EXP NO: 11 SETTING UP A FIBRE OPTIC ANALOG LINK

11.1 OBJECTIVE:

1. To set up an 850 nm fiber optic analog link.
2. To observe the linear relationship between the input and received signal.
3. To measure the bandwidth of link.
4. To observe the effect of gain control received signal.

11.2 HARDWARE REQUIRED:

Optical fiber trainer kit, Two channel 20 MHz oscilloscope, Function generator (1Hz – 10MHz)

11.3 INTRODUCTION:

This experiment is designed to familiarize the user with optical fiber trainer kit. An analog fiber optic link is to be set up in this experiment. The preparation of the optical fiber for coupling light in to it and the coupling of the fiber to the LED and detector are quite important. The LED used is an 850nm LED. The fiber is a multimode fiber with a core diameter of 1000µm. The detector is simple PIN detector.

The LED optical power output is directly proportional to the current driving the LED. Similarly, for the PIN diode, the current is proportional to the amount of light falling on the detector. Thus, even though the LED and the PIN diode are non-linear devices, the current in the PIN diode is directly proportional to the driving current of the LED. This makes the optical communication system a linear system.

11.4 PRELAB QUESTIONS:

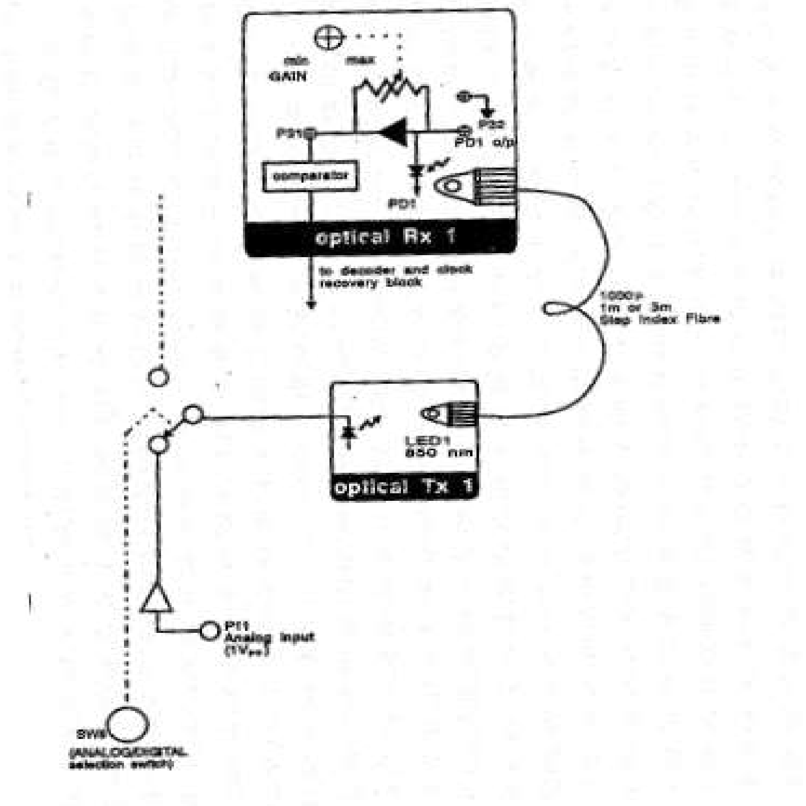
1. What is point to point link?
2. Define link power buget.
3. What is rise time budget?
4. What is the transmission frequency in optical fiber?
5. In Communication link what is the need for repeater?

11.5 PROCEDURE:

1. Set the switch SW8 to the analog position. Switch the power on. The power on switch is located at the top right-hand corner.
2. Feed a 1 V p-p sinusoidal signal at 1 KHz from a function generator, to the analog in post P_{11} using the following procedure:
   i. Connect a BNC-BNC cable from the function generator to the BNC socket I/03
   ii. Connect the signal post I/03 to the analog in post P11 using a patch cord.
3. With this, the signal from the function generator is fed through to the analog in signal post P11 from the I/O3 BNC socket.
4. Connect one end of the 1m fiber to the LED source.
5. Observe the light output at the other end of the fiber.
6. Feed a 5V p-p rectangular signal at 0.5 Hz at P_{11}. Observe the signal on the oscilloscope. Now observe the intensity of the light output at the other end of the fiber.
7. Now, feed a 5V p-p sinusoidal signal at 0.5 Hz at P_{11}. Observe the variation in the brightness of the light output at the other end of the fiber as a driving signal varies sinusoidally.
8. Thus, light intensity is modulated by an input rectangular of sinusoidal signal.
9. Connect the other end of the fiber to the detector PD_1 in the optical RX_1 block.
10. Feed a sinusoidal wave of 1 KHz, 1 V p-p from the function generator of P_{11}. The PIN detector output signal is available at P_{32} in the optical RX1 block. Vary the input signal level driving the LED and observe the received signal at the PIN detector. Plot the received signal peak to peak amplitude with respect to the input signal peak to peak amplitude.
11. The Pin detector signal at P_{32} is amplified, with amplifier gain controlled by the GAIN potentiometer. With a 3 Vp-p input signal at P_{11}, observe P_{31} as a gain potentiometer is varied.
12. Measure the bandwidth of the link as follows: Apply a 2V p-p sinusoidal signal at P_{11} and observe the output at P_{31}. Adjust GAIN such that no clipping takes place. Vary the frequency of input signal from 100Hz to 5MHz and measure the amplitude of the

received signal. Plot the received signal amplitude as a function of frequency. Note the frequency range for which the response is flat.

Layout



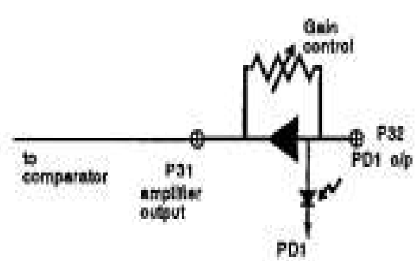


Figure 1: Gain control

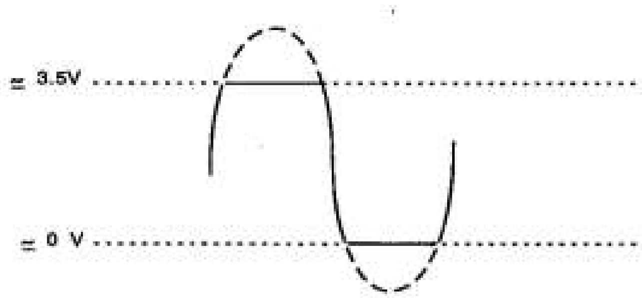
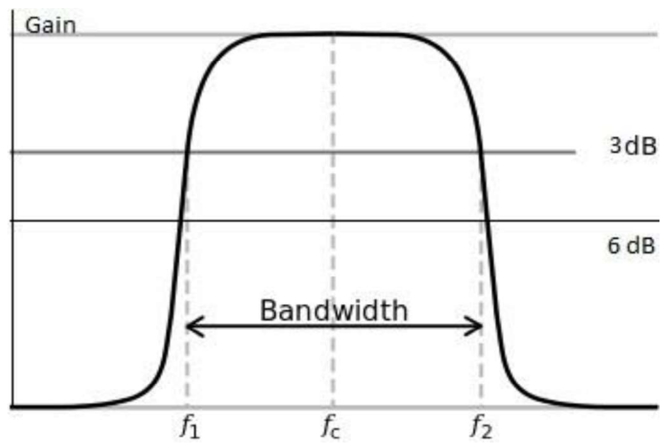


Figure 2: Signal at P31

Model Graph



11.6 TABULATION:

Input: Sine Wave V_i= ______________________Vp-p

S.No.	Frequency (Hz)	Output Voltage V_O (V)	Gain (dB) $G = 20 \log (V_O/V_i)$
1.			
2.			
.			
.			
14.			
15.			

11.7 POSTLAB QUESTIONS:

1. What is Optical Bandwidth and Electrical Bandwidth? Give their relation.
2. What is the maximum bandwidth the analog link can support?
3. What are the important blocks of point-to-point links?
4. What is the function of Optical receiver?
5. Calculate link loss (LL) for a 2-km-long multimode link with a power budget (PB) of 13 dB having five connectors and two splices for the following parameters:

   Fiber attenuation = 1 dB/km

   Loss in connector = 0.5 dB

   Loss in splice = 0.5 dB

   Higher-order mode loss = 0.5 dB

   Clock recovery module = 1 dB

Also find the link has sufficient power for transmission or not?

11.8 RESULT:

Hence, the Analog link is established in fiber optic link.