4. **Procedure**

Simulate an FSO System:

a. Connect the optical components as represented in the block diagram Fig. 2.
b. Vary the FSO range and observe the BER.
c. Vary the source wavelength and analyze the effect on BER by observing the eye diagram.

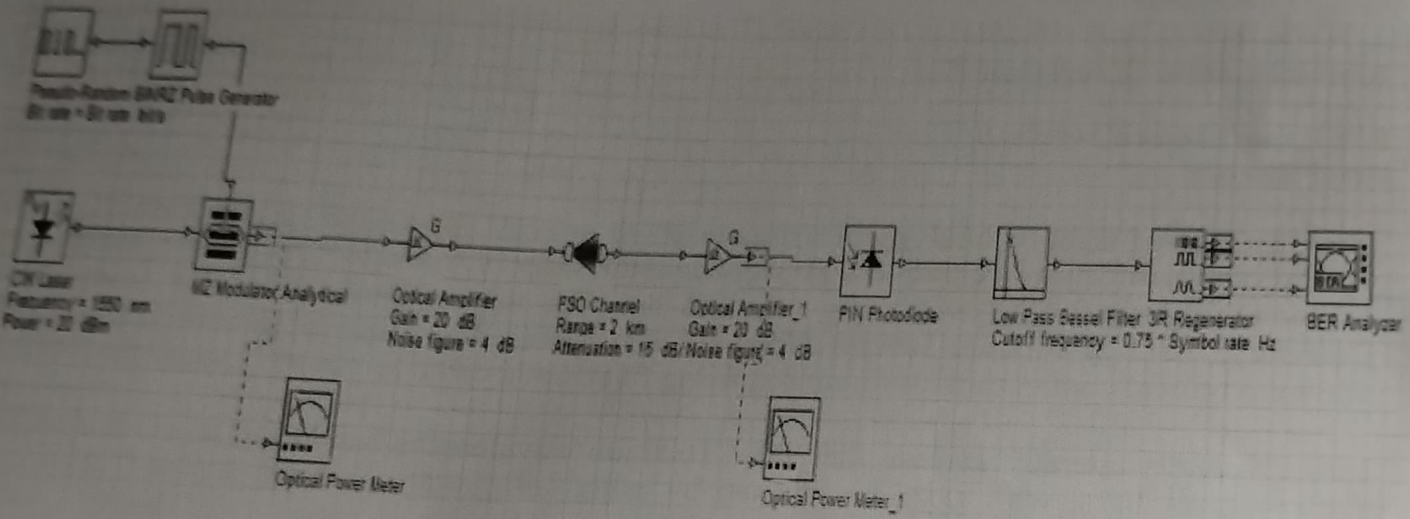
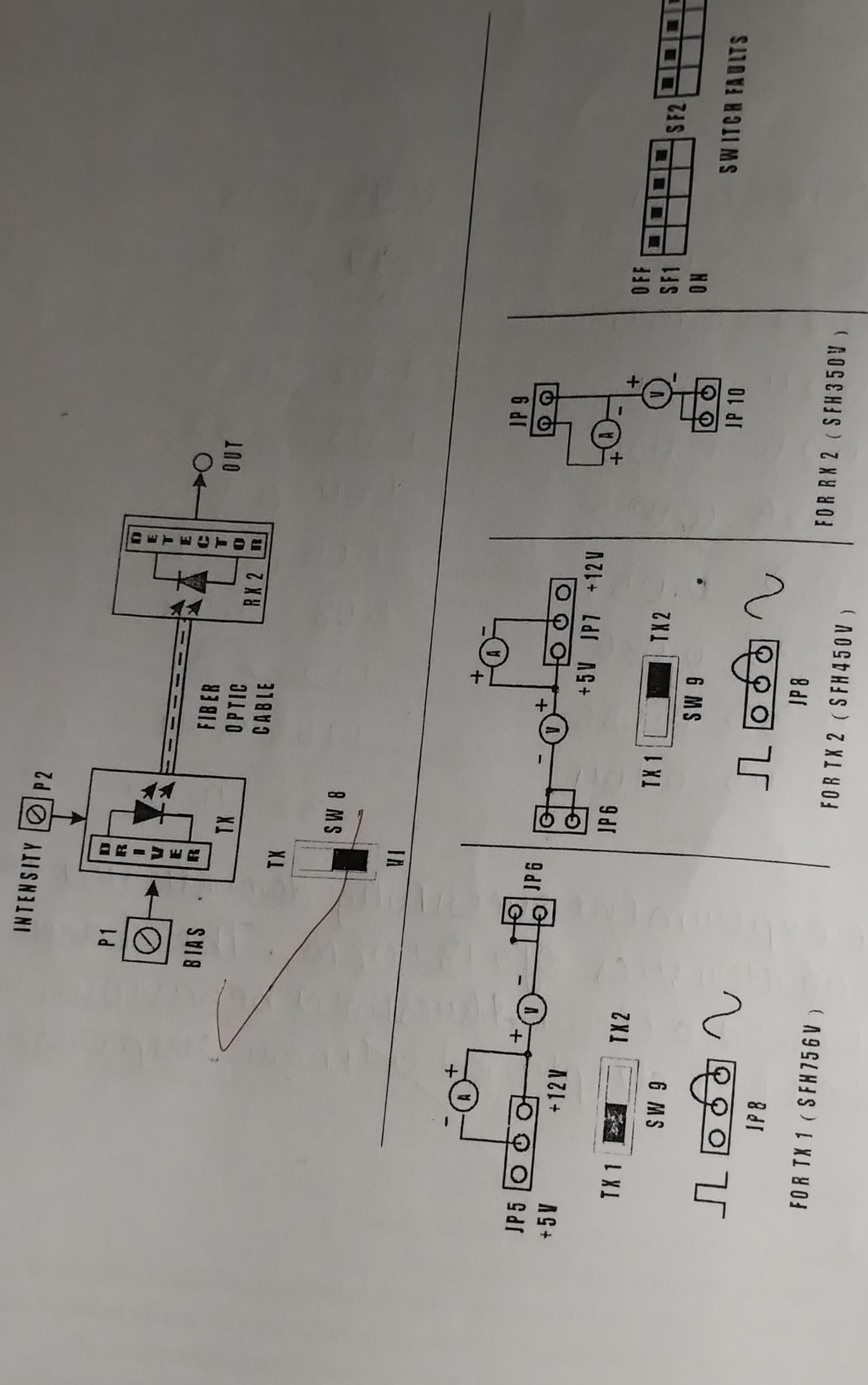


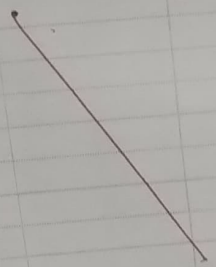
Fig. 2: Layout to demonstrate FSO System

Observations:


INTENSITY
P2
P1
BIAS
DRIVER
TX
FIBER OPTIC CABLE
DETECTOR
RX 2
OUT
TX
SW 8
VI
JP5 +5V
+12V
JP6
TX 1
TX2
SW 9
JP8
FOR TX 1 (SFH756V)
JP6
+5V
JP7
+12V
TX 1
TX2
SW 9
JP8
FOR TX 2 (SFH450V)
JP 9
JP 10
FOR RX 2 (SFH350V)
OFF
SF1
ON
SF2
SWITCH FAULTS

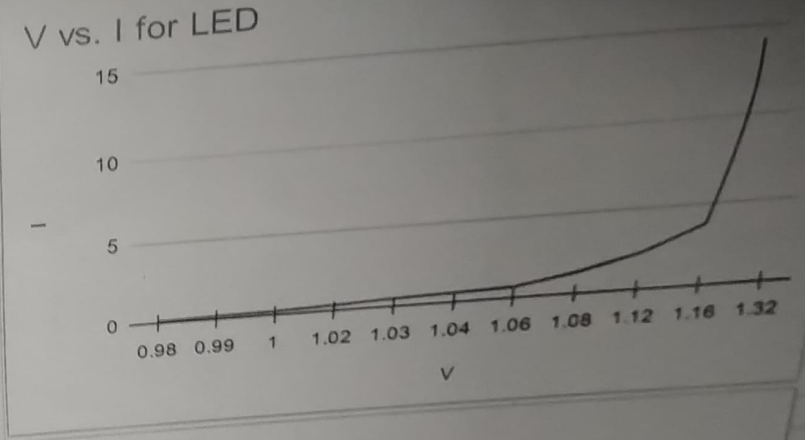
LED

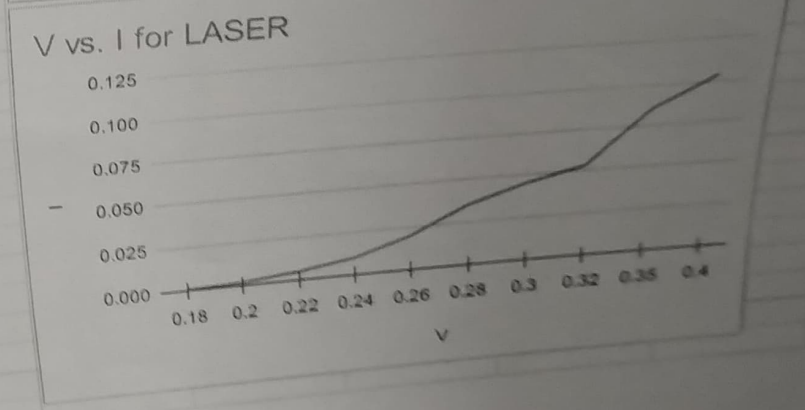
V	I
0.98	0.13
0.99	0.22
1	0.26
1.02	0.37
1.03	0.52
1.04	0.64
1.06	0.72
1.08	1.38
1.12	2.32
1.16	3.81
1.32	14.27

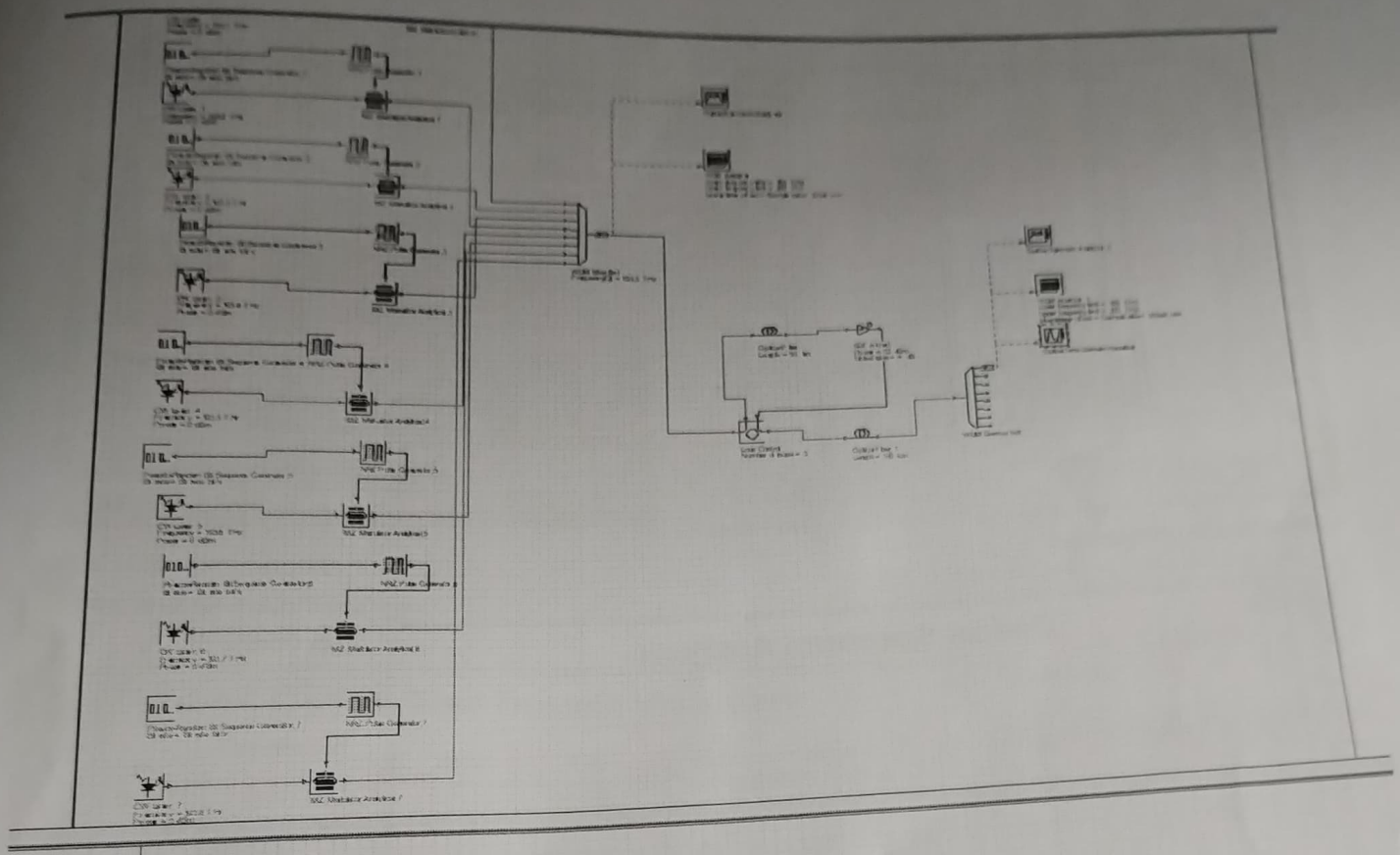


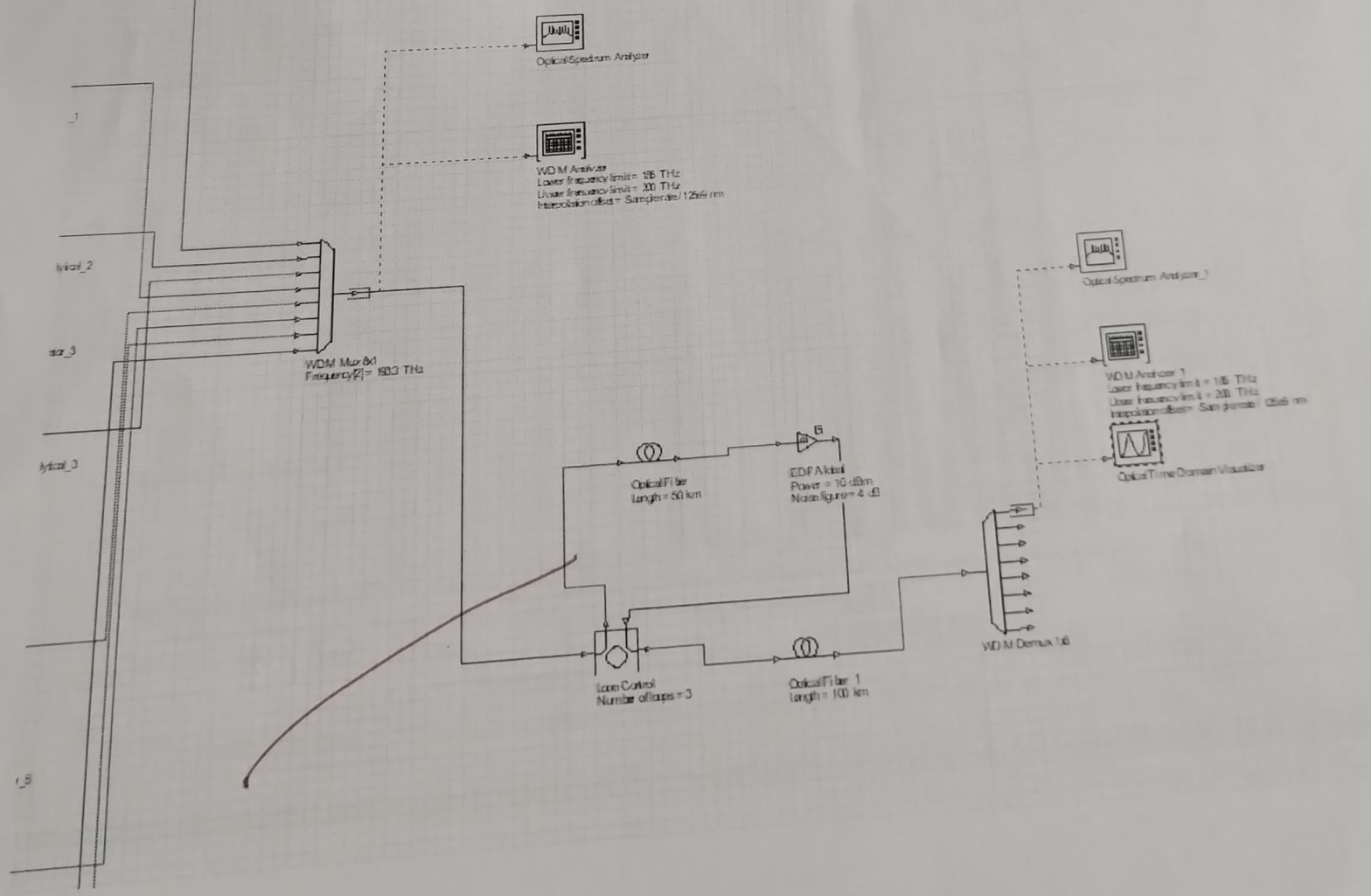
LASER

I	V
0.18	0.001
0.2	0.002
0.22	0.005
0.24	0.01
0.26	0.02
0.28	0.035
0.3	0.045
0.32	0.053
0.35	0.086
0.4	0.104








Optical Spectrum Analyzer
WDM Analyzer
Lower frequency limit = 186 THz
Upper frequency limit = 200 THz
Interpolation offset = Sample rate/1256 nm
WDM Mux 8x1
Frequency[Hz] = 193.3 THz
Optical Spectrum Analyzer_1
WDM Analyzer 1
Optical Time Domain Visualizer
Optical Fiber
Length = 50 km
EDFA Model
Power = 10 dBm
Noise figure = 4 dB
Loss Control
Number of taps = 3
Optical Fiber 1
Length = 100 km
WDM Demux 1x8

e the results and plot the relationship between attenuation and fiber length.
he procedure at wavelengths of 1300nm and 1550nm.

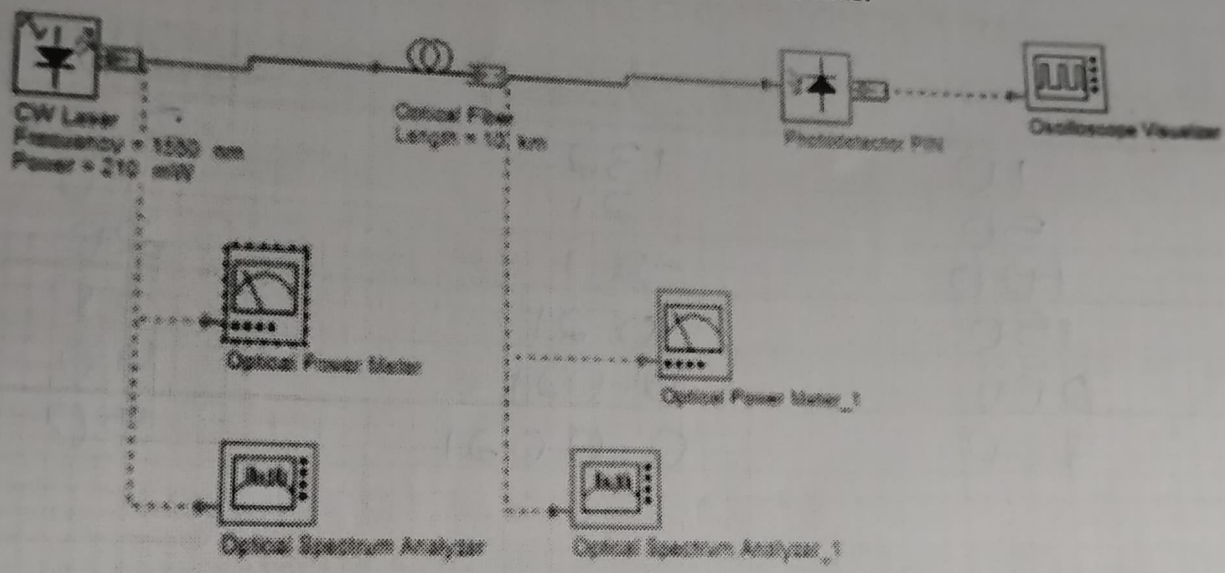
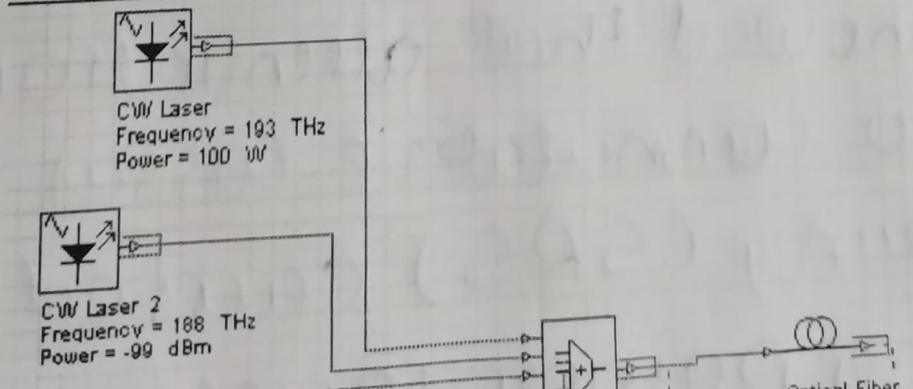


Fig. 4: Layout to demonstrate attenuation effect

n a fiber:

e optical components as represented in the block diagram Fig. 5.
ut and output spectrums using the analyzers.



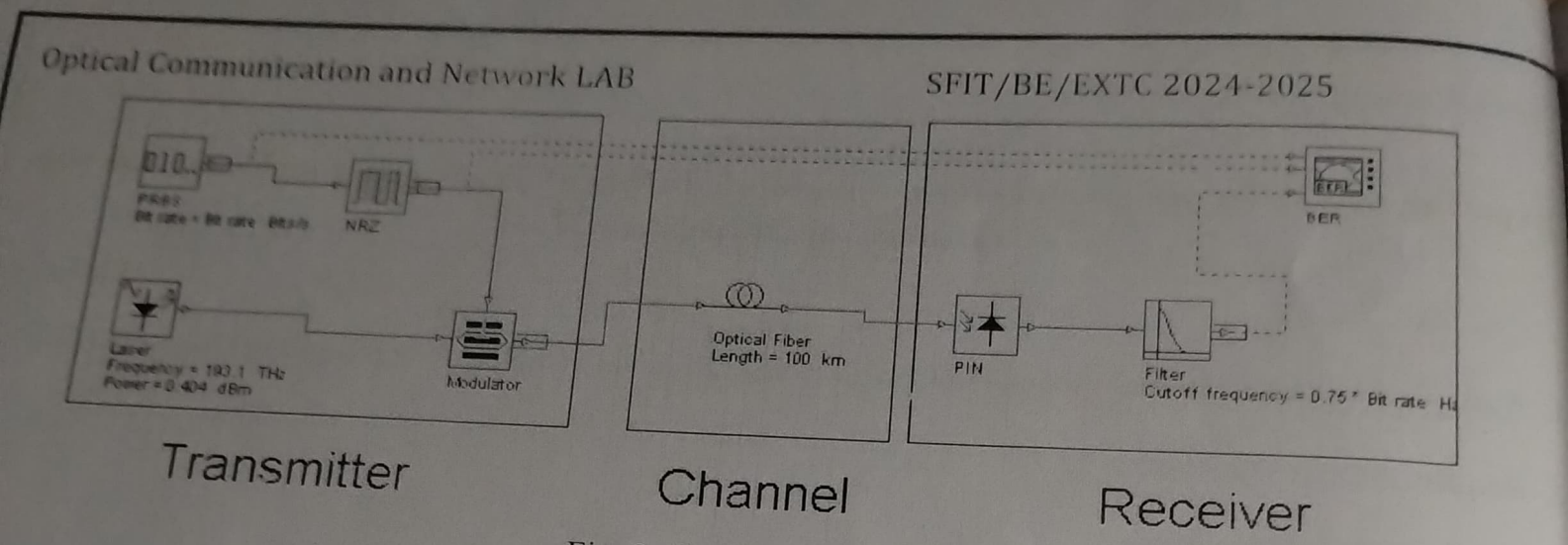


Fig. 2: Optical System

Procedure

omponents Required in OptiSystem 22 and its function:

CW Laser Source: Generates a continuous optical signal.
Mach-Zehnder Moduiator (MZM): Modulates the optical signal using an external electrical signal.
RBS Generator: Generates a pseudo-random bit sequence for testing.
RZ Pulse Generator: Converts the bit sequence into an electrical signal.
as Controller: Ensures proper MZM operation.
tical Fiber (Optional): To transmit the modulated signal.
ical Receiver: Converts the modulated signal back to an electrical signal.
lloscope/BER Analyzer: For signal visualization and performance analysis.

ations:

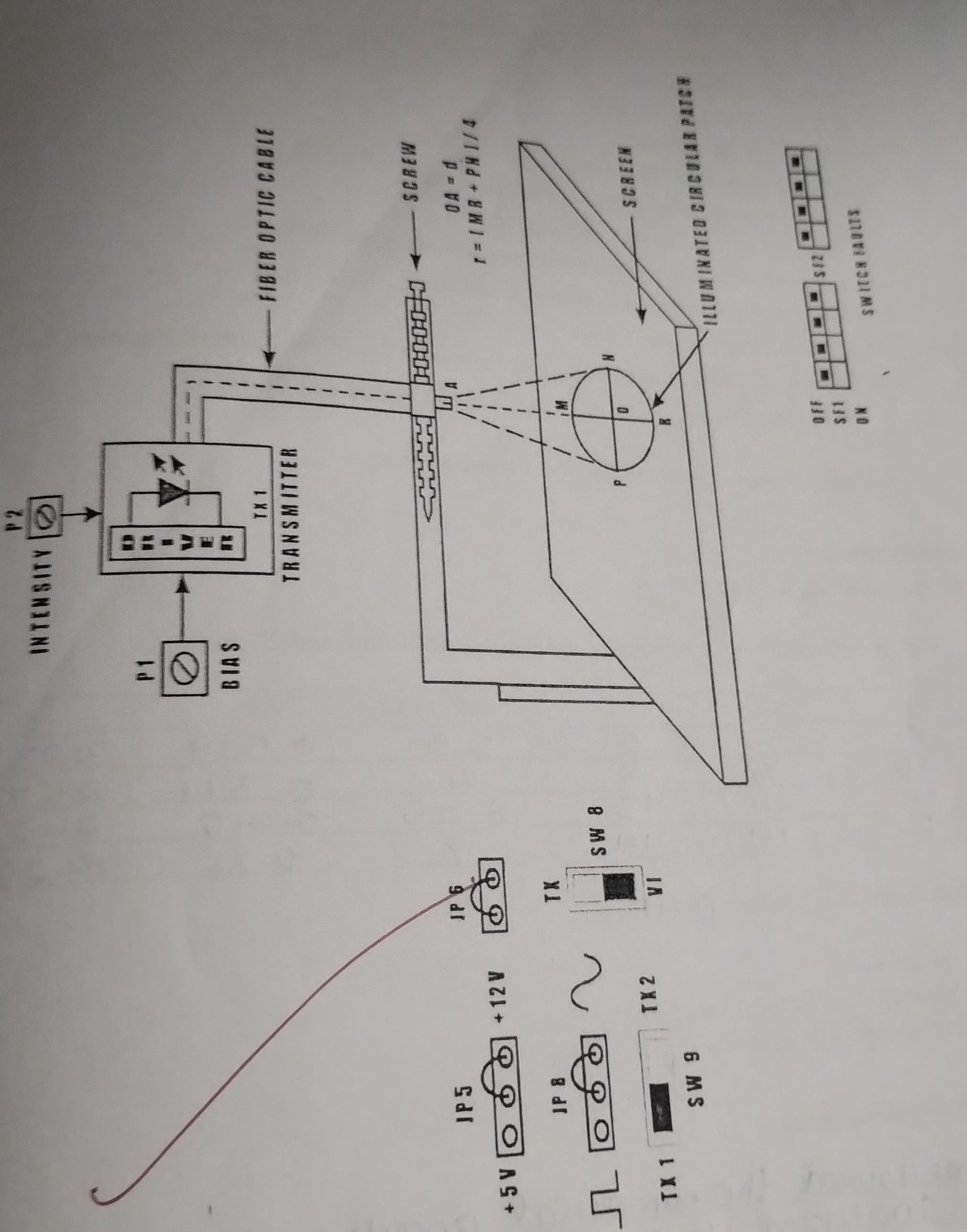
e simulated block diagram and graphical observations

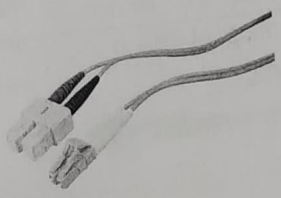
on/Comments:

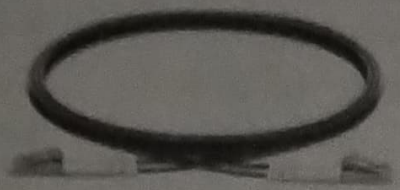
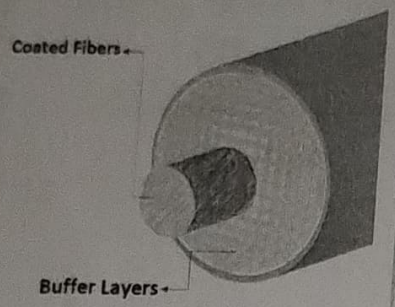
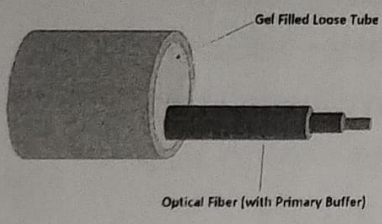
on your observations on the basis of following points:

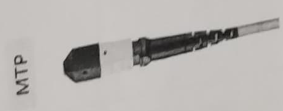
of varying length of fiber on the attenuation:
of spectral width of source increases the effect on input and output power:
ect of wavelength on scattering and hence attenuation:

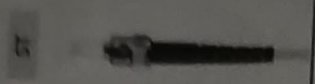
periment demonstrated the design & response
ternally modulated optical


P2
INTENSITY
P1
BIAS
DRIVER
TX 1
TRANSMITTER
FIBER OPTIC CABLE
SCREW
A
OA = d
r = (MR + PN)/4
M
N
P
O
R
SCREEN
ILLUMINATED CIRCULAR PATCH
OFF
SF1
ON
SF2
SWITCH FAULTS
JP5
+5V
+12V
JP 6
JP 8
TX
SW 8
VI
TX 1
TX 2
SW 9

Name	Image	Specifications	Applications
OM1 Multimode		Jacket Color – Orange Core Size – 62.5um Data Rate – 1Gb @ 850nm wavelength Distance – Up to 300 meters	Short-haul networks, Local Area Networks(LANs) & private networks
OM2 Multimode		Jacket Color – Orange Core Size – 50um Data Rate – 1Gb @ 850nm wavelength Distance – Up to 600 meters	Short-haul networks, Local Area Networks(LANs) & private networks Generally used for shorter distances. Has twice the distance capacity has OM1
OM3 Multimode (Laser-Optimized Multimode)		Jacket Color – Aqua Core Size – 50um Data Rate – 10Gb @ 850nm wavelength Distance – Up to 300 meters Uses fewer modes of light, enabling increased speeds Able to run 40GB or 100GB up to 100 meters utilizing an MPO connector	Larger Private Networks
OM4 Multimode		Jacket Color – Aqua Core Size – 50um Data Rate – 10G @ 850nm wavelength Distance – Up to 550 meters Able to run 100GB up to	High-Speed Networks, Data Centers, Financial Centers and Corporate Campuses

		150 meters utilizing an	
OM5 Multimode		Jacket Color – Lime Green Fully compatible and can mate with OM3 and OM4 cabling Utilizes a wider range of wavelengths between 850nm and 953nm Designed to support Short Wavelength Division Multiplexing (SWDM) Can Transmit 40 Gb/s and 100 Gb/s	High-speed Networks and Data Centers that require greater link distances and higher speeds.
Single-Mode Fibers (OS1)		Core diameter: ~9 µm, Cladding diameter: 125 µm. **Attenuation**: ≤ 1.0 dB/km (1310 nm), ≤ 1.0 dB/km (1550 nm).	Indoor and low-distance telecommunications.
Single-Mode Fibers (OS2)		Core diameter: ~9 µm, Cladding diameter: 125 µm. **Attenuation**: ≤ 0.4 dB/km (1310 nm), ≤ 0.4 dB/km (1550 nm).	Outdoor and long-distance high-speed networks, including DWDM.

Name	Image	Specification	Application
LC Connector		• **Measure** LC Connector • **Insertion Loss** dB (Single and Multi Mode) : <0.3 • **Return Loss** : > 55dB UPC Style Ferrule > 60dB APC Style Ferrule • **Cable Boot** 2mm white, 3mm upon request • **Mating Cycle** : Up to 1000 times	Data centers: LC connectors are often used in data centers because of their small size and high density. Telecommunications: LC connectors are used in telecommunications networks, such as Fiber-To-The-Home (FTTH). Local area networks: LC connectors are used in local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs).
SC Connector		• Mating Durability :500 matings, <0.2 dB change • Operating Temperature :-25 to +70, 12 cycles • Cable Torsion :1.5kg – 2.5kg for 2mm-3mm cable diameter • **Mating Cycle** : Up to 1000 times	Local Exchange Carrier (LEC) • Competitive LEC (CLEC) • Broadband/Cable TV (CATV)
MTP/MPO Fiber Connector		Insertion Loss: Typically less than 0.35 dB per connector Return Loss: Typically greater than 40 dB (single-mode), 30 dB (multi-mode) Ferrule Diameter: Typically 2.5 mm (MPO/MTP ferrules) Operating Temperature: Typically between -40°C and +85°C Mating Cycle: Typically up to 1,000 cycles Fiber Count: Typically 8, 12, 24, 48, or 72 fibers	MTP/MPO connectors are commonly used in data centers because they suppo high-density connections an facilitate quick, efficient deployment of fiber optic cables in high-speed networks. Their multi-fiber capacity allows for higher bandwidth and faster data transmission, making then ideal for the high-performance environments of modern centers.

ST Connector		• Insertion loss: Typically less than 0.3 dB • Return loss: Typically greater than 50 dB • Ferrule diameter:Typically 2.5mm • Operating temperature: Typically between -40°C and +85°C • Mating cycle: Typically up to 1,000 times	• Local area networks • Data processing networks • Distribution application • Premises distribution
FC Connector		Insertion Loss: Typically less than 0.3 dB Return Loss: Typically greater than 50 dB Ferrule Diameter: Typically 2.5 mm (for SC, LC) Operating Temperature: Typically between -40°C and +85°C	• TelecommunicationsNetworks • Local Area Networks • Data Processing Networks • Device Terminations • Premises Distribution • Cable Television • Fiber-to-the-Home

Color Coding				
	Jacket	Jacket Nomenclature	Connector	Connector Body
OM1 62.5-µm Multimode	Orange	62.5/125	Beige	Beige
OM2 50-µm Multimode	Orange	50/125	Black	Black
OM3 50-µm Multimode	Aqua	850 50/125	Aqua	Black
OS1 APC Single-mode	Yellow	SM/NZDS, SM	Green (MPO is black)	Green
OS1 UPC Single-mode	Yellow	SM/NZDS, SM	Blue	Blue

Colour code	specification	Application
blue	Primary fiber color	Used for the first fiber in a group. Commonly used in networking and telecommunications.
Orange	Secondary fiber color	Used for the second fiber in a group. Found in high-speed data connections.
Green	Third fiber color	Often used for LAN (Local Area Network) cables or links in fiber optic systems.
Red	Seventh fiber color	Less common; used for redundancy or in specialized configurations.
Yellow	Jacket color for single-mode fibers	Typically for single-mode fiber (SMF), which carries data over long distances.