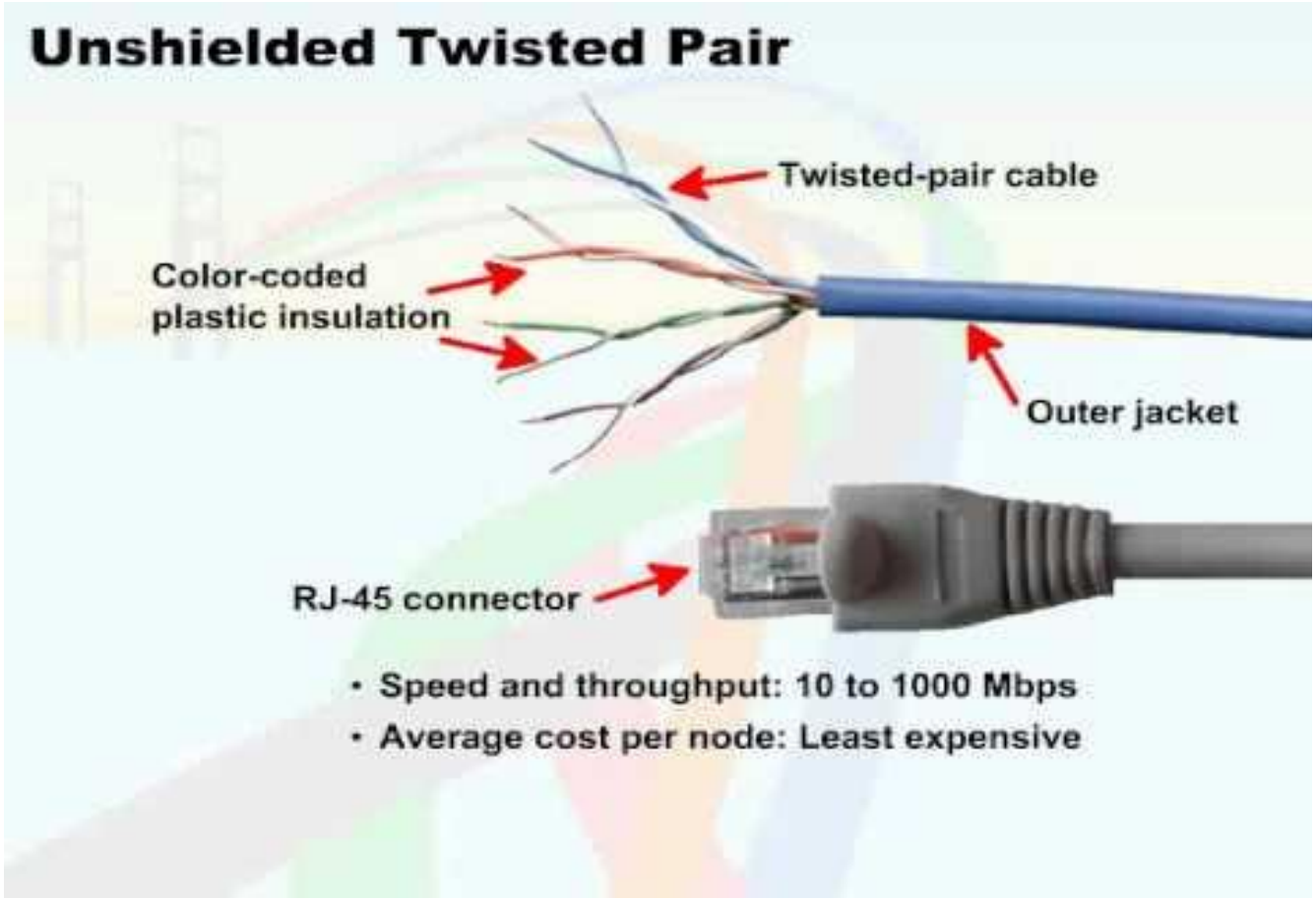
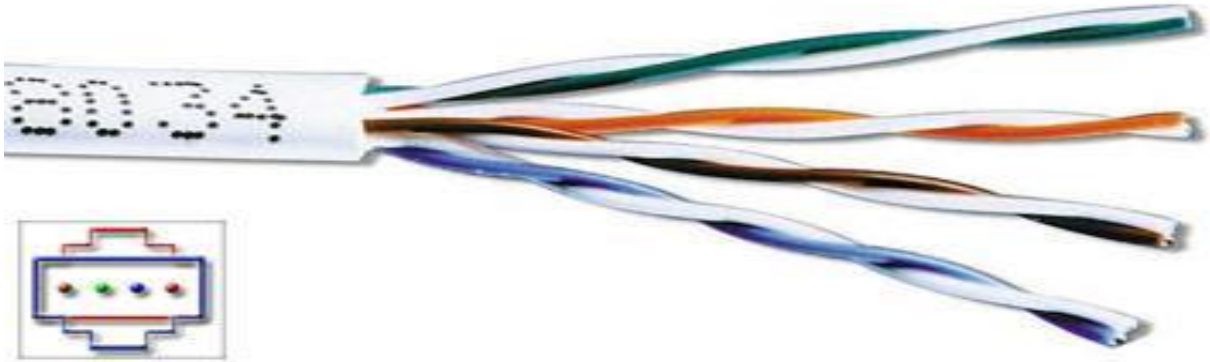


TRANSMISSION MEDIA

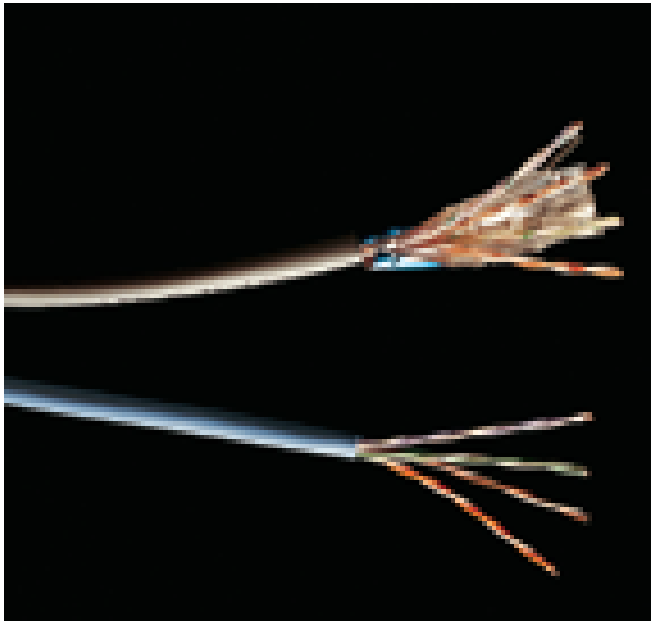
Shielded twisted pair (STP)

Unshielded twisted pair (UTP)



Twisted-pair cabling

- Most common LAN cable
- Called Cat5 or 100BaseT
- Four pairs of copper cable twisted
- May be shielded from interference
- Speeds range from
  1 Mbps to 1,000 Mbps



Twisted-Pair Cable

- In twisted pair technology, two copper wires are strung between two points.
- The two wires are typically ``twisted'' together in a helix to reduce interference between the two conductors .
- Twisting decreases the cross-talk interference between adjacent pairs in a cable.
- Typically, a number of pairs are bundled together into a cable by wrapping them in a tough protective sheath.

Twisted-Pair Cable

- Can carry both analog and digital signals.
- Data rates of several Mbps common.
- Spans distances of several kilometers.
- Data rate determined by wire thickness and length.
- In addition, shielding to eliminate interference from other wires impacts signal-to-noise ratio, and ultimately, the data rate.
- Good, low-cost communication. Indeed, many sites already have twisted pair installed in offices -- existing phone lines!

Twisted-Pair Cable

Typical characteristics:

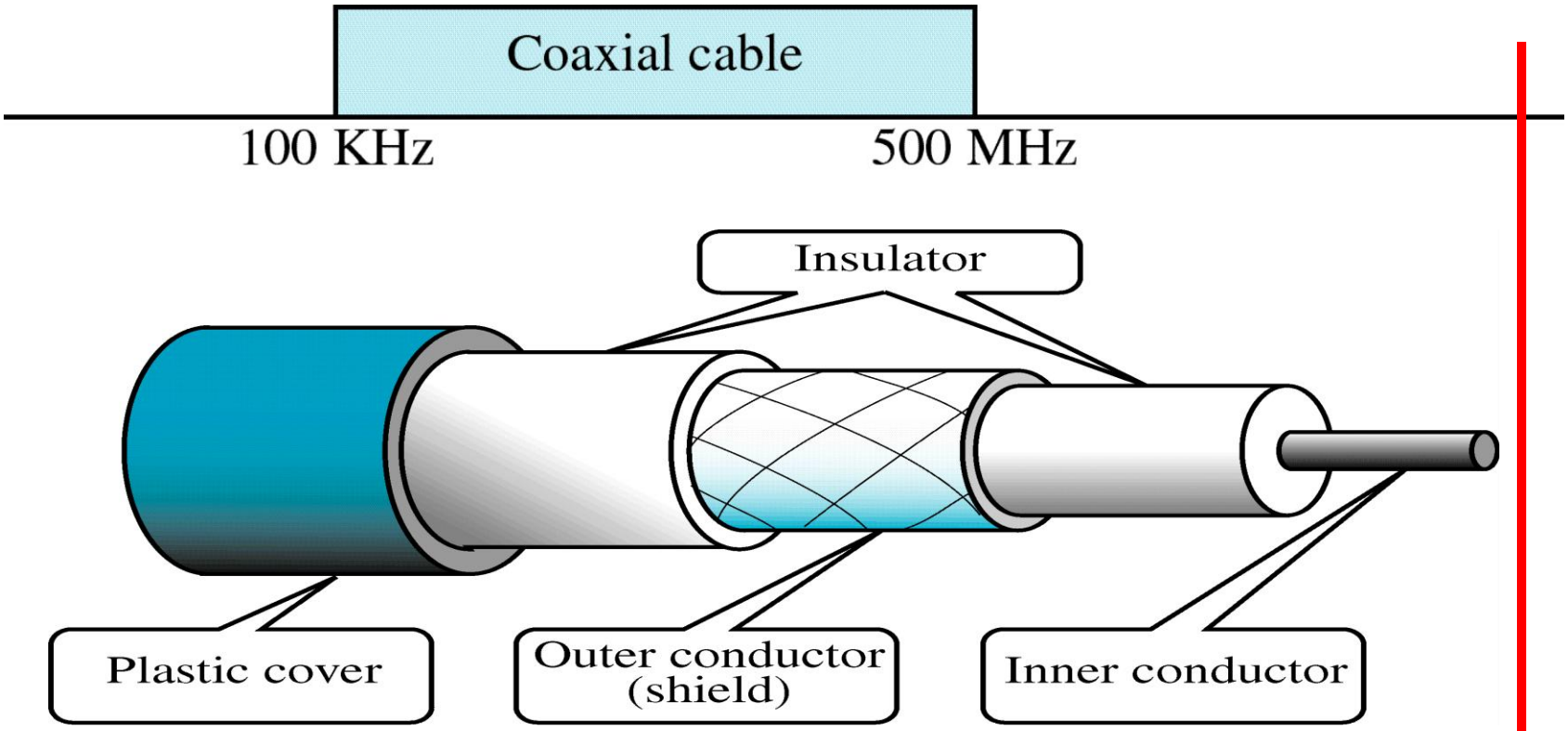
- Twisted-pair can be used for both analog and digital communication.
- The data rate that can be supported over a twisted-pair is inversely proportional to the square of the line length.
- To reduce interference, the twisted pair can be shielded with metallic braid. This type of wire is known as *Shielded Twisted-Pair (STP) and the other form is known as Unshielded Twisted-Pair (UTP)*

Use:

The oldest and the most popular use of twisted pair are in telephony. In LAN it is commonly used for point-to-point short distance communication (say, 100m) within a building or a room.

Coaxial Cable

- Carries signals of higher frequency ranges than twisted pair cable.



Coaxial Cable

- Central core conductor – solid or stranded wire
- Outer conductor – metal foil, braid or a combination of both – serves as shield against noise and it acts as a second conductor.

Coaxial Cable Connectors

- It is used to connect coaxial cable to devices.
- Three types of connectors are BNC connector, BNC T connector, BNC terminator (BNC – Bayone – Neill Concelman)

BNC Connector – used to connect the end of the cable to a device.

BNC T Connector – used to branch out to a connection to a computer or other device

BNC Terminator – Used at the end of the cable to prevent the reflection of the signal.

Performance

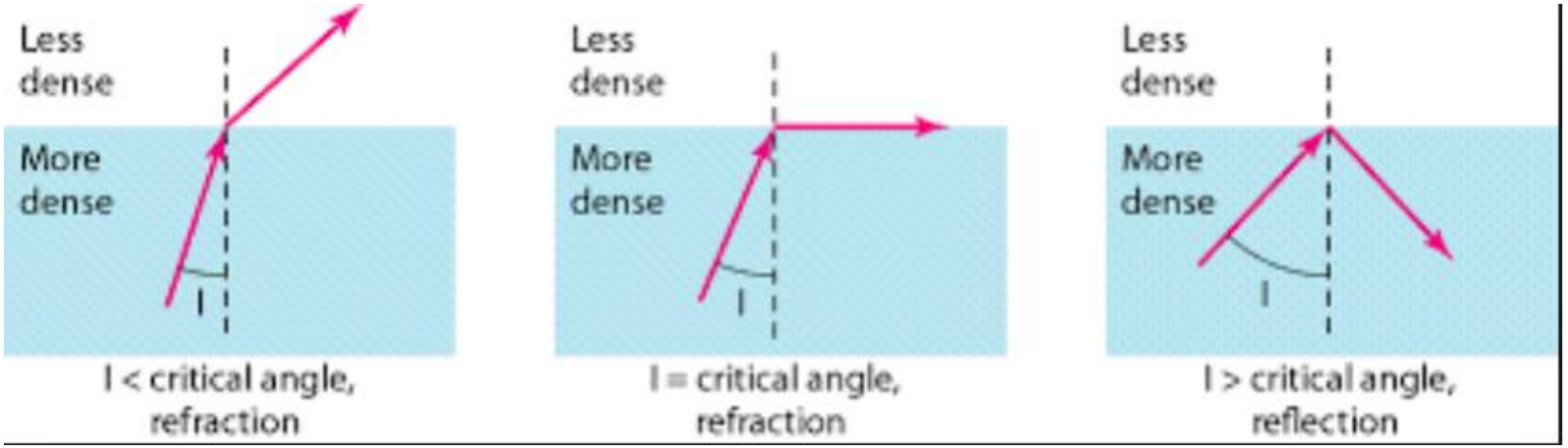
- Attenuation is much higher in coaxial cables than in twisted pair cable, so the signal weakens rapidly and requires the frequent use of repeaters.

Fiber Optic Cable

- A Fiber optic cable is made of glass or plastic and transmit signals in the form of light.
- if a ray of light traveling through one substance suddenly enters into another substance, the ray changes direction.

Fiber Optic –Operation Principle

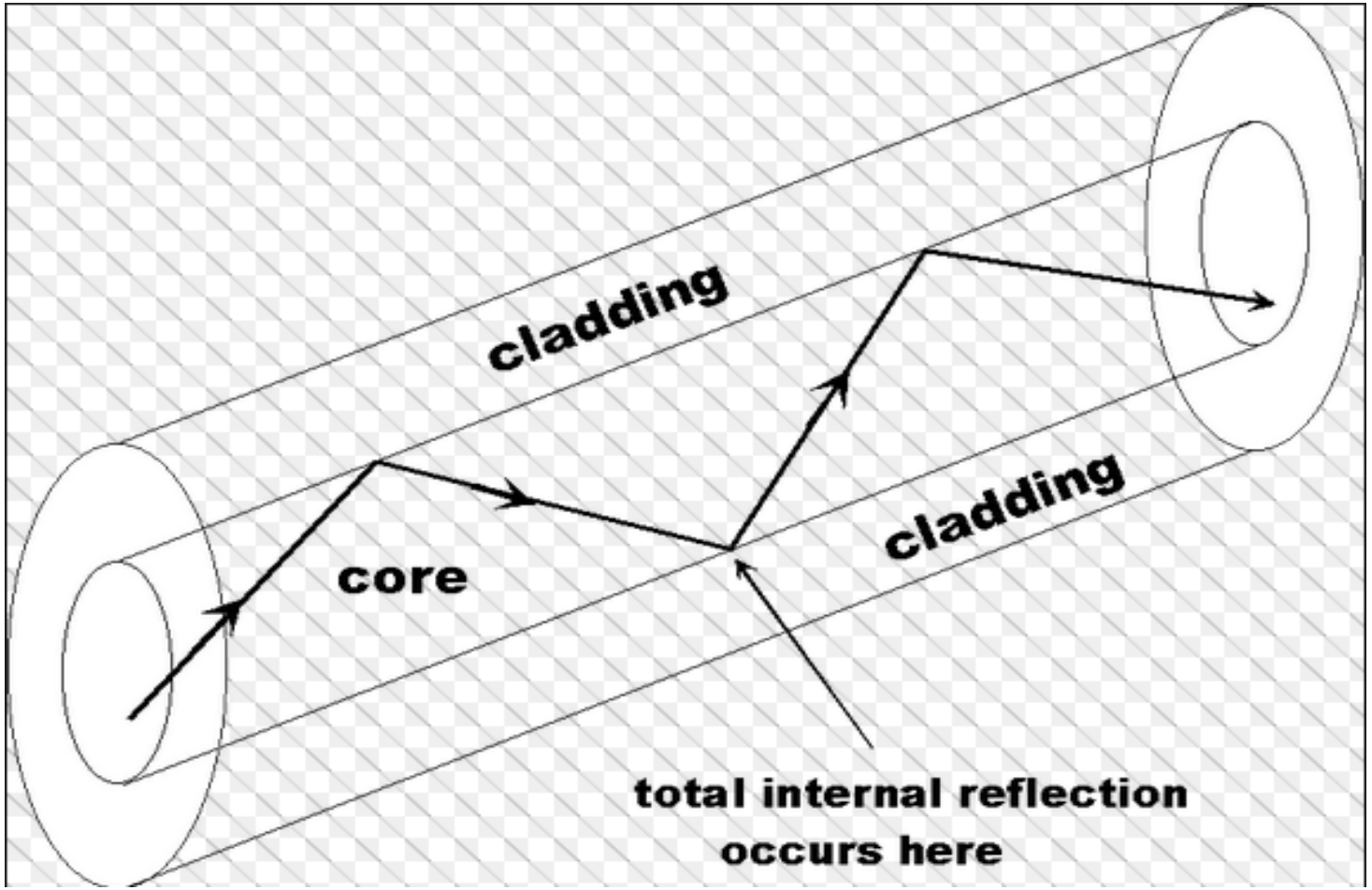
Fig shows how a ray of light changes direction when going from a more dense to a less dense substance.



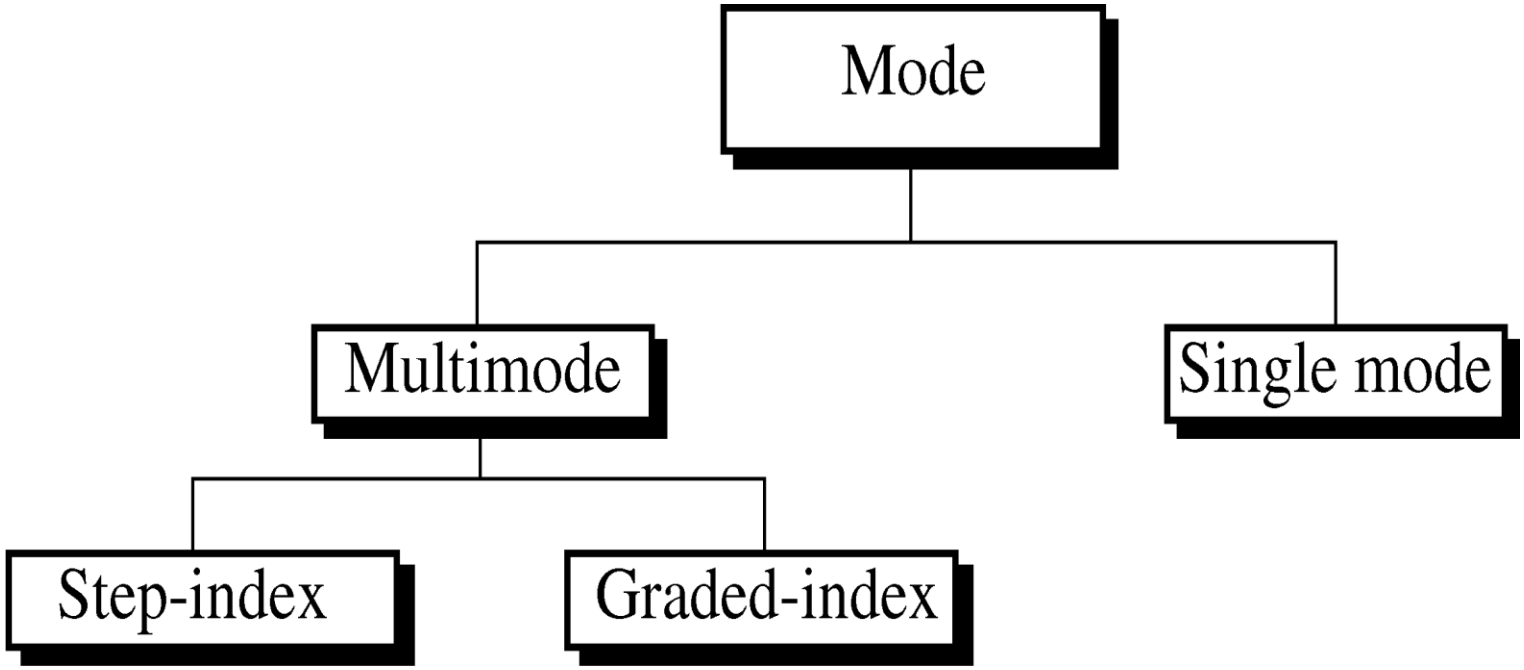
Fiber Optic –Operation Principle

- I < Critical angle, the ray refracts
- I = Critical angle, the light bends along the interface.
- I > Critical angle , the ray reflects.
- Optical fiber use reflection to guide light through a channel.
- A glass or plastic core is surrounded by a cladding of less dense glass or plastic.
- The difference in density of the two materials must be such that a beam of light moving through the core is reflected off the cladding instead of being refracted into it.

Fiber Optic –Operation Principle



Propagation Modes



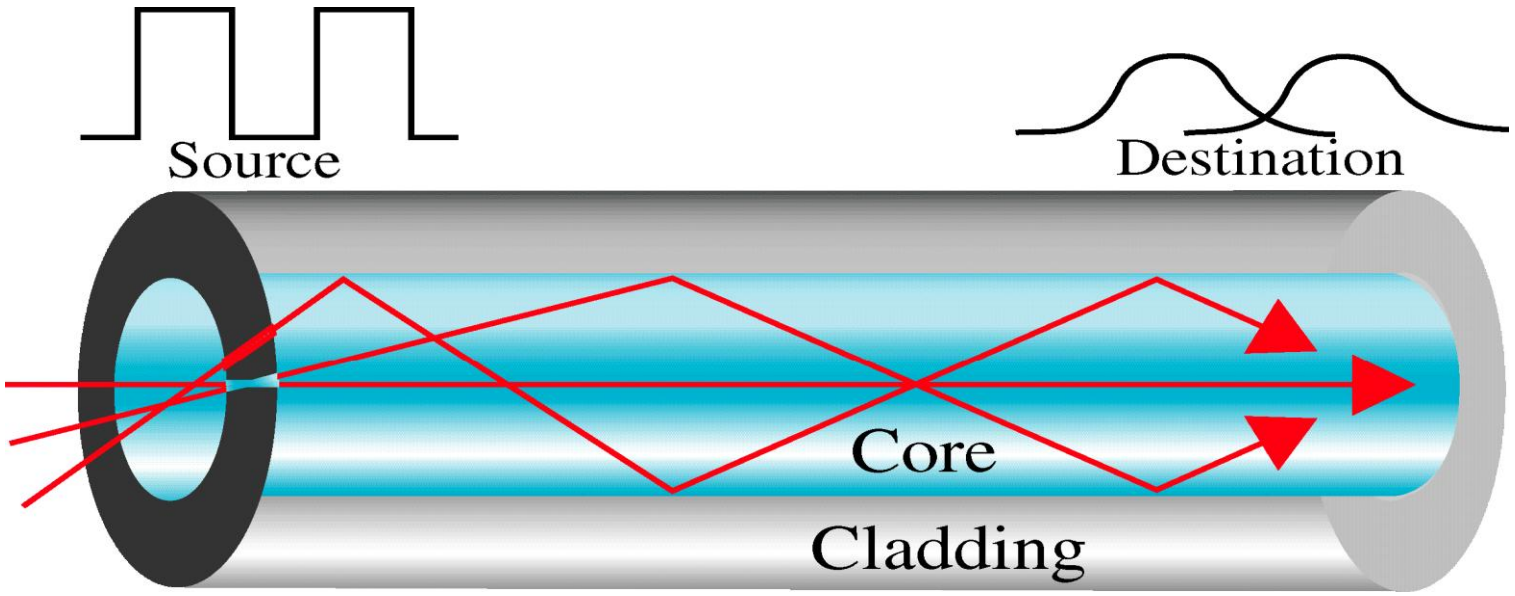
Multimode

- Its so named because multiple beams from a light source move through the core in different paths.
- Multimode step index fiber – density of the core remains constant from the center to the edges.
- At the core cladding interface there is abrupt change in the density- step index.
- Distortion of the signal is more.

Multimode

- A beam of light moves in straight line through the constant density core until it reaches the core cladding interface where the angle of the beams motion is altered due to change in density – this contributes to the signal distortion.

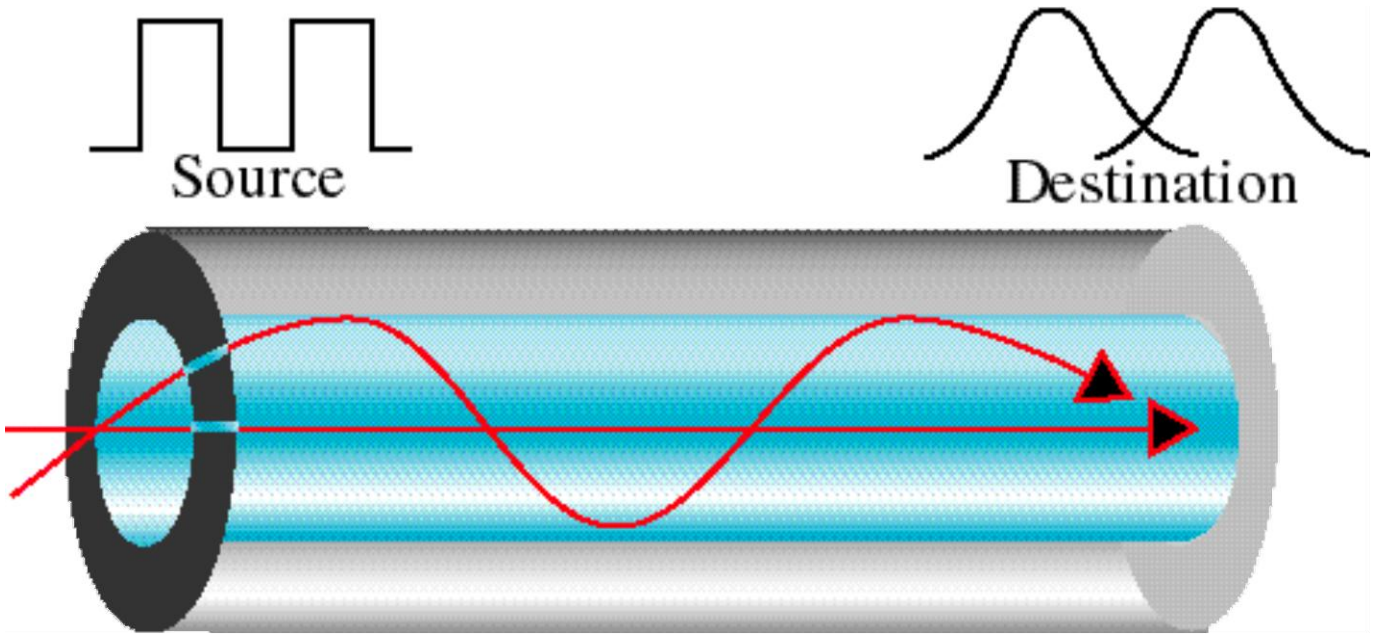
Multimode Step-Index



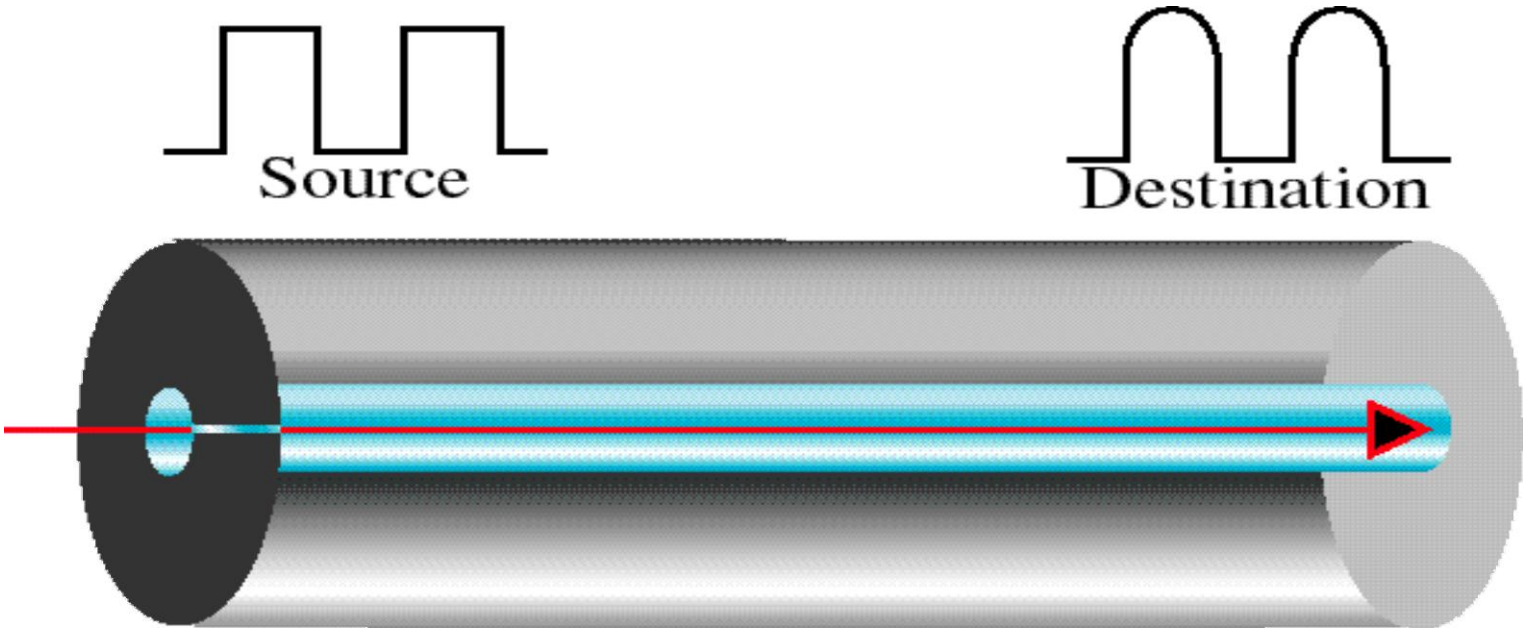
Multi mode Graded index fiber

In graded index fiber density is highest at the center of the core and decreases gradually to its lowest at the edges – distortion is less.

Multimode Graded-Index



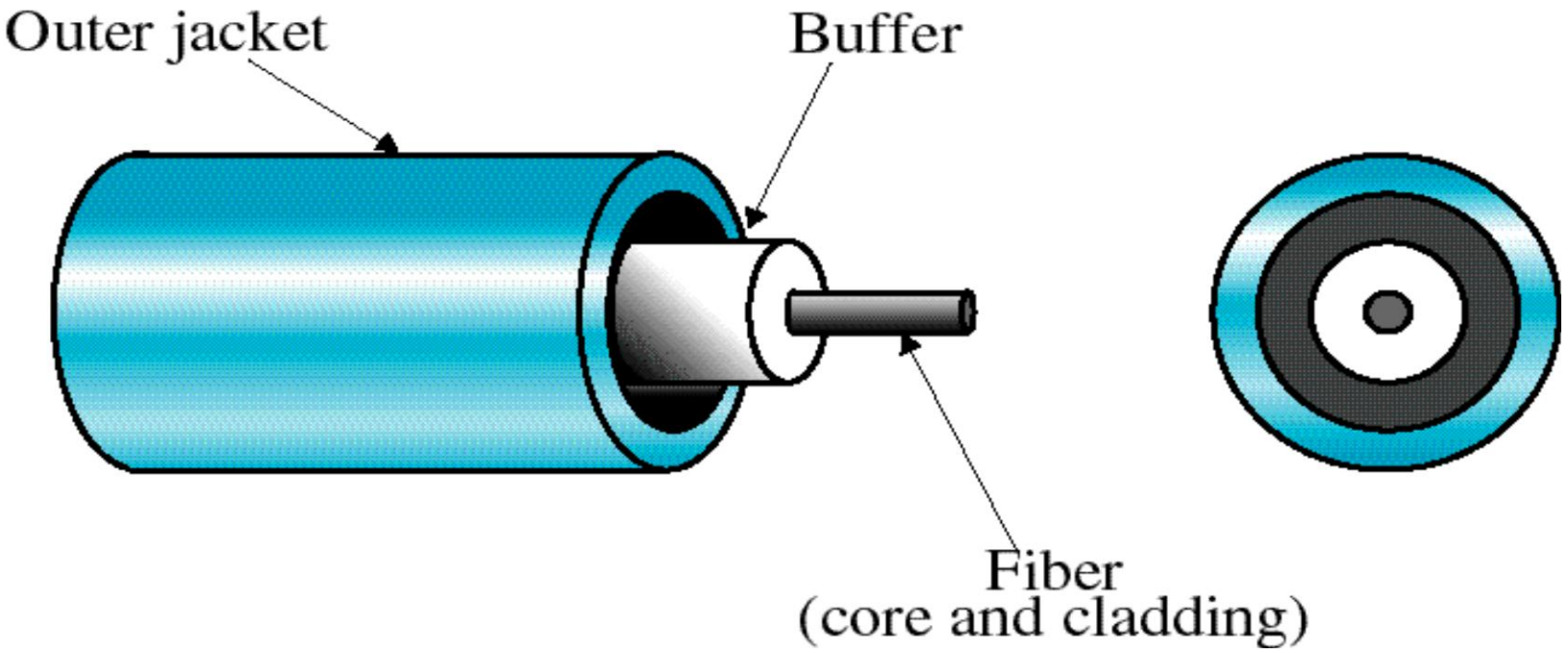
Single Mode



Fiber Sizes

- Optical fibers are defined by the ratio of the diameter of their core to the diameter of their cladding.
- 50 / 125 – 50µm core and 125 µm cladding.

Fiber Construction



Fiber Construction

- Outer jacket – PVC or teflon
- Inside the jacket are kevlar strands to strengthen the cable.
- Kevlar – strong material – bullet proof vests.
- Below the kevlar – another plastic coating to cushion the fiber.
- The fiber is at the center of the cable with core and cladding

ntages

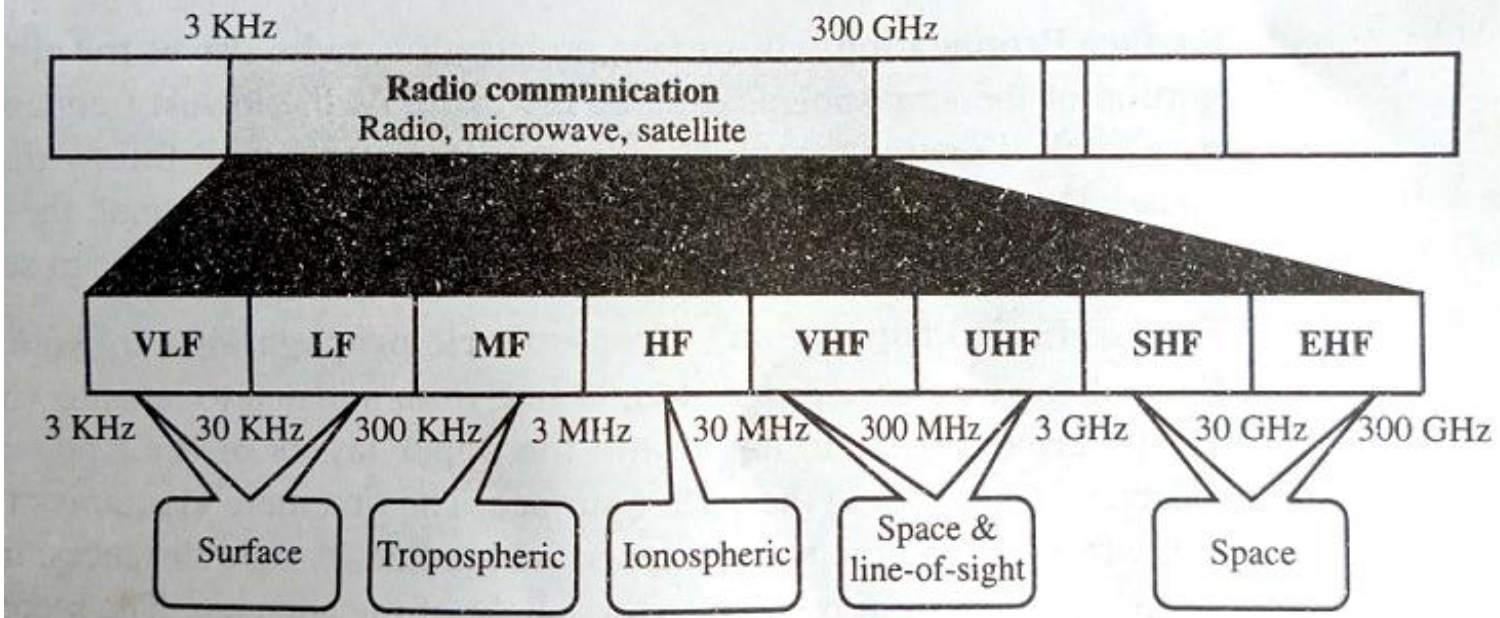
- Higher Bandwidth
- Less signal attenuation – a signal can run 50 km without regeneration.
- Immunity to electromagnetic interference
- Resistant to corrosive materials
- Light weight

Disadvantages

- Installation and maintenance requires expertise
- Unidirectional light propagation – for bidirectional communication we need 2 fibers.
- Cables and interfaces are more expensive.

Unguided Media

VLF	Very low frequency	VHF	Very high frequency
LF	Low frequency	UHF	Ultra high frequency
MF	Middle frequency	SHF	Super high frequency
HF	High frequency	EHF	Extremely high frequency



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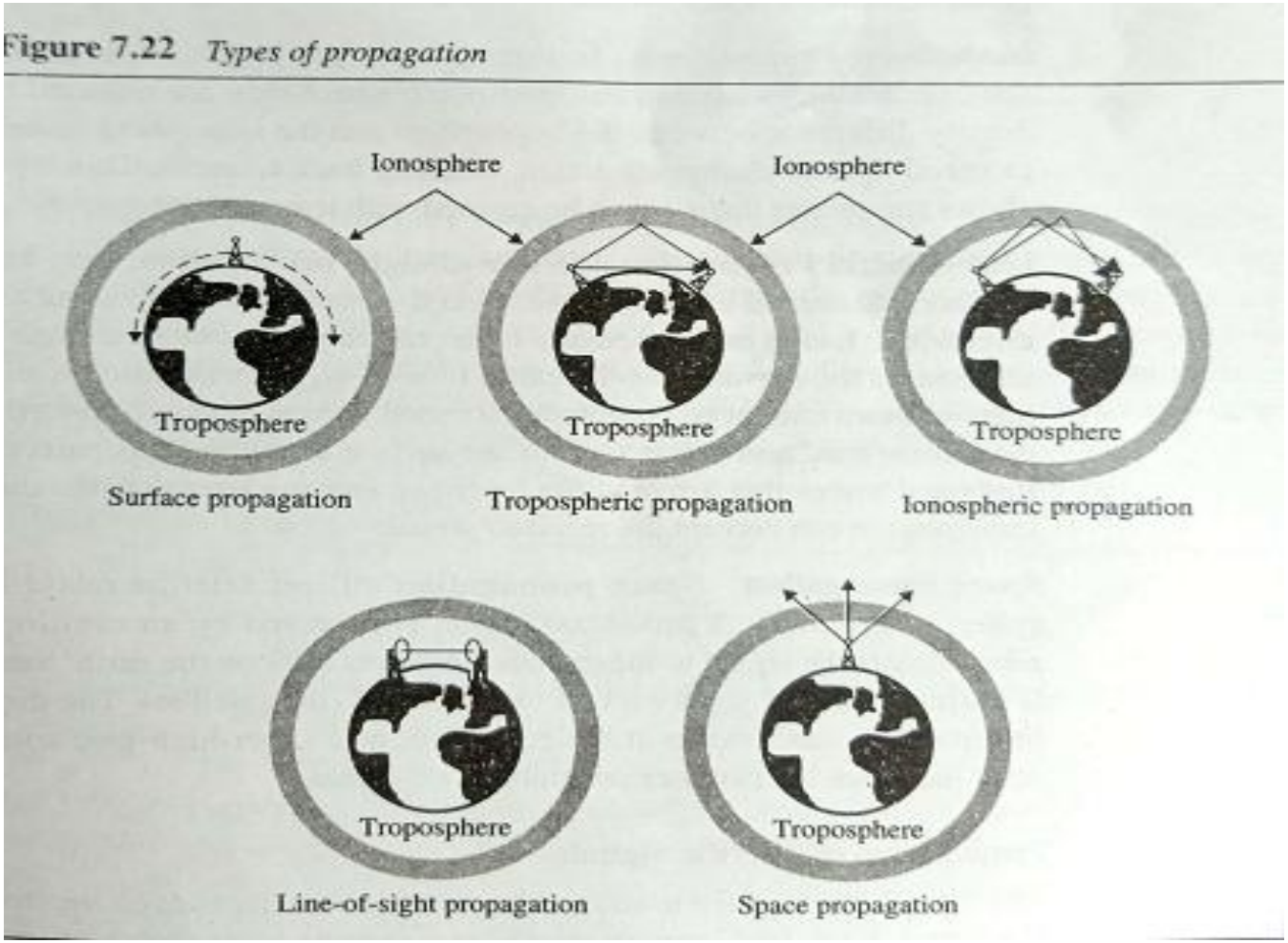
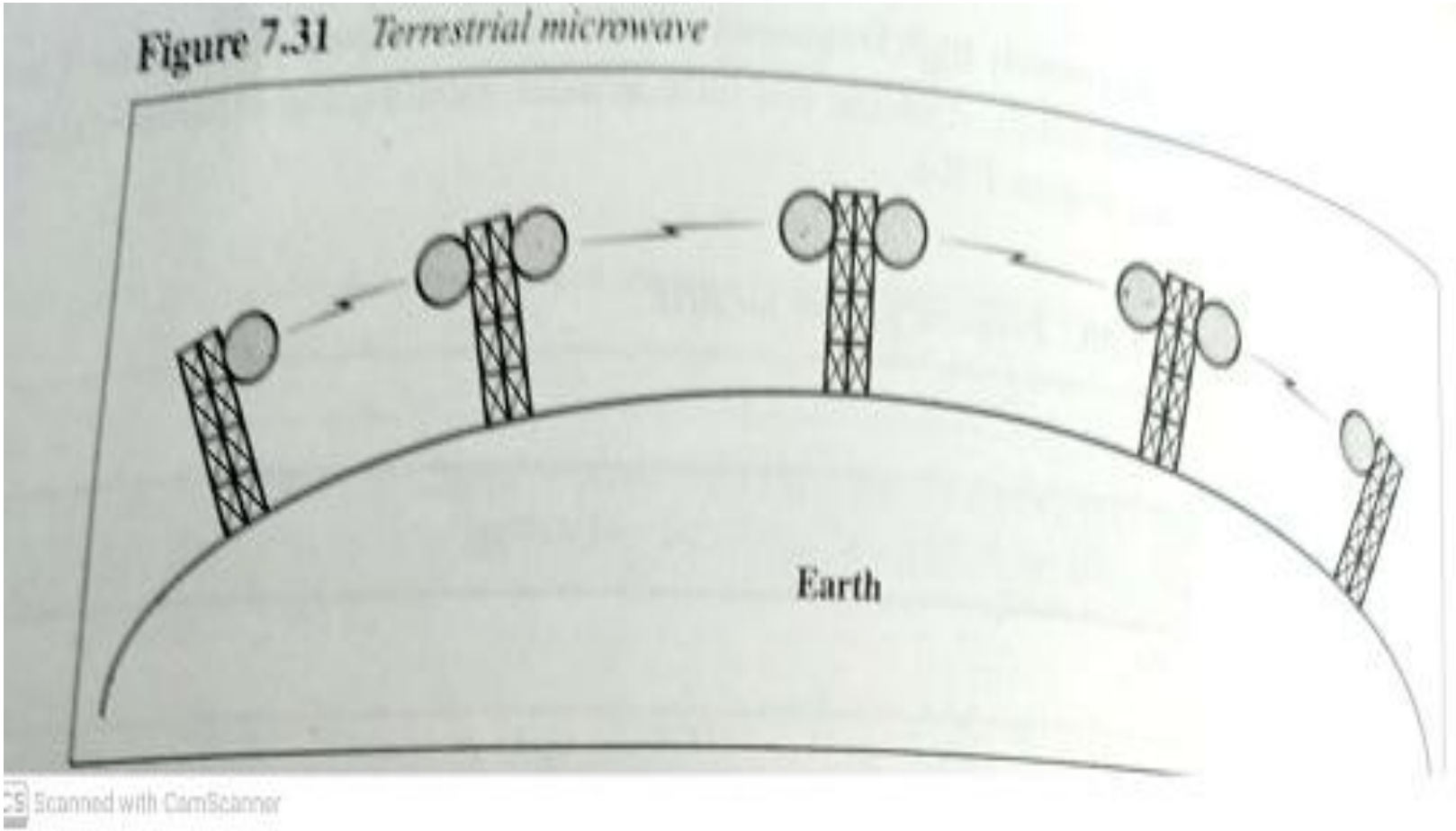
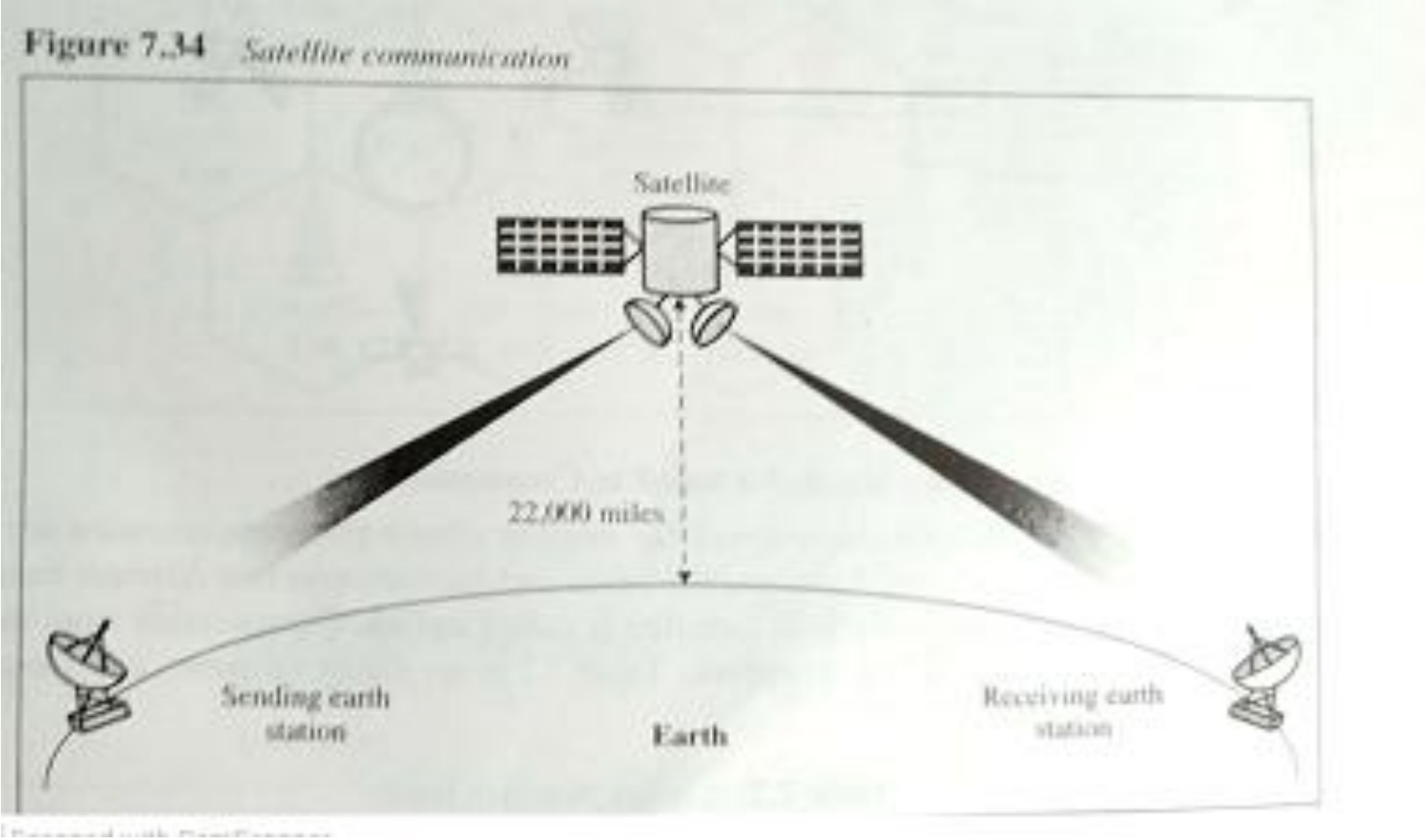


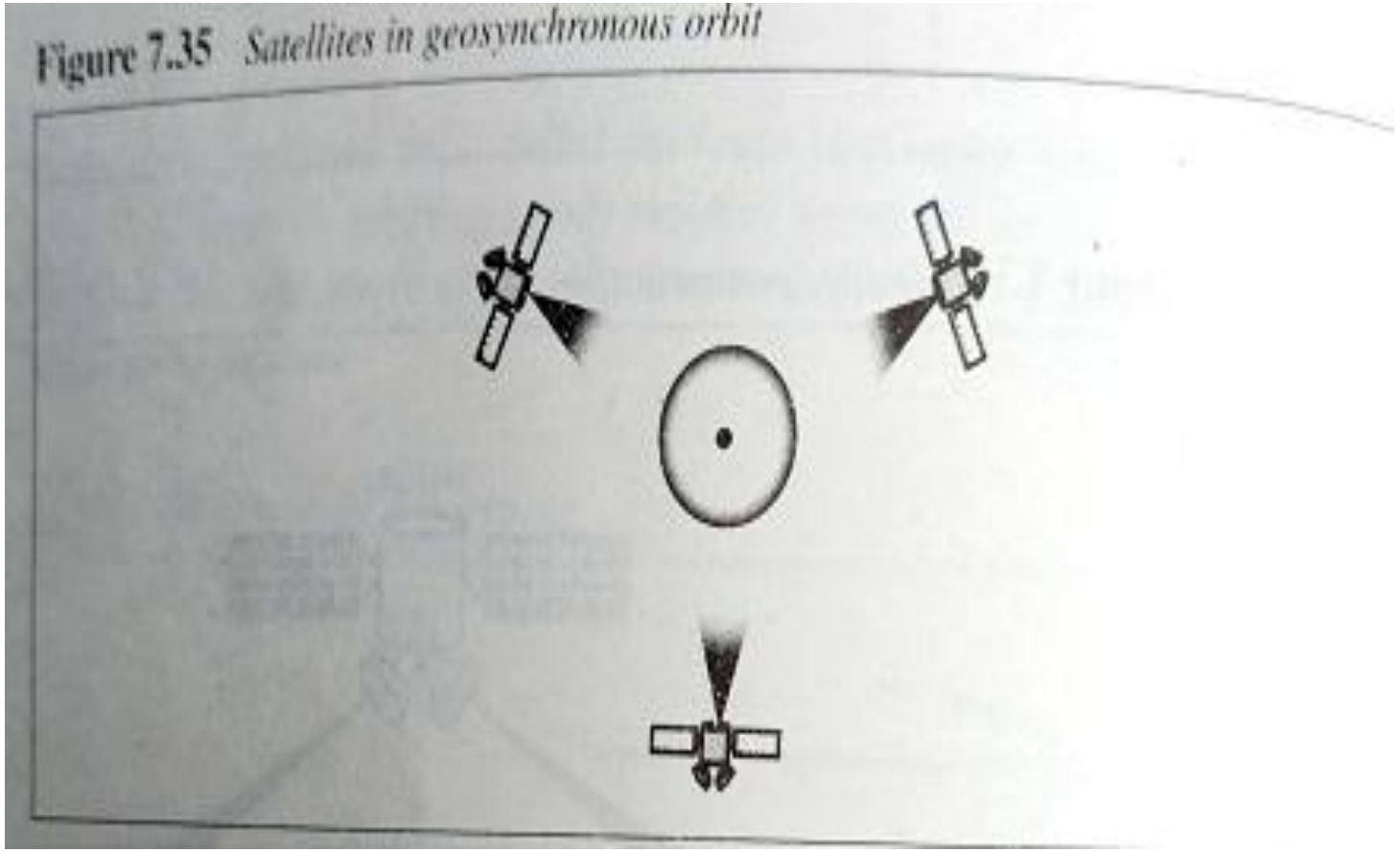
Terrestrial Microwave



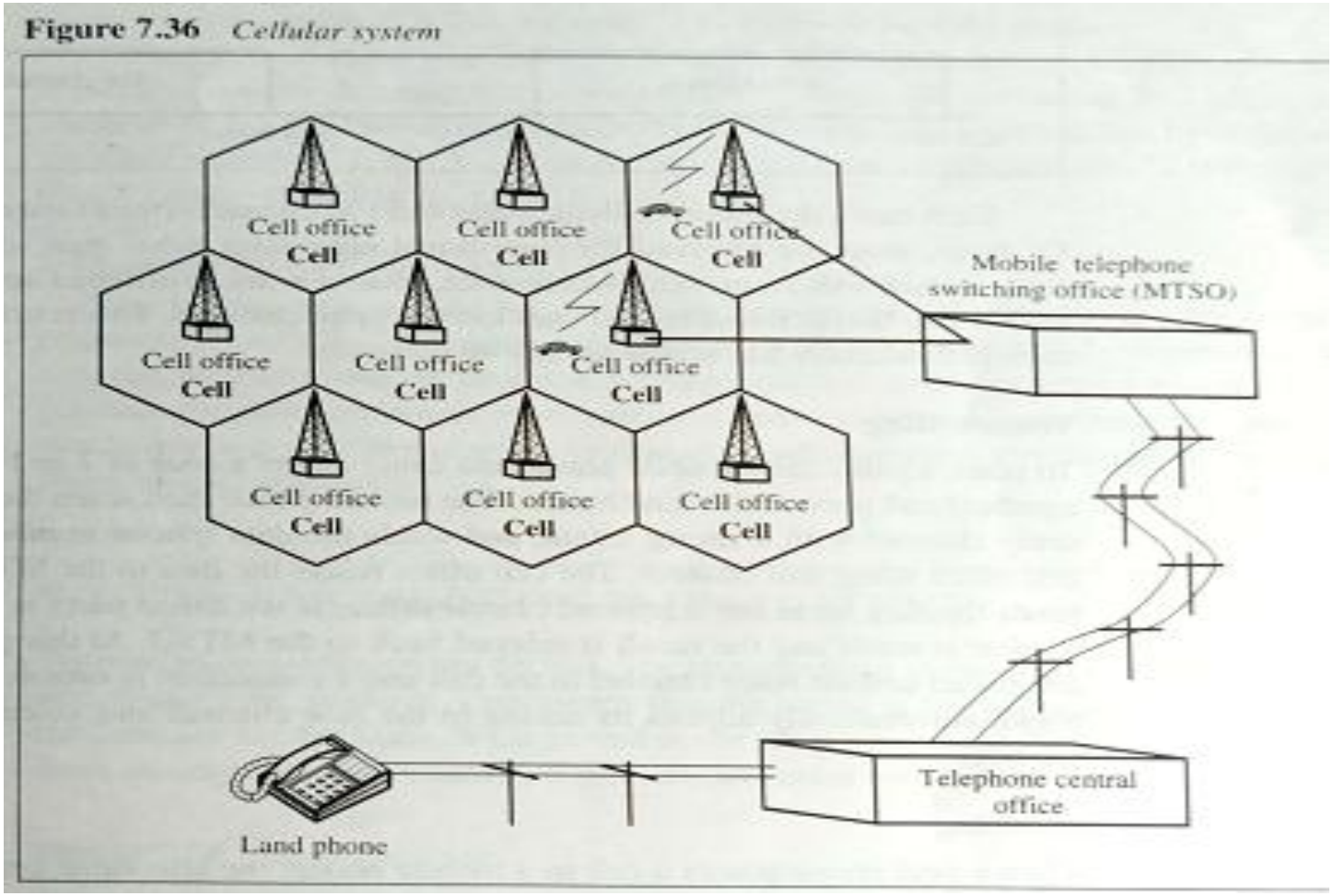
Satellite Communication



Geosynchronous Satellite



Cellular System



THANK YOU