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Participant Handbook

Sector
Electronics

Sub-Sector
Communication

Occupation
After Sales Service

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NSQF Level 4

Digital Cable Technician - Access

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> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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Certificate

COMPLIANCE TO

QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

ELECTRONICS SECTOR SKILL COUNCIL OF INDIA

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **"- Digital Cable Technician - Access "** QP No. **"ELE/Q8106, NSQF Level 4"**

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Authorised Signatory
(Electronics Sector Skill Council)

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The need for having a standard curriculum for the Job Role based Qualification Packs under the National Skills Qualification Framework was felt necessary for achieving a uniform skill based training manual in the form of a participant handbook.

I would like to take the opportunity to thank everyone who contributed in developing this handbook for the QP Digital Cable Technician - Access.

The handbook is the result of tireless pursuit to develop an effective tool for imparting the Skill Based training in the most effective manner.

I would like to thank the team of KontentEdge for their support to develop the content, the SME and the team at the ESSCI along with the industry partners for the tireless effort in bringing the handbook in the current format.

CEO

Electronics Sector Skills Council of Indi

About this Book

This Participant Handbook is designed to enable training for the "Digital Cable Technician – Access" Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit/s.

Key Learning Objectives for the specific "Digital Cable Technician – Access" mark the beginning of the Unit/s for that NOS.

1. Explain the history behind cable and TV
2. Explain master distribution centre
3. Identify headend components
4. Identify Cable types
5. List the tools and devices at work
6. Explain Cable laying procedure
7. Explain STB installation and configuration
8. List testing procedure
9. List the troubleshooting procedures
10. Explain the troubleshooting cases
11. Identify the safety procedure
12. Explain safety
13. Use appropriate language for communication
14. Make the best impression

The symbols used in this book are described below.

Symbols Used


Key Learning Outcomes


Steps


Role Play


Tips


Notes


Unit Objectives


Activity

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1. Basics of Digital Cable Technology

Unit 1.1: Evolution of Cable and Satellite Television

Unit 1.2: Headend System and Distribution Network

Unit 1.3: Multi Play Digital Services

Unit 1.4: Access Network Architecture

ELE/N8108, ELE/N8109
ELE/N8112

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain the history behind cable and TV
2. Explain master distribution centre
3. Identify headend components
4. Identify Cable types
5. Explain cable structure
6. Identify supporting wires
7. Explain connectors
8. Define amplifier and power inserter

UNIT 1.1: Evolution of Cable and Satellite Television

Unit Objectives

At the end of this unit, you will be able to:

1. Explain the history of cable TV
2. Explain the history of satellite television in India

Television was introduced to India, with experimental transmission from Delhi, on September 15, 1959. It was managed and controlled by All India Radio (AIR) which provided the engineering and programme professionals. That time, it included:

- 21 community television sets (CATV)
- A make shift studio
- A low power transmitter

In 1965, a news bulletin, in addition with a daily one-hour service, was started. The services were extended to a Mumbai in 1972.

The television stations were set up by Doordarshan in 7 cities by 1975. Those cities are Calcutta, Chennai, Srinagar, Amritsar and Lucknow. Though in the beginning, AIR and Doordarshan were controlled by the same management, but later, in 1976, Television services were separated from Radio.

The initial version of CATV started taking place in the households in some states, such as Maharashtra and Gujarat, by the name of Master antenna Television (MATV). In this system, one common antenna at the rooftop was used to serve 1 Door darshan channel and a local VCR channel in analog mode.

Doordarshan started facing a big challenge in the decade of 1990s. The Gulf War was covered by CNN through satellite and was telecast, in the national channels of the Asian and western countries. It created potentiality among the viewers, particularly in developing countries, to watch foreign broadcast via satellite.

In 1992, a Hong Kong based group of companies launched a Satelite, for Satellite Television Asian Region (STAR), whose footprint was available in Indian subcontinent. The STAR Television programmes are broadcast by AsiaSat-1 Satellite. The STAR TV channels, for example, Star Plus, BBC, Prime Sports and MTV (which is now replaced by V Channel) relay their signal round the clock. Zee TV, a Hindi channel, started showing its programs by using a transponder from Star TV.

The advent of Satellite television motivated the cable operators to receive its programs of the channels, rising on a regular interval. They also show their own programs, such as, popular serials and film based programmes in their own local channel, apart from linking satellite channels. It provided the Indian middle class families, an alternative of the DD. The popularity of satellite television became popular in small towns and villages of India too, as well as the metropolitan cities.

The demand of the customers for various channels was found increasing day by day with the growing number of channels. It was a limitation for analog transmission to create any further expansion. The era of digitization came in to action in 2003, starting from Metro cities and covering all the Indian subcontinents by December 2016. It recent days, more than 1200 channels are available in Indian footprint including SD and HD transmission. Customers can choose a plan to view the channels of his/her choice and pay only for those.

In the journey from MATV to Multi play services, there has been a significant advancement in the field of:

- Transmission technology
- Video compression and modulation technology
- Access technology or various delivery platforms

Development of fibre technology and its uses have provided unlimited bandwidth of data propagation and thus, made the network faster.

UNIT 1.2: Headend System and Distribution Network

Unit Objectives

At the end of this unit, you will be able to:

1. Explain Cable and cable types
2. Explain Headend system
3. List the Cable Connectors
4. Describe Power Inserter
5. Describe Amplifier

1.1.1 Basic of Headend System

The master distribution centre of a CATV system is the headend, that receives the incoming television signals from various video sources such as video players, DBS satellites or local studios. It then selects the signal, amplifies and re-modulates them onto TV channels so that they can be transmitted through a distribution network, down the CATV system.

The incoming signals for headend systems, involve satellite receivers, off-air receivers and different types of transmission links. The signals are received and processed by the channel decoders. The headends typically use integrated receiver devices which incorporates multiple receiver and decoding and decryption functions into a single assembly. After the incoming signals are received, separated and converted into new formats, they are selected and encoded for being stored or retransmitted in the CATV network. These signals are then sent on the CATV distribution system after being modulated, amplified and combined.

Components of Headend System

The following figure lists the components of headend system:

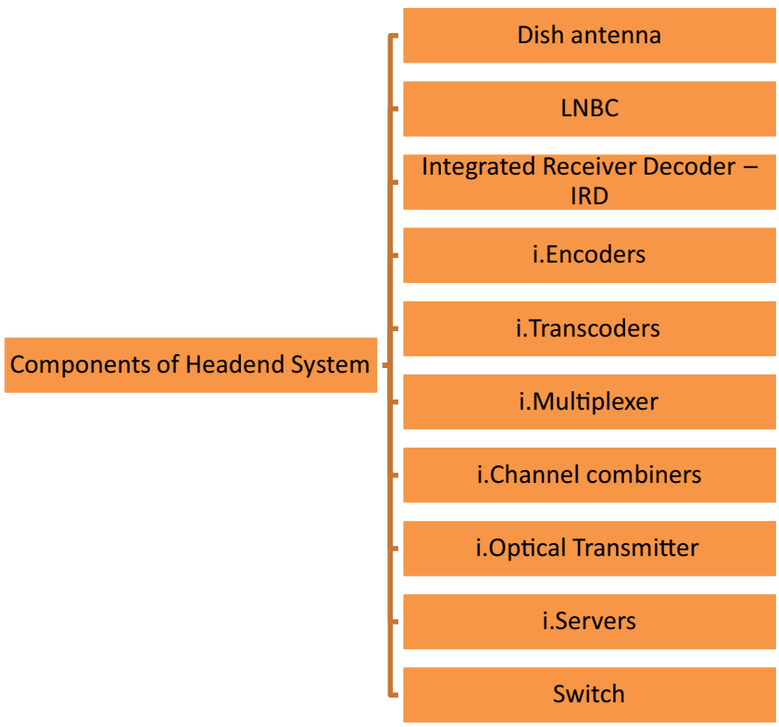

Fig. 1.1.1: Headend system components

Dish Antenna

It is a parabolic reflector that acts as the gateway of the satellite signal by receiving it from the satellite in C' band frequency within the range from 3.7 to 4.3 GHZ and concentrating them in a focal point where the they are gathered by a low noise block converter (LNBC).

LNBC

It is the device, placed in the front of the dish antenna. It receives the low-level microwave signal from satellite, amplifies and converts them to a lower frequency band ranging from 950 to 2150 MHz and transmits them to the indoor receiver.

Integrated Receiver Decoder (IRD)

The IRD helps to recover the desired base-band signal by the following steps:

- It receives low band frequency signals from LNBC
- It processes and decodes the signal
- It demodulates them and then decode as per the encoding system (while transmitted)

The following figure shows the components of IRD:

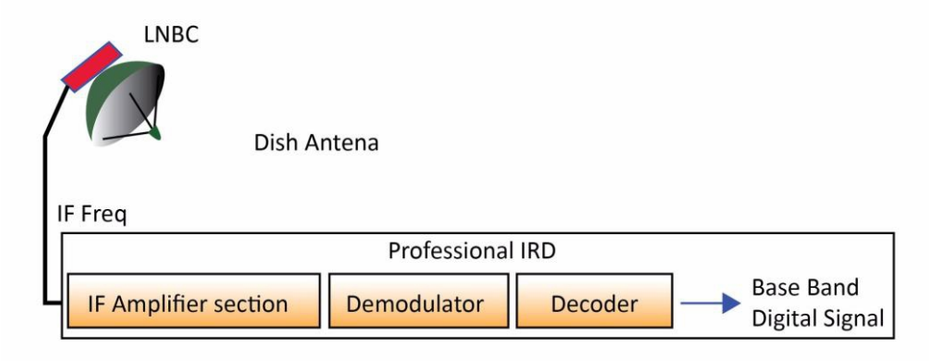

Fig. 1.1.2: IRD components

There are two professional IRD outputs. They are:

1. **Asynchronous Serial Interface (ASI):** It uses a 270-Mbps digital signal for transferring one or more compressed video, audio or various data signals, from the MPEG transport stream packets.
2. **Serial Digital Interface (SDI):** It is a family of digital video interfaces which was first standardized by the Society of Motion Picture and Tel evision Engineers (SMPTE). The use of this interface are as follows:

a. The digital video interfaces defined by SMPTE 259M are used for broadcast-grade video.
b. High-definition SDI, standardized in SMPTE 292M, offers a nominal data rate of 1.485 Gbit/s
c. Uncompressed and unencrypted digital video signals, that may include embedded audio and time code, are transmitted within television facilities using SDI standards.
d. The standards can also be used for packetized data.

Difference between ASI and SDI Signal

Both ASI and SDI may be serial digital streams and use BNC connectors. But they are not interchangeable, which means, SDI cannot be fed out of one device and put into another device that is expecting ASI or vice versa. The main difference between the ASI and SDI signals is listed in the following table:

ASI	SDI
•ASI carries compressed data that may incorporate multiple programs, available in a particular frequency of a transponder.	•SDI is an uncompressed format for transferring a baseband digital signal which include audio or video program.

Fig. 1.1.3: Difference between ASI and SDI

Encoders

The encoders digitize the analog video signal to a baseband digital signal, compress and modify the format of the data and control signals which need to be transmitted by using some standard devised format or codec. The following figure shows location of encoder:

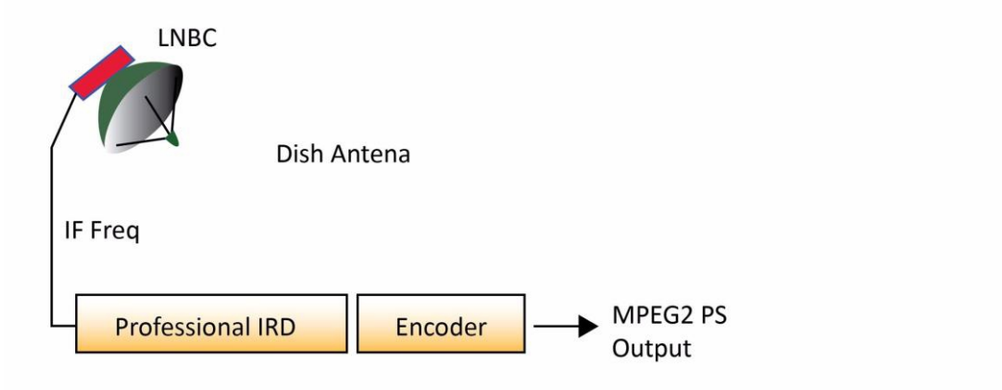

Fig 1.1.4: Location of encoder

Transcoder

It changes the format of a digital video, to make them viewable across various platforms and devices. Video transcoding is one to adapt the media formats, such as changing a MPEG-2 format to MPEG-4 format.

Multiplexer

It takes multiple program streams such as ASI or MPEG PS, to be transmitted through various channels, services, SMS, CAS, EPG and combines them into a single ASI or MPEG2 TS. This intelligent device is also called Multiple Program per Transport Stream (MPTS). The following figure shows the concept of a multiplexer:

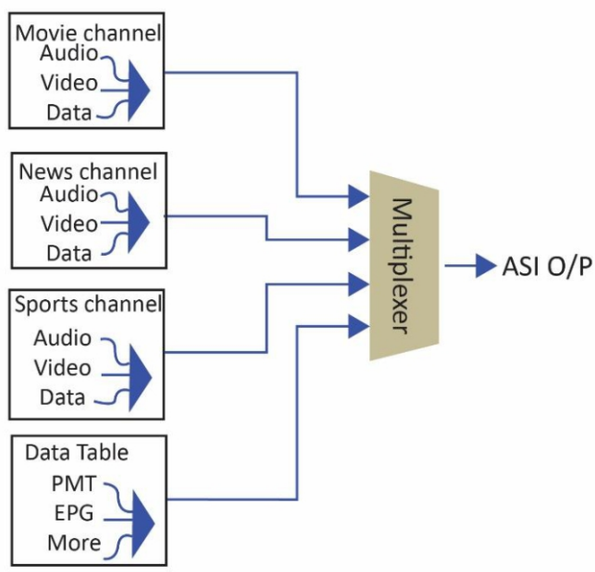

Fig. 1.1.5: Concept of a Multiplexer

Channel Combiners

It combines the multiple RF channels into a single transmission line preventing the signals from a single channel from pushing them back into a transmitter.

Optical Transmitter

An optical transmitter is a vital part of fibre optic communication. The light source of the transmitter, that coverts the electrical signal into light, may be light-emitting diodes (LEDs) or laser diodes (LDS). The following figure shows the concept of an optical transmitter:

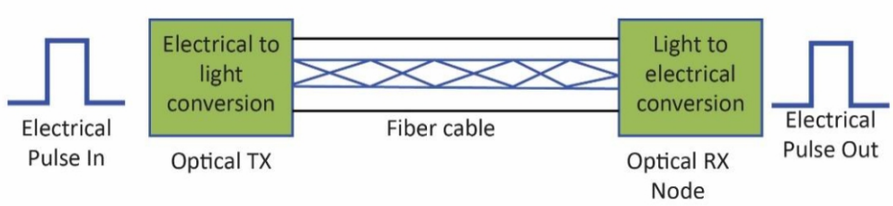

Fig. 1.1.6: Concept of an optical transmitter

Servers

A server is a hardware device, used to store, retrieve and send files and data from one electronic device to other devices such as computers, handheld gadgets or display devices connected on a network. On a wider scale, Internet, the worldwide computer network, depends on a large number of servers around the world. The files, data and functionality of a website are dependent on servers. It is a most powerful and contains high memory and storage.

Servers hold more power than their client computers in context to processing, memory and storage. The client computer requests information from the server. The servers are classified based on their usage.

The following figure lists the different types of servers:

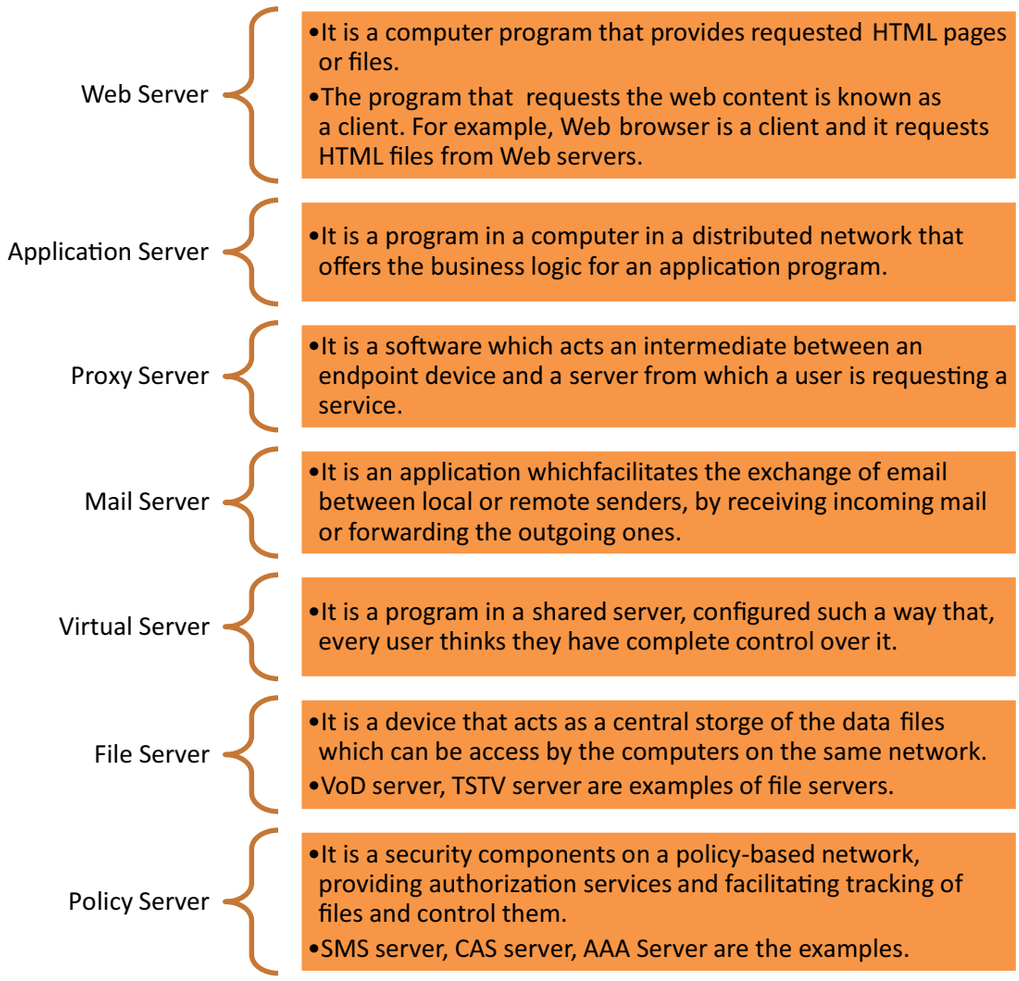

Fig. 1.1.7: Different types of servers

Switch

A switch is a network device which connects multiple devices, connected to the network. It receives, processes and forwards data, using packet switching, to the destination device. It acts as a multiport network bridge, that processes and forwards data at the data link layer, by using hardware addresses. Layer-3 switches or multilayer switches, also, process data at the network layer by incorporating routing functionality.

The digital services are basically packetized video which are stored in differed formats. The formats depend on the types of the devices that are required to be served. When the file is requested by a customer, it is routed to him/her by the switch only, after proper authentication.

1.1.2 Basic Distribution Network

A distribution network is used to distribute digital video programs, data services and value added digital services to the end customers. All the customers must be connected by cables to the Central office or headend. The distribution network is designed by the network experts of the Service Providers, in such a way that the customers can receive the least threshold level of signal all the time.

The main elements of a distribution network are:

- Cables
- Connectors

Cable

Cables are the nerves of the distribution system for providing services. Various services such as Telecom, CCTV and broadband services require to be pushed through a cable network.

The types of cables depend on the geography, customer base and availability. The cables used for primary, secondary and tertiary network are known as trunk line, feeder line and distribution line respectively. The cables are used as per the requirement such as, its length, loss and future expansion of the distribution network. The following figure lists the cables used in distribution network:

Fig. 1.1.8: Cables used in distribution network

Optic Fibre Cable

As name suggest it has bunch of fibres which are protected with the use of individual plastic covers. Digital data signals are transferred up to distances of hundreds of miles, through the optical cables in the form of light. The cables provide higher throughput rates as compared to electrical communication cables. This cable is commonly used in trunk lines.

The fibre-optics is replacing the copper wire system. The difference between the two, lies in the mechanism used for the data transfer. The fibre-optics use light pulses to transmit information whereas the copper wire system uses electronic pulses for the transfer. The following figure lists the benefits of the use of fibre optic cables:

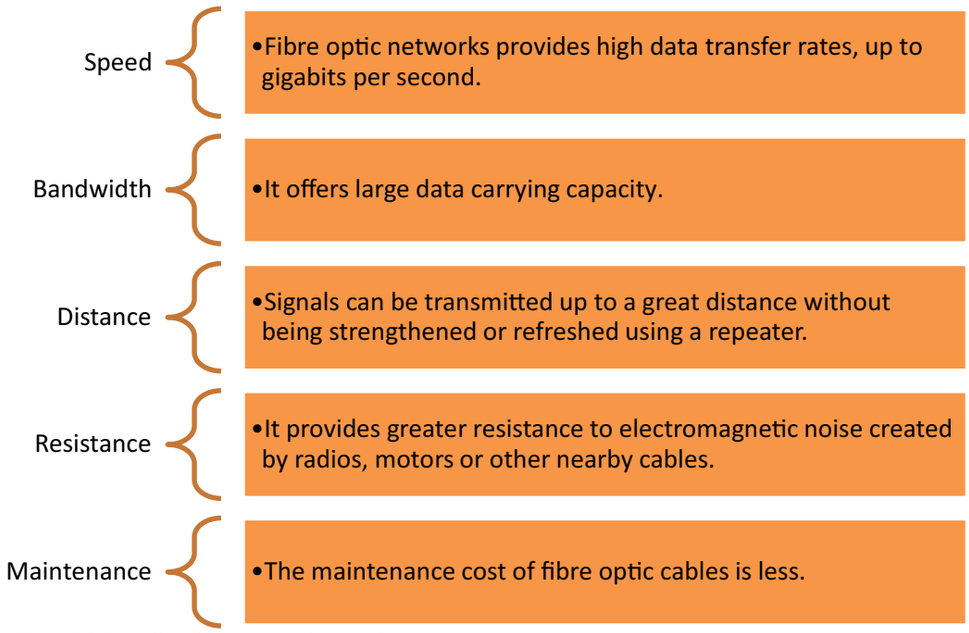

Fig. 1.1.9: Benefits of the use of fibre optic cables

There are two types of fibre optic cable commonly used:

- Single mode
- Multimode

Single Mode Fibre Cable

Single Mode cable provides one mode of transmission through a single strand of glass fibre of diameter of 8.3 to 10 microns. It requires a light source with a narrow spectral width and carries a bandwidth higher than multimode fibre. It has a small diametrical core allowing only one mode of light to propagate typically 1310 or 1550nm. Hence, the number of created light reflections gradually decreases as the light passes through the core, lowering the level of attenuation and thus, allowing the signal to travel further. This is generally used for the long-distance applications requiring higher bandwidth, run by CATV companies, Telco's and Colleges and Universities. The following image shows a single mode fibrecable:

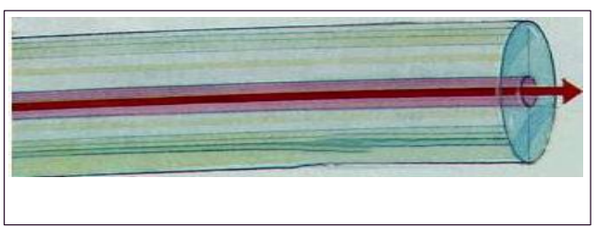

Fig. 1.1.10: Single mode fibre cable