Experiment No. 4

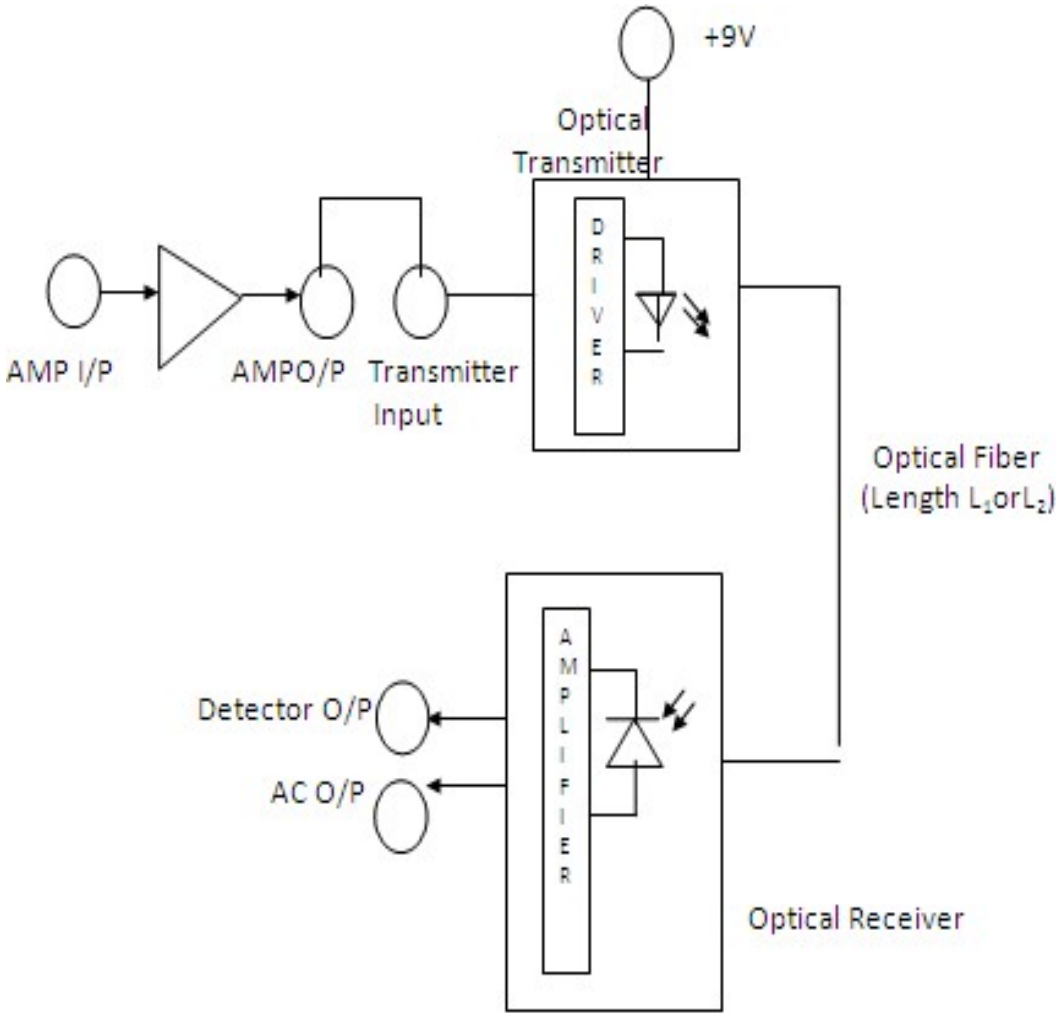
Aim: To measure Propagation loss in optical fiber.

Objectives: i) To observe transmission and reception of signals through OF using two different lengths fiber.

ii) To measure Propagation loss in neper/meter.

Equipments/Components: kit1, kit2, 1MHz Function Generator, 20 MHz Dual Trace Oscilloscope, 1 & 3 Meter Fiber Cable.

Circuit/BlockDiagram



BLOCK DIAGRAM FOR PROPAGATION LOSS MEASURMENT

Theory: Optical fibers are available in different variety of materials. These materialsare usuallyselected by taking into account their absorption characteristics for different wavelengths of light. In case of optical fiber, since thesignal is transmitted in the form of light which is completely different in nature asthat of electrons, one has to consider the interaction of matter with the radiationto study the losses in fiber. Losses are introduced in fiber due to various reasons.As light propagates from one end of fiber to another end, part of it is absorbed inthe material exhibiting absorption loss. Also part of the light is reflected back or insomeotherdirectionsfromtheimpurityparticlespresentinthematerialcontributing to the loss of the signal at the other end of the fiber. In general termsit is known as propagation loss. Plastics fibers

have higher loss of the order of 180db/km. whenever the condition for angle of incidence of the incident light isviolated the losses are introduced due torefraction oflight. Thisoccurswhenfiberissubjectedtobending.Lowertheradiusofcurvaturemoreistheloss.Otherlossesaredu etothecouplingoffiberatLED& photodetector ends.

Procedure:

1. Slightly unscrews the cap of IR LED SFH 450v from kit 1. Do not remove the cap from the connector. Once the cap is loosened, insert the fiber into the cap and assure that the fiber is properly fixed. Now tighten the cap by screwing it back.
2. Connect the power supply cables with proper polarity to kit 1 and kit 2 while connecting this, ensure that the power supply is off.
3. Connect the signal generator between the AMP input and GND posts in kit 1 to feed the analog signal to the preamplifier.
4. Keep the signal generator in sign wave mode and the select the frequency of 1KHz with amplitude of 2VP-P (Max input level is 4 VP-P).
5. Switch on the power supply and signal generator.
6. Check the output signal of the pre-amplifier at the post AMP output in kit 1. It should be same as that of the applied input signal.
7. Now rotate the Optical Power Control pot P1 located below power supply connector in kit 1 in anticlockwise direction. This ensures minimum current flow through LED.
8. Short the following posts in kit 1 with links provided.
   a) -9V and -9V . This ensures supply to the transmitter.
   b) AMP Output and Transmitter Input.
9. Connect the other end of the fiber to detectorSFH250V in kit 2 very carefully as per the instruction in step 1.
10. Ensure that the jumper located just above IC U1 in kit 2 is shorted to pin 2 and pin 3. Shorting of the jumper allows the connection of PIN diode to trans- impedance amplifier stage.
11. Observe the output signal from the detector at AC OUTPUT post in kit2 on CRO. Adjust optical power control pot P1 in kit1. You should get the reproduction.of original transmitted signal. Also adjust the amplitude of received signal as that of transmitted one. Mark this amplitude as V1.
12. Now replace 1m fiber by 3m fiber without changing settings of kit1 & kit2. Measure the amplitude of received signal again. You will notice that it is less than previous one. Mark this as

V2.

13. If α is the attenuation/loss in the fiber then, we have,

$V_1/V_2 = \exp\{-\alpha(L_1+L_2)\}$

Where- α=neper/meter,

L_1= Fiber length for V_1, L_2= Fiber length for V_2,

14. Calculate propagation loss α using above equation.

Observations:

i) The measured length of fiber, L_1= meter

ii) O/P voltage V_1 for length of fiber, L_1= Volts

iii) The measured length of fiber, L_2= meter

iv) O/P voltage V_2 for length of fiber, L_2= Volts

Calculations:

$V_1/V_2 = \exp\{-\alpha(L_1+L_2)\}$ $\text{Log}_{10}(V_1/V_2) = -\alpha(L_1+L_2)$

Therefore $-\alpha = \text{Log}_{10}(V_1/V_2)/(L_1+L_2)$ neper/meter= neper/meter

Result:

Conclusion: