**PREFACE**

This manual is a compilation of information on the practical aspect of the programme available for the undergraduate programme in the Department of Mechanical Engineering. The Department presently offers a Bachelor of Science (B.Sc.) degree in Mechanical Engineering. The Department is one of the five engineering programmes in the College of Engineering and Environmental Studies and is equipped with seasoned and well-trained academic staff and qualified academic technologists personnel who are prepared to help the students to develop themselves through research, engineering practice and creativity. The Department places great emphasis on the practical application of engineering and scientific principles to produce industry-ready engineers, who are immediately employable and capable of adapting to an ever-changing future. Mechanical Engineers are responsible for the application of engineering principles to design, production, processing to provide solutions to complex real-world problems by using different engineering applications and other cutting-edge technologies.

In order for the Department to meet her targeted goal and objectives, the Department sets high standards of moral and academics for all her students, and they are guided and monitored to meet up with those standards. This manual contains information on the practical classes of the different aspects of Mechanical Engineering for the purpose of guiding students for smooth academic pursuit in the Department. Graduates from the Department are being trained to develop their personal initiatives and to possess intellectual independence as well as to be creators of employment.

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INTRODUCTION

**1. General**

            The need for laboratory work in Mechanical Engineering is very important. Laboratory’s course work enables students to do experiments on the fundamental laws and principles encountered in the theoretical work; to study and use a wide variety of measuring instruments and equipment, to learn and to handle them with skill and to appreciate their limitations.

**2. Conducting the Experiments**

The experiment should be planned in advance by consulting necessary reference books in order to understand the principles behind the experiment. Before starting the experiment, the following steps should be taken:-

i Produce the Sketch for the experiment.

ii Produce the working diagram of the experiment.

iii Write down, in the form of a table, all the measurements you propose to make, and the calculation or formula to be used to obtain the results.

After this has been done, set up the experiment neatly, making sure that the instruments are well separated and all of them can be reached easily and the scales easily read. Then test the apparatus to see if it is working correctly.

**3. Records**

A faithful record of all observations taken should be made in the space provided in the tables contained in the laboratory manual and should be duly signed by the supervisor. To obtain accurate results, repeat the experiment using different methods where possible. The account of the experiment should be written in a practical notebook, which has graph paper on alternate pages. If the notebook is not ruled for graphical work, a sheet of graph paper can be interleaved when necessary between the double pages of the record. The report should contain full account of the experiment with diagrams and practical details, in a manner similar to that followed in the pages of this manual. To be neat and orderly, headings are required at each stage of the report, a suitable format being as follows:-

i. Title

ii. Objectives

iii. Equipment/Apparatus/Materials

iv. Theory/Diagram

v. Method/Procedures

vi. Measurements/Results

vii. Calculations

viii. Graphs

ix. Results or Conclusion

x. References

**4. Attendance:**

All students who registered for the laboratory courses must attend classes when required. There is a system of taking attendance register and this is considered when grading your laboratory work/report.

**5. General Laboratory Safety:**

            Safety is one of the major elements of good laboratory management, but it is perhaps the most neglected. It should be understood that any use of electricity inherently involves some degree of safety hazard. Whilst every effort is made by responsible manufacturers to reduce the hazard, it is still rest with the users to play his part in ensuring his own safety.

The major-causes of laboratory accidents can be categorized into two:

I Human cause which includes

i. Carelessness

ii. Ignorance

iii. Wrong attitudes

iv. Negligence.

II Contributory causes

i. Physical condition of students

ii. Unsatisfactory or inappropriate equipment

iii. Diverted attention

iv. Congested work stand, or inappropriate attire

The best ways to achieve safety in the use of electrical equipment includes:

i. Understanding equipment you are proposing to use and its ratings;

ii. Understanding the application to which the equipment is to be put;

iii. Ensuring that all reasonable safety measures are followed;

iv Taking no chances, not short cuts, in safety procedures.

# 6.0 Reference Tables

**6.1 Multiple and Submultiples units and their abbreviations**

T = Tera = 1012 f = femto = 10-15

G = Giga = 109 p = pico = 10-12

M = Mega = 106 n = nano = 10-9

K = Kilo = 103 u = Micro = 10-6

M = Milli = 10-3

1 MPa (megapascal) = 1 × 106 N/m2 = 1 N/mm2

            1 GPa (gigapascal) = 1 × 109 N/m2 = 1 kN/mm2

**6.2 Common Abbreviations**:

mA = Milliameter, d = diameter

t = thickness, s = second

σ = Stress, ε = Strain

*l* = Original length of the body, Δ*l*  = Change in length of the body, and

*E* = *Young's modulus* or *modulus of elasticity*

τ = Shear stress,

ϕ = Shear strain,

*C* = Shear modulus or Modulus of rigidity).

**7. Graphs:**

Whenever possible, the result of an experiment should be presented in graphical form. Not only does a graph provide the best means of averaging a set of observations but also the dependence between the quantities is clearly shown. In plotting the results, the dependent variable should be plotted as ordinates on the y- axis, and the independent variable as abscissas on the x – axis. The scale used should a convenient one for arithmetical work, and should be sufficiently extensive for the graph to occupy a wide sweep of the space available. On the other hand, too large a scale will tend to accentuate the errors of observation and obscure the relationship between the two quantities.

**8. SAFETY**

This manual contains a number of guidelines which can help you perform your research works

more safely and maintain better order and safety in our laboratories.

Each student is expected to read this manual thoroughly and act in accord with the guidelines. This manual should also be kept available for future reference.

One of the most essential aspects of safety in research is good laboratory organization/housekeeping. This includes the proper storage and handling of equipment/tools, machines, chemicals, gas cylinders, electrical equipment and others. The appearance and organization of our facilities directly affects their safety and productivity as well as our departmental reputation. There are two golden rules in developing a safe and productive environment:

1) Whenever you use a lab, it is your responsibility to see that unsafe conditions are corrected immediately; and

2) Always leave a laboratory in better condition than you found it.

If we all take this level of personal responsibility, our facilities can only improve.

We hope to periodically update and revise this manual to make it more useful and more effective.

We hope keep you stay safe and productive.

Safety requires a careful and deliberate approach to each test before undertaking any experiment; the student must understand what to do and how to do it.

The following important safety rules should be observed at all times.

1. Don’t clown or gossip in the laboratories
2. Don’t sit on the work bench
3. Extraneous items should be removed from the table
4. Attention should be paid for clamping the job, tool, tool holders or supporting cutters.
5. Ask for instructions before the use of any item of test equipment for the first, time, even if you think you know how to use it. A little knowledge can be dangerous.
6. Do not use any ring and wrist watch during practical periods.
7. Do not use any necklace or chain during practical periods.
8. Your hand nails must be dressed and properly maintained.
9. Avoid loose clothes in the laboratory and workshop.
10. Always wear safety goggle where necessary.
11. Do not eat nor drink during practical periods.
12. Ask when you do not know.

**MANDATORY PERSONAL PROTECTIVE WEARS FOR LABORATORY AND WORKSHOP**

i. White long sleeve laboratory coat for laboratory practical.

ii. Blue long sleeve overall for workshop practical.

iii. Safety boot / hard sole leather shoe.