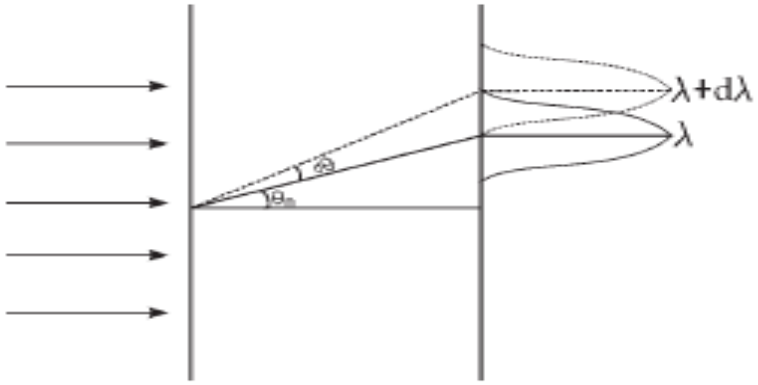
Experiment No. 5
Resolving Power of Plane Transmission Grating

Aim and Objectives: To determine resolving power of grating.
Apparatus: Mercury vapour lamp, Spectrometer, diffraction grating.
Diagram:



Outcome: To define the resolving power and verify its dependency on order of diffraction and number of lines on grating

Theoretical Background:

1)Resolving power- It is ability of optical instrument expressed in numerical measures to separate two separate images of two closed point objects.

2) Rayleigh's criterion- Two images of two closed point objects are separated if and only if principal max. due to one exactly coincides with first secondary minimum of other and vice versa.

3) R. P. of Grating - The resolving power of a grating is its ability to separate the spectral lines of wavelength which are close together.

"It is the ratio of wavelength of line in spectrum to the least difference in the wavelength of next line which can be just distinguished."

It is given by,

$$R.P. = \frac{\lambda}{d\lambda} = nN$$

Where., N= Total no. of slits/lines on grating.
n= order of spectrum.

Thus, resolving power depends on order of diffraction and number of lines on diffraction grating.

Experimentation:

First, the position of telescope is adjusted on first order principal maximum for yellow doublet on one side of central maximum. Then using adjustable slit, the condition of just merge yellow spectral lines is obtained while closing the slit. The total reading is considered as slit width A_1.

Then slit is completely closed and while opening the slit, the condition of just resolved yellow spectral lines is obtained. The total reading on slit is considered as slit width A_2. The resolving power of given grating is calculated using formula.

Observations :

i) Least count of Adjustable slit = M/S = ----------cm

Where M=the smallest division on main scale

S=Total no of divisions on circular scale

Observation Table:

Micrometer reading when yellow lines just merged			**Micrometer reading when yellow lines just resolved**			$A=\frac{A_1+A_2}{2}$	$N=\frac{15000}{2.54}\times A$
Main	**Circular**	**Total A_1**	**Main**	**Circular**	**Total A_2**		

Formula: $R.P.=\frac{\lambda}{d\lambda}=nN$

Calculations:

Result and discussion:

Resolving power of grating-

CONCLUSION:

Questions:

1. Find out the smallest wavelength difference that can be resolved in first order by a grating of 15000 lines/inch for the incident light of wavelength 5000 A^O.
2. Which has higher resolving power- telescope or diffraction grating? Why?