spot.

- Find the numerical aperture of the fiber using the formula,

$$N.A. = \sin \theta a = W/\sqrt{4L^2+W^2}$$

- Vary the distance between in screen and the fiber optic cable and make it coincide with one of the concentric circles. Note its distance.

· Tabulate the various distances and diameters of the circles made on the white screen and computer the numerical aperture from the formula given above.

Observation Table:

Obs. No.	MR	PN	Distance(d)cm	Mean radius (r)	Numerical Aperture (NA)	Angle (θ_a)(Degree)
1	0.7	0.7	1	0.35	0.33	19°
2	1.5	1.5	2	0.75	0.35	20°
3	2.5	2.5	3	1.25	0.38	22°

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Result analysis and Conclusion:

Numerical Aperture is the light gathering property of the fiber. It was observed, that as the distance decreases, the angle of aperture increases. Hence, angle of aperture is inversely proportional to distance.

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Post Experiment Questions:

- What is the significance of Numerical Aperture?
- Why is there any trade-off between NA and the Data rate of optical fibre?

Number of turns	Output voltage Vo (v)
1	2.7V
2	2.1V
3	1.2V

Result analysis and Conclusion:

We measured the bending losses in optical fiber w.r.t output voltage & of turns. We observed that the No of turns are the bends increase of the voltage decreases.

Post experiment questions:

1. Explain your understanding of radius of curvature in optical communication.
2. What is the reason for bending losses?

13. Calculate the propagation (attenuation) loss with the help of

$$\frac{V_1}{V_2} = e^{-\alpha (L_1 + L_2)}$$

Where

α = loss in nepers / meter

1 nepers = 8.686 dB

L_1 = length of shorter cable (0.5 m)

L_2 = Length of longer cable (1 m)

Result analysis and Conclusion:

In the above experiment propogation loss or Atten in optical fiber is measured and verified. by com between distance, power and voltage.

Post Experiment questions:

1. Explain the difference between attenuation and dispersion.
2. How to measure propagation losses?

Result analysis:

$l_1 = 1$, $l_2 = 0.5$, $V_1 = 1.5$, $V_2 = 6.7$

$$\alpha = \frac{20}{l_1 - l_2} \times \log_{10}\left(\frac{V_2}{V_1}\right)$$

$$= \frac{20}{1 - 0.5} \times \log_{10}\left(\frac{6.7}{1.5}\right)$$

$$= 25.99 \qquad = 14.14\,dB.$$

Post Answers.

Observation Table:

Sr No	Voltage (Vf)	If(mA)
1	1.8	0.97
2	1.98	2.17
3	2.13	5.4
4	2.36	5.89
5	2.7	5.96
6	3.01	6
7	3.85	6.01
8	4	6.04
9	5	6.04

Result analysis and Conclusion:

We have study the characteristics of photo LED has successfully high lighted. intensities & frequency. The linear relationship between voltages & current within a certain range confirms the photo LEDs efficiency in converting electrical energy into light.

Post Experiment Question:

1. Write a minimum of four points for Comparison between Spontaneous and Simulated emission.
2. Differentiate between homojunction and heterojunctions.

Observations:

Sr No	Voltage (Vf)	Id(mA)
1	1.05	0.21
2	1.51	0.35
3	1.58	0.46
4	1.61	0.78
5	1.7	3.19
6	2.25	7.31
7	3.3	7.3
8	3.65	7.3
9	4.2	7.3.

Result analysis and Conclusion:

The experiment successfully demonstrated the response to light intensity of wavelength. The reading indicate that photo-detectors output current is directly proportional to the incident light intensity. The photodetectors sensitivity to different wavelength which is crucial for applications requiring spectral discrimination.

Post Experiment Questions:

1. Explain the dependence of wavelength on responsivity.
2. How input signal is related to responsivity.

Result analysis and Conclusion:

Hence, we successfully implemented the code in MATLAB & calculated the power budget for an optical fiber for the given parameters.

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Post Experiment Question:

1. What is the significance of the Link Power Budget ?
2. How to determine power Margin?

Where, tt= Transmitter rise time
tr= Receiver rise time
tmodal= modal dispersion of the fiber
tmat= Material dispersion rise time

Result analysis and Conclusion:

The total system time was found to be supporting bit rates of (NRZ) and (RZ) indicating suitability for high speed optical communicatio

Post Experiment Question:

1. What is the significance of the Rise time Budget?
2. How rise time is defined?

$$\eta(r) = \begin{cases} \eta 1(1 - 2\Delta(\frac{r}{a})^{\alpha})^{\frac{1}{2}} & r \leq a \quad \text{(Core)} \\ \eta 1(1 - 2\Delta)^{\frac{1}{2}} = \eta 2 & r \geq a \quad \text{(Cladding)} \end{cases}$$

Where Δ is the relative refractive index difference and α is the profile parameter which gives the characteristic refractive index profile of the fiber core. The above equation which is a convenient method of expressing the refractive index profile of the fiber core as a variation of α allows representation of the step index profile when $\alpha = \infty$, a parabolic profile when $\alpha = 2$ and a triangular profile when $\alpha = 1$.

Result Analysis and Conclusion:

Refractive index profile of step index & graded index fi provided a visual understanding of their once core & cladding characteristics. The step index exhibits distinct boundary between core & cladding while grad index showcase a gradual change in R-I showing smo transition between core & cladding while other shou sharpar change.

Observation Table 1:

Sr No	Clock Frequency (CLK)	Time Duration (Td)	Total no. of transmitted bits N=CLK*Td	Bit Error Count (E)	Bit Error Rate=E/N
1	64 KHz	5s	325	64	0.196
2	128 KHz	5s	640	285	0.44
3	256 KHz	5s	1280	389	0.30

Observation Table 2:

Sr No	Clock Frequency (CLK)	Time Duration (Td)	Total no. of transmitted bits N=CLK*Td	Bit Error Count (E)	Bit Error Rate=E/N
1	256	5s	1280	523	0.40
2	256	10s	2560	1035	0.40
3	256	15s	3840	1599	0.41

Result Analysis and Conclusion:
In this experiment we observe that with greater clock frequency we get greater bit error count which result in smaller BER. It also observed that BER decreases, with increases in Td with constant clock frequency. Hence BER is required for assessing the system reliable minimizing the error ensures optical performance of the optical link enhancing efficient data transmission.

Post Experiment Question:

1. Discuss the trade-off between bandwidth and Bit Error Rate.
2. What is the significance of BER in designing reliable communication systems?

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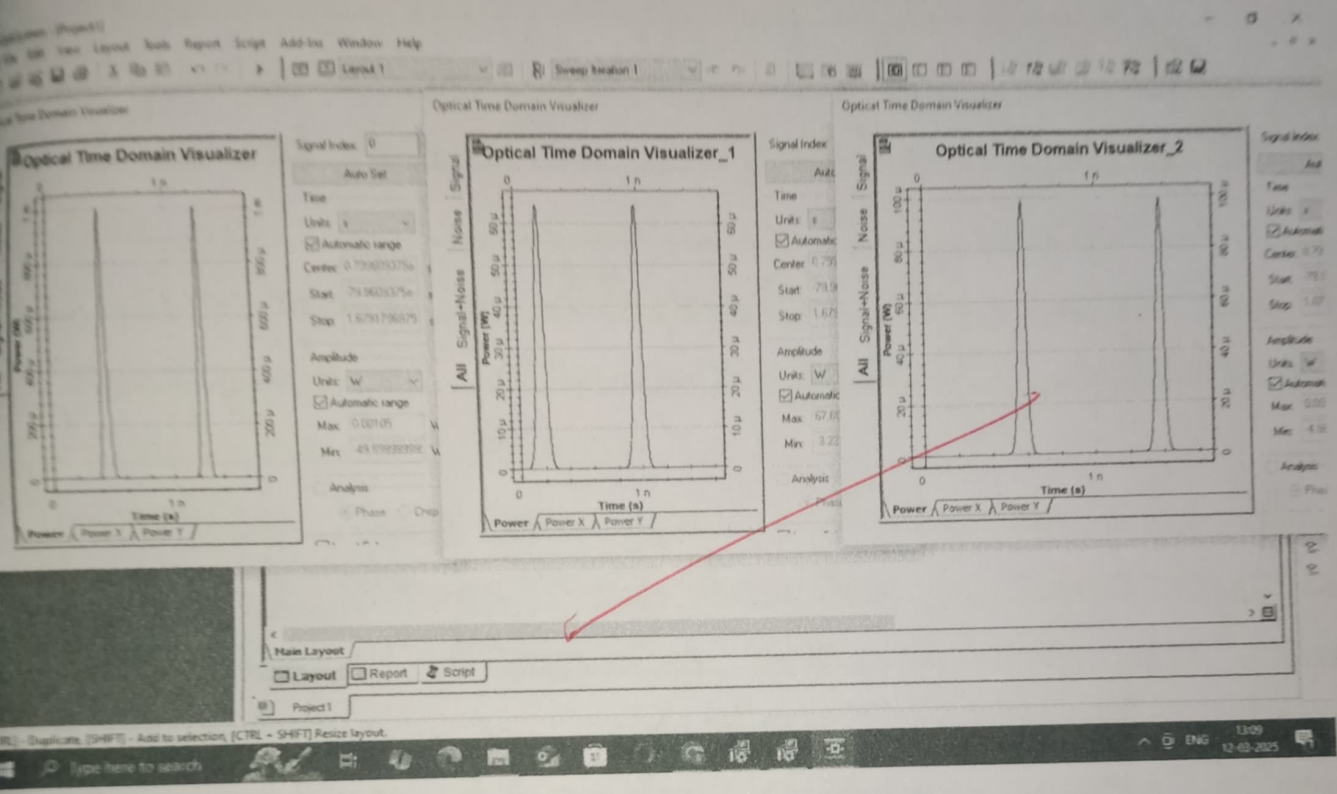
Output:



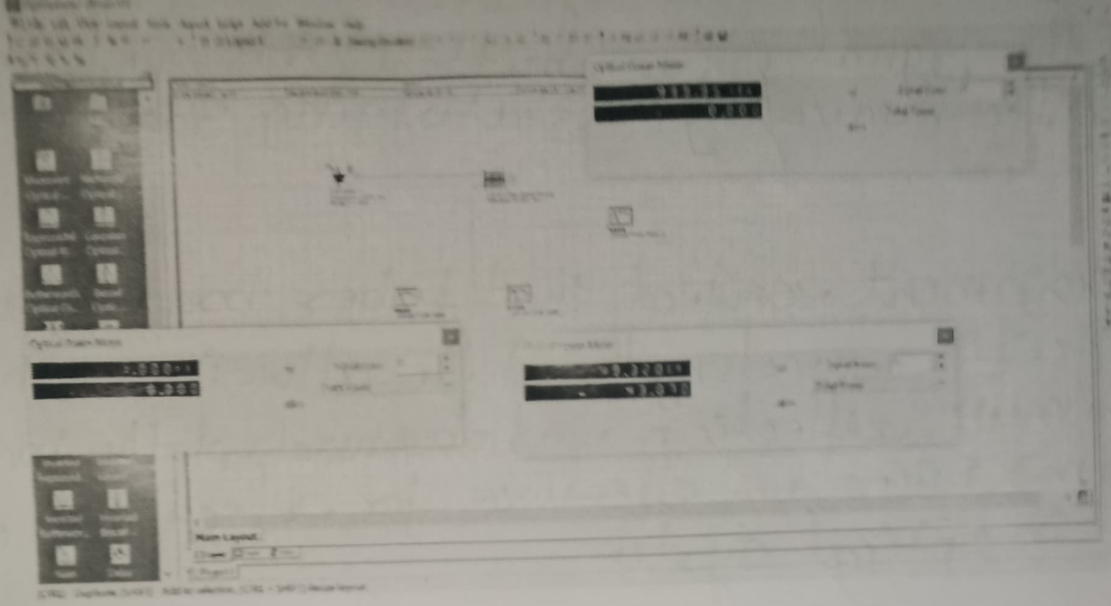
Result analysis and Conclusion:

These are various transmission effect in optical fiber like attenuation & dispersion is also known as broadening of pluse. These effects should be as less as possible hence it effects are reducing by adding components like (DCF) successfully simulated. & observed. reduction. of pluse in pluse broadening by using DCF in opti-system software.

Post Experiment Question:

1.Dispersion hampers information carrying capacity of fiber. Justify

2.What is the impact of distance on length 0f the fiber.



9. Repeat simulation for 1510 nm, 1550 nm and 1570 nm.
10. Complete the Observation Table.

Observation Table

Sr. No.	Wavelength (nm)	Input Power, P1	Reflected Power	Transmitted Power, P2	Reflectivity, $R = \frac{P1-P2}{P1} * 100$
1.	1510	1	154.919	845.080	-84408
2.	1530	1	2.603	999.997	-99899.7
3.	1550	1	257.652	1.000	00
4.	1570	1	300.839	1.000	00

Result Analysis and Discussion:

The simulation showed high reflection at 1550 and 1570nm indicating these are near the Bragg wavelength. At 1510 and 1530 reflection was minimal and most of the signal is transmitted. This confirms that only specific wavelength satisfying Bragg condition are reflection.

Conclusion:

The experiment verified that fiber bragg gratings reflect specific wavelength while allowing others to pass. Maximum reflection was observed at the bragg condit The confirms FBGs are effective for selective waveleng filtering in optical system.