



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

OPTICAL AND MICROWAVE ENGINEERING

III YEAR/ VI SEMESTER

UNIT 5-OPTICAL NETWORKS

WDM-DWDM



WAVELENGTH & DENSE WAVELENGTH DIVISION MULTIPLEXING





Introduction

- Multiplexing
- Wavelength Division Multiplexing (WDM)
 - Advantages
 - Disadvantages
- Dense Wavelength Division Multiplexing (DWDM)
 - Advantages
 - Disadvantages
- DWDM Standards
- Comparison between WDM and DWDM



Multiplexing

- Multiplexing
 - A process where multiple analog message signals or digital data streams are combined into one signal over a shared medium.
- Types
 - Time division multiplexing.
 - Frequency division multiplexing.
- Optically
 - Time division multiplexing.
 - Wavelength division multiplexing.

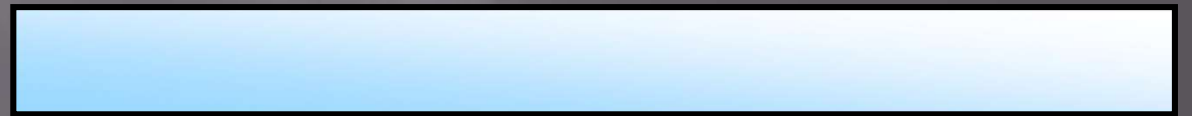


Timeline

1975 1980 1985 1990 1995 2000 2005 2010



Optical Fibre



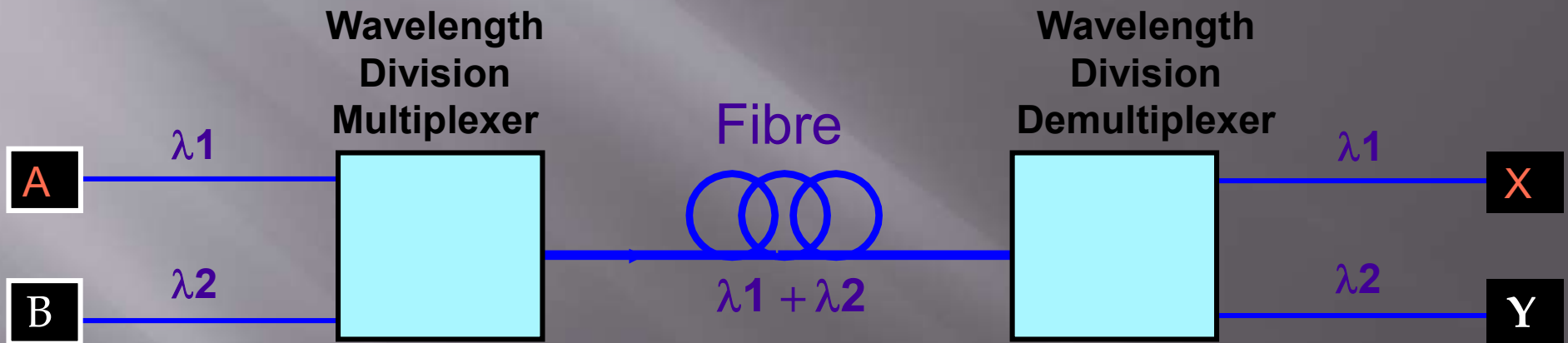
SDH



DWDM



Wavelength Division Multiplexing





Wavelength Division Multiplexing

- ❑ Multiple channels of information carried over the same fiber, each using an individual wavelength.
- ❑ A communicates with X and B with Y as if a dedicated fiber is used for each signal.
- ❑ Typically one channel utilizes 1320 nm and the other 1550 nm.
- ❑ Broad channel spacing, several hundred nm.
- ❑ WDM is a way of transmitting more data by separating channels by "color".



Wavelength Division Multiplexing

1. Advantages:

- ❑ Fewer wires or channels to transmit and receive data.
- ❑ A single fiber-optic cable can handle dozens of channels, instead of using 12 cables, you only use 1 .



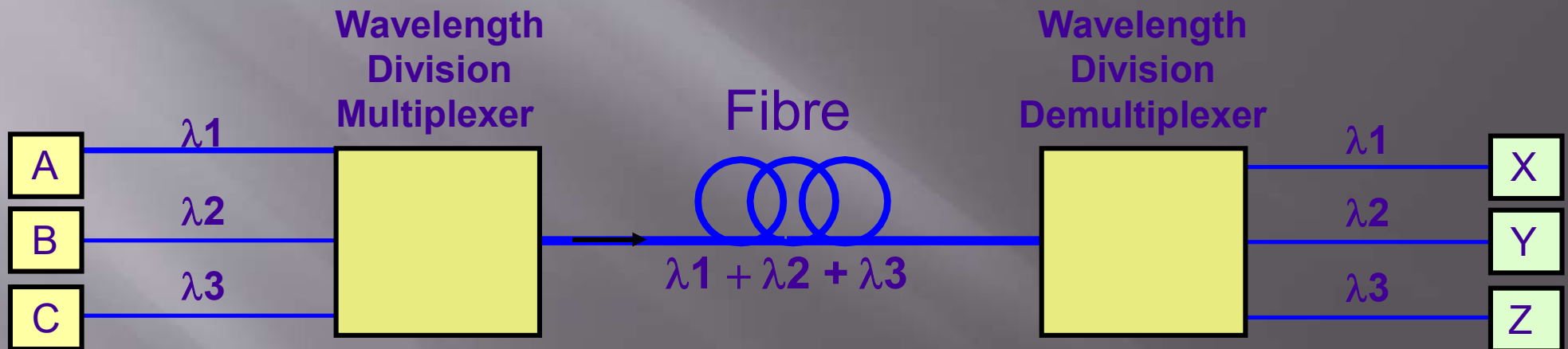
Wavelength Division Multiplexing

2. Disadvantages:

- Complex transmitters and receivers.
- They must be wide-band, which means they are more expensive and possibly less reliable.



Dense Wavelength Division Multiplexing



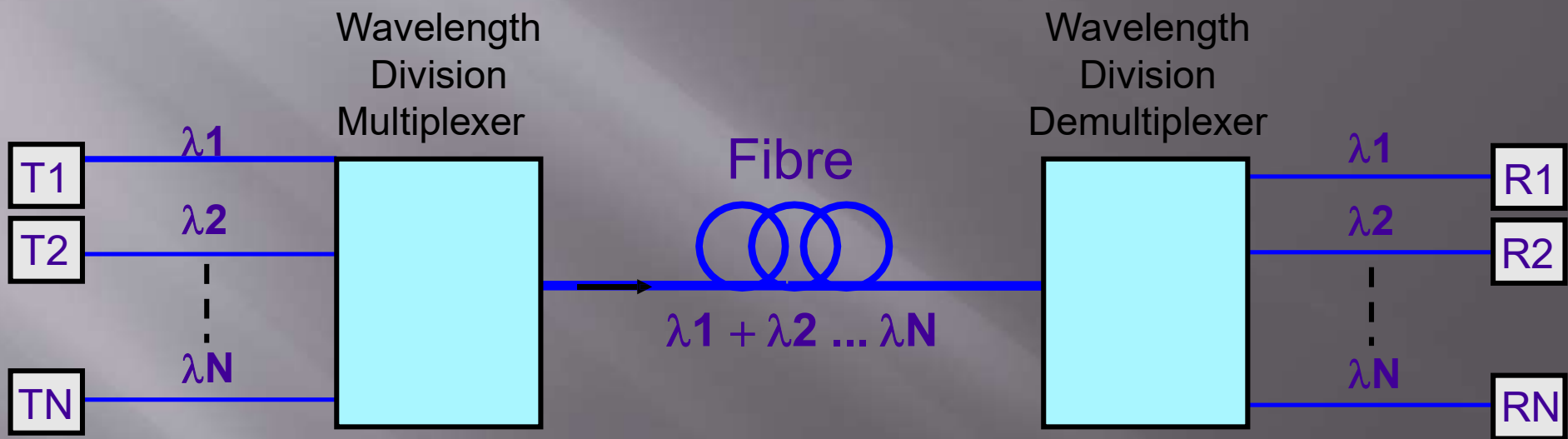


Dense Wavelength Division Multiplexing

- ❑ Multiple channels of information carried over the same fiber, each using an individual wavelength.
- ❑ Dense WDM is WDM utilizing closely spaced channels.
- ❑ Channel spacing reduced to 1.6 nm and less .
- ❑ Cost effective way of increasing capacity without replacing fiber.
- ❑ Commercial systems available with capacities of 32 channels and upwards; > 80 Gb/s per fiber.



Dense Wavelength Division Multiplexing





Dense Wavelength Division Multiplexing

- ❑ Multiple channels of information carried over the same fiber, each using an individual wavelength.
- ❑ Unlike WDM channels are much closer together.
- ❑ Transmitter T1 communicates with Receiver R1 as if connected by a dedicated fiber as does T2 and R2 and so on.



Dense Wavelength Division Multiplexing

1. Advantages:

- ▣ Greater fiber capacity.
- ▣ Easier network expansion.
- ▣ DWDM can give increases in capacity which TDM cannot match.
- ▣ Incremental cost for a new channel is low.



Dense Wavelength Division Multiplexing

2. Disadvantages:

- ❑ Not cost-effective for low channel numbers.
- ❑ Introduces another element, the frequency domain, to network design and management.
- ❑ SONET/SDH network management systems not well equipped to handle DWDM topologies.
- ❑ DWDM performance monitoring and protection methodologies developing.



Dense Wavelength Division Multiplexing Standards

- ▣ ITU Recommendation is G.692 "Optical interfaces for multichannel systems with optical amplifiers".
- ▣ G.692 includes a number of DWDM channel plans.
- ▣ Channel separation set at:
 - 50, 100 and 200 GHz .
 - Equivalent to approximate wavelength spacings of 0.4, 0.8 and 1.6 nm.
- ▣ Channels lie in the range 1530.3 nm to 1567.1 nm (so-called C-Band).
- ▣ Newer "L-Band" exists from about 1570 nm to 1620 nm.



Comparison between WDM & DWDM

	WDM	DWDM
Channel Spacing	1310 nm lasers used in conjunction with 1550 nm lasers	Small 200GHz and Small
Number of Bands Used	O and C	C and L
Cost per Channel	Low	High
Number of Channels Delivered	2	Hundreds of Channels Possible
Best Application	PON	Long-haul



Thank You.....