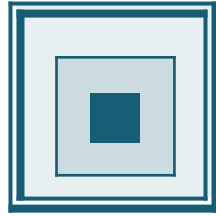


YOUR INSTITUTE OF TECHNOLOGY, NAGPUR

Department of Applied Physics



A Practical File on

Engineering Physics Practical File

B.Tech First Year · Laboratory record

Submitted in partial fulfilment of the practical examination requirements

SUBMITTED BY

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Enrolment No. 25BT0142

PROGRAMME

B.Tech I Sem, Section B

SUBMITTED TO

Dr. S. N. Bhat

Session 2025–26

CERTIFICATE

This is to certify that Aditya Kumar, a student of B.Tech I Sem, Section B, has satisfactorily completed the practical work in Engineering Physics prescribed by the Department of Applied Sciences during the academic session 2025–26.

The experiments recorded in this file were performed by the student in the laboratory under my supervision, and the observations and results are the student's own.

Dr. S. N. Bhat
Subject Teacher

External Examiner
Date: _____

Dr. P. Raman
Head of Department

Acknowledgement

I would like to express my sincere gratitude to my subject teacher, Dr. S. N. Bhat, for guidance and encouragement throughout the practical sessions, and for patiently clearing my doubts in the laboratory.

I am also thankful to Dr. P. Raman, Head of Department, for providing a well-equipped laboratory, and to the laboratory staff for their help in arranging the apparatus for every experiment.

Finally, I thank my parents and classmates for their constant support while I completed this practical file.

Aditya Kumar

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1	Newton's rings	08 Jul 2025		
2	Wavelength using a diffraction grating	22 Jul 2025		
3	Energy band gap of a semiconductor	05 Aug 2025		

Write the page number of each experiment in the remarks column once the file is complete.

Laboratory Safety Rules

- Check connections before switching on the supply
- Never touch live terminals
- Use the correct range on meters
- Switch off the supply before changing connections
- Keep the work bench dry and tidy

Experiment 1: Newton's rings

Date: 08 Jul 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the wavelength of sodium light by Newton's rings.

Apparatus / Materials Required

- Plano-convex lens of large radius and optically flat glass plate
- Sodium vapour lamp
- Travelling microscope and glass plate inclined at 45°
- Spherometer

Theory

When a plano-convex lens rests on a flat glass plate, a thin air film of varying thickness forms between them. Interference between rays reflected from the top and bottom of the film produces concentric dark and bright rings. The diameters of the dark rings are related to the wavelength of light and the radius of curvature of the lens.

$$\lambda = (D_{n+p}^2 - D_n^2) / (4 p R)$$

Procedure

1. Clean the lens and plate and place them under the microscope with the 45° glass plate.
2. Illuminate with sodium light and focus the microscope on the rings.
3. Set the cross-wire on the 16th dark ring on the left and move inward, noting readings for alternate rings.
4. Continue across the centre to the 16th ring on the right.
5. Find the diameters and plot D^2 against ring number.
6. Measure R with a spherometer.

Observations

Ring no.	Left (cm)	Right (cm)	D (cm)	D^2 (cm ²)
16	5.412	4.892	0.520	0.2704
12	5.380	4.928	0.452	0.2043
8	5.341	4.969	0.372	0.1384
4	5.290	5.023	0.267	0.0713

Observation table (sample readings – replace with your own)

Calculations

Slope of D^2 vs $n = 0.0166$ cm² per ring; $R = 70$ cm (sample).

$\lambda = \text{slope} / 4R = 5.93 \times 10^{-5}$ cm = 593 nm.

Result

Result

Wavelength of sodium light = 593 nm (sample result; standard value 589 nm).

Precautions

- The lens and plate must be clean and dust-free.
- The microscope should move in one direction only to avoid backlash error.

Viva Questions

Q1. Why is the centre of the ring pattern dark?

At the point of contact the film thickness is zero and the reflected ray undergoes a phase change of π , so the waves interfere destructively.

Experiment 2: Wavelength using a diffraction grating

Date: 22 Jul 2025

Page No.: ____

Teacher's sign: _____

Aim

To determine the wavelength of the prominent lines of mercury light using a plane transmission grating.

Apparatus / Materials Required

- Spectrometer
- Plane transmission grating
- Mercury vapour lamp
- Spirit level and reading lens

Theory

A diffraction grating has a large number of equally spaced slits. For normal incidence, bright maxima occur at angles where the path difference between adjacent slits is a whole number of wavelengths.

$$(a + b) \sin \theta = n \lambda$$

Procedure

- Adjust the spectrometer for parallel rays using Schuster's method.
- Set the grating normal to the incident light.
- Observe the first-order spectrum on both sides and note the readings for each colour.
- Calculate the angle of diffraction for each line.

Observations

Colour	Left reading (°)	Right reading (°)	2θ (°)	θ (°)
Violet	193.2	166.8	26.4	13.2
Green	195.8	164.2	31.6	15.8
Yellow	196.6	163.4	33.2	16.6

Observation table (sample readings – replace with your own)

Result

Result

Wavelengths of the mercury lines were calculated from the measured angles and the grating constant (sample readings above).

Precautions

- Do not touch the ruled surface of the grating.
- Read the vernier carefully.

Experiment 3: Energy band gap of a semiconductor

Date: 05 Aug 2025

Page No.: _____

Teacher's sign: _____

Aim

To determine the energy band gap of a semiconductor (germanium) using the four-probe method.

Apparatus / Materials Required

- Four-probe set-up with oven
- Germanium crystal
- Constant current source and digital voltmeter
- Thermometer

Theory

The resistivity of an intrinsic semiconductor decreases with temperature. Plotting $\log \rho$ against $1/T$ gives a straight line whose slope is proportional to the band gap.

$$E_g = 2k \times 2.303 \times \text{slope}$$

Procedure

11. Place the crystal in the oven and connect the four probes.
12. Pass a constant current and note the voltage at room temperature.
13. Heat the oven and note the voltage at every 10 °C rise up to about 150 °C.
14. Calculate resistivity and plot $\log \rho$ against $1/T$.

Observations

T (K)	V (mV)	ρ (Ω cm)	$10^3/T$ (K^{-1})	$\log \rho$
303	52.0	10.4	3.30	1.02
333	29.5	5.9	3.00	0.77
363	15.0	3.0	2.75	0.48
393	7.8	1.6	2.54	0.20

Observation table (sample readings – replace with your own)

Result

Result

Energy band gap of germanium = 0.70 eV (sample result).

Precautions

- Current should remain constant.

- Do not heat beyond the rated temperature.

Bibliography

- Laboratory manual issued by the department / school.
- Prescribed textbook for the subject (latest edition).
- Class notes and practical demonstrations by the subject teacher.