JADAVPUR UNIVERSITY

Faculty & Engineering & Technology

....POWER.....Engg. Laboratory

Name. UJJWAL KUMAR RAY

Class. 4th Year Sec. 2nd Sem Roll No. 1084

9/10

Date of Experiment..... Date of Submission.....

Marks Obtained.....Signature of Examiner.....

NAME	CO-WORKER	ROLL
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Experiment No. 05.

Commence at .....

Completed at .....

Name of Techer concerned

TITLE : Observation on Aerosol Optical Depth at Jadavpur University, Salt Lake Campus.

OBJECT : ① Aerosol optical Depth (AOD) is defined as the degree to which the aerosols prevent the transmission of light.

② It refers to the fractional depletion of radiation per unit path length

SALT LAKE 2ND CAMPUS

Name ..... Roll .....

* Instrument Specification

Dynamic Range → 0.01 W/cm² on 305nm channel.

Viewing Angle → 300.000

Resolution → 2.5°

Precision → 1.2 %

Non - Linearity → max 0.002 FS

Interface → USB

Power Source → 4 × AA Alkaline Batteries.

Size → 4" W × 8"H × 1.7" D (10 × 20 × 4.3 cm)

Weight → 21oz (600 grams)

* Major features

- Higher Accuracy
- Ease of use
- Portability
- Computer Interface
- GPS interface
- Instantaneous Results.
- Non-Volatile memory
- Low Cost.

Checked By

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AOT 500 - 7.341

AOT 870 7.741

AOT 936 1.202

AOT 1020 5.336

Radiation 340 - 5.78 -50 (w/m²)

Roll - 1084 SOP - 1.86E-01 w/m²

870 - 5.0E-00 w/m²

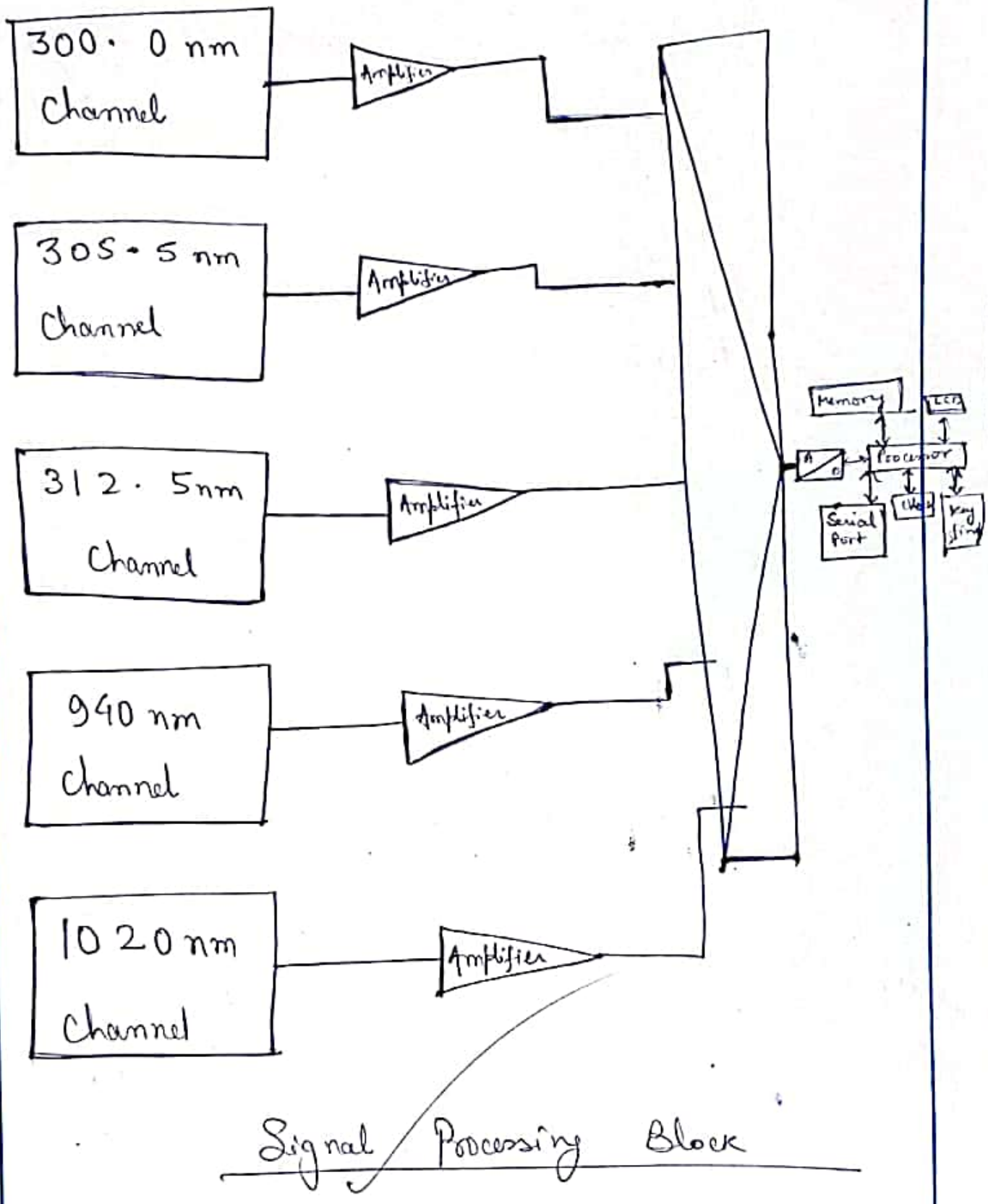
936 - 8.9E 01 w/m²

1020 - 9.25E-8 w/m²

Ujjwal Kumar Ray

Roll - 1084

PE 4th year



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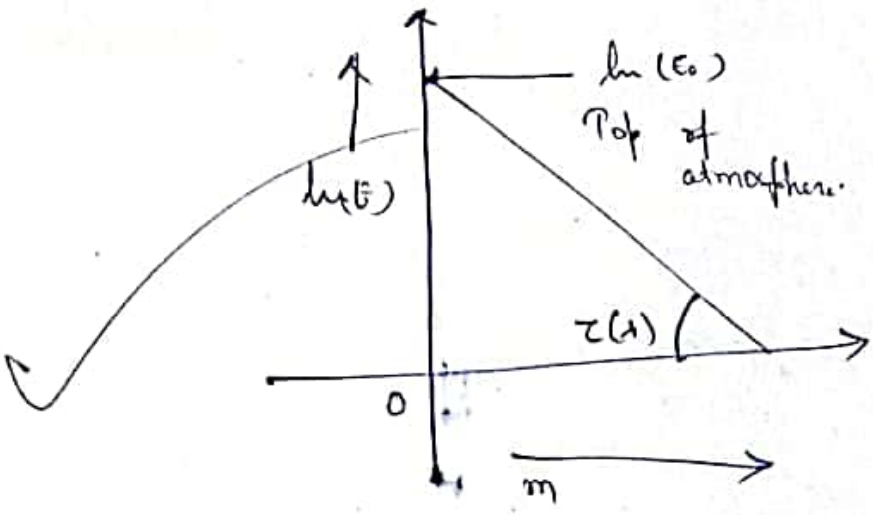
Langley Plant method : Calibration

$$\ln(E) = \ln(E_0) - m\tau(\lambda)$$



The five calibration constants involved in the AOD Calculations are:

① $\ln(V_{01})$ — the natural logarithm of extra terrestrial constant for channel 1 (340 nm).

② $\ln(V_{02})$ — Channel 2 (500 nm)

③ $\ln(V_{03})$ — Channel 3 (870nm)

④ $\ln(V_{04})$ — Channel 4 (936 nm)

⑤ $\ln(V_{05})$ — channel 5 (1020 nm).

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* Theory

Aero_Sol Optical Depth (AOD) is defined as the degree to which the aerosols prevent the transmission of light. It refers to the fractional depletion of radiance per Unit path length. So, higher the AOD more is the absorption by the aerosols and more is the depletion of the incoming Solar radiation. In other words higher the aerosol concentration more is the absorption of incoming radiation by them and hence lesser is the amount of it reaching the earth's surface. Hence, the adverse implications of high AOD values for shorter wavelength are of concern to the surrounding environment. Hence their monitoring is necessary.

* Effects to the environment

(1) Higher the AOD more is the absorption by the aerosols and more is the depletion of the incoming Solar radiation.

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(2) The AOD value for a shorter wavelength in comparison to higher wavelength, more is the contribution of the finer fraction to the total particulate concentration.

(3) Hence the adverse implications of high AOD values for shorter wavelength are of concern to the surrounding environment.

(4) Hence their monitoring is necessary.

* Measurement of Aerosol optical Depth (AOD) →

The aerosol optical Depth is to be obtained using a hand held microtopes-II sunphotometer (Solar light CO, USA) at five wavelengths by the world which are close to the recommended wavelengths by the world Meteorologic Organisation. The recommended wavelength are 340 nm, 500 nm, 870 nm, 936 nm and 1020 nm respectively. The instrument also provides additional parameters such as atmospheric pressure, Solar irradiance at the above mentioned five wavelengths

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* Principle of operation of the instrument :-

(1) The instrument is equipped with five (5) accurately aligned optical collimators with a full field view of 2.5°.

(2) Internal baffles are also integrated into the device to diminate internal reflections.

(3) Each channel is fitted with a narrow - band interference filter and a photodiode suitable for the particular wavelength range.

(4) A sun target and pointing assembly is permanently attached to the optical block and laser - aligned of the sun is sent to ensure accurate alignment with the optical channels.

(5) These signals are first amplified and then converted to a digital signal by a high resolution A/D converter.

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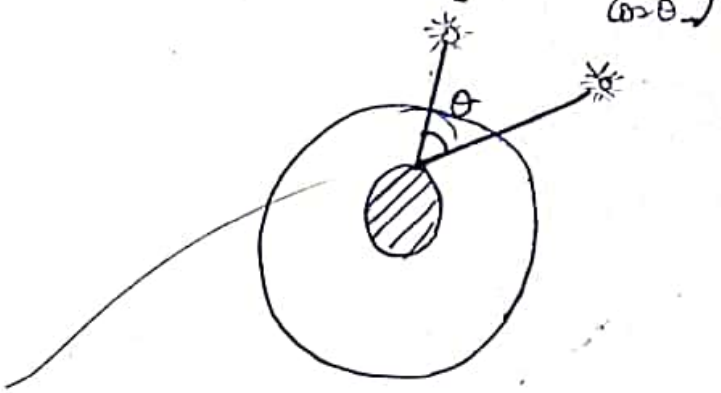
* Calibration of Sunphotometer

The Sunphotometer used for the measurement purpose was calibration both at factor and on land. The long term stability of the instrument was found to be appreciably good and the degradation of the filter or the drifts in the calibration values were found to be marginal.

Beer's Law

A connection between radiation at the top of the atmosphere (E_0) and on the surface (E) is,

$$E(\lambda) = E_0(\lambda) \exp[-\tau(\lambda) m] \quad \left[\because m = \frac{1}{\cos\theta}\right]$$



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