**PHS 291/292 EXPERIMENTAL PHYSICS I/II (2 CU each)**

**COURSE STRUCTURE**

15 carefully selected experiments (spanning 15 weeks) covering all areas of physics including Modern Physics to teach basic experimental techniques. In addition, analysis and eventual demonstration of famous experiments should supplement the students' laboratory work. Emphasis at this level however remains classical physics.

**PHS 291 EXPERIMENTAL PHYSICS I (2 CU)**

**Section A**

Introduction to methods of Data Handling          (Duration: 2 weeks)

i)      Choice of experiment components;
ii)     Initial preparations such as observation, cleaning, and testing of components;
iii)    Setting out on experiments;
iv)     Experiment layout;
v)      Techniques of reporting – Page layout, Date, Title. Aim, Apparatus, Diagram, and Method;
vi)     Tabulation of result – Setting of columns, Labelling, and Units;
vii)    Recording of experimental data – Choice of decimal places;
viii)   Graph plotting – Titling, Choice of scales, Labelling of axes, Units, and Points positioning.
ix)     Analysis of graphical result – Linearisation, Making calculations, and Drawing inferences;
x)      Calculation of slope errors;
xi)     Reporting results with accompanying errors;
xii)    Drawing and writing of Precautions, Sources of Unavoidable Errors, and Conclusion.

**Section B**

Introductory Graph Plotting       (Duration: 2 weeks)

i)       Plotting of linear-linear  graph;
ii)      Plotting of log-log  graph;
iii)     Plotting of log-linear graph;
iv)      Plotting of unspecified graph, and determination of nature of graph.

**Section C**

Pre lab talks               (Duration: 2 weeks)

Follow up experiments and corrections           (Duration: 6 weeks)

| Section B: Introductory Graph Plotting   (Duration: 2 weeks) |
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## GRAPH PLOTTING B1

AIM: To plot a linear graph and make deductions using the slope and intercept.

METHOD: The following values of resistance R and corresponding Celsius temperature $\theta$ conform to the equation

$R = R_0(1 + \alpha\theta)$ , where $R_0$ and $\theta$ are constants.

| $\theta$ /$^0$C | 10 | 30 | 60 | 90 |
| --- | --- | --- | --- | --- |
| R /$\Omega$ | 10.3 | 11.0 | 12.0 | 13.0 |

Plot a straight line graph for these results and hence determine $R_0$ and $\alpha$. Determine the values of R when $\theta = 105^0$C. Re-write the equation.

## GRAPH PLOTTING B2

AIM: To plot a log - log graph and make deductions using the slope and intercept.

METHOD: Corresponding values of volume, V and pressure, P are given below for a fixed mass of air at constant temperature. Given that   $P = AV^\alpha$, where A and $\alpha$ are constants.

| P /kPa | 100 | 200 | 300 | 400 | 500 | 600 |
| --- | --- | --- | --- | --- | --- | --- |
| V /cm$^3$ | 100 | 50 | 32 | 25 | 20 | 16 |

Plot a suitable graph involving V and P; hence deduce the values of $\alpha$ and A. Re-write the equation.

## GRAPH PLOTTING B3

AIM: To plot a log - linear graph and make deductions using the slope and intercept.

METHOD: For a hot object cooling in a draught the excess temperature $\theta$ recorded at times t are as follows;

| t /min$^{-1}$ | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $\theta$ /$^0$C | 60 | 50 | 40.5 | 31.5 | 25.8 | 20.1 | 16.5 |

Show that the results agree with $$\frac{d\theta}{dt} = -A\theta \qquad \text{or} \qquad \theta = \theta_0 e^{-At}$$

Plot a suitable graph and deduce the values of constants A and $\theta_0$. What is the value of t for which $\theta$ is $12.5^0$C? Re-write the equation.

# GRAPH PLOTTING B4

AIM: To plot a suitable graph and make deductions using the slope and intercept.

METHOD: The following readings were taken of power, P supplied to evaporate a liquid and the resulting mass per second, m of liquid evaporated.

| P /W | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
|------|-----|-----|-----|-----|------|
| m /$10^{-5}$kgs$^{-1}$ | 0.3 | 1.0 | 1.65 | 2.3 | 3.0 |

Plot a suitable graph to check agreement of these results with the equation P = mL + h, where h is a constant rate of heat loss and L is constant. Hence evaluate L and h. What is the value of P when m is $13 \times 10^{-5}$kgs$^{-1}$? Re-write the equation.

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**Section C:** Pre lab talks  (Duration: 2 weeks);     Follow up experiments and corrections  (Duration: 6 weeks)