Author's Instruction for ME354 Formal Lab Report

By

Author's Name
Author's Lab Section, Day, Time
Lab TA's Name

Date of this Lab Exercise:

Date of Lab Report Submission:

General requirements:

- Font: 12 pt Times New Roman or 11 pt Arial
- Spacing: 1.5 lines
- Maximum length: 10 pages, not including appendices. Title page and executive summary on their own separate pages.
- Color or B&W
- Double-sided printing is appreciated

Executive Summary:

You should provide a brief description that previews the main points of the report. The objectives, procedures, results and conclusions of the laboratory exercise are to be briefly summarized. Total length should be 300-500 words and on its own separate page. Final quantitative results (e.g., % error in strain, modulus of elasticity for each material) should be provided to add quantitative detail and credibility to the conclusions. This section is often the only part of a report that higher-level managers will read so you need to capture the essence of the work, results, and key recommendations. Avoid technical jargon.

A. Introduction:

Provide an introduction to the laboratory through a short statement of the goals of the experiment or test. You must provide a statement on the **hypothesis**, i.e. what do you expect? Very few experiments are "what if" exercises. You must also give some background.

Example:

In this laboratory exercise, two beams with strain-gages were subjected to an applied force. The beams had similar lengths and moment of inertias, but different cross-sectional designs. The strain state in each beam was determined using uniaxial and rosette strain gages mount at multiple locations. Constitutive relations were used to calculate the experimentally-determined stresses from resulting strain measurements. These stresses were compared to analytically-determined stresses to assess how well analytical methods match the experimental results. The working hypothesis is that the same loading condition for each beam will produce different stress states for each beam design. Specific objectives included: a) to familiarize the user with strain gages and associated instrumentation, b) to measure deflections and compare these to predicted deflections, and c) to verify aspects of stress-strain relations and simple beam theory.

B. Procedure:

Provide a discussion regarding the test set-up to allow replication of both the test itself and the test results. The information needs to be sufficient to ensure that others can verify the measurements and allow someone else to setup and run the test in the future. Do not copy and paste the lab instructions verbatim here.

Describe the type of experiment or test, the materials tested, and the apparatus used in the experiment or test. Include an illustration of the actual experimental set up. In the appendix, you can provide a detailed description of the apparatus that should include a digital image, make, model, and serial number (if possible). Description of the test material should include the proper specification for the material. Illustrations must be referred to in the text by figure number (don't leave a figure dangling!). Do not cut and paste text or images from the lab instructions.

Example:

Uniaxial tensile tests of reduced gage section tensile specimens (Fig. 1) were conducted on four different materials per ASTM E8M "Standard Test Methods of Tension Testing of Metallic Materials [Metric]." Materials tested include a low carbon steel (1018 hot rolled), a structural aluminum allow (6061-T6), a ductile polymer (polycarbonate), and a brittle polymer (PMMA). All tensile specimens were fabricated on a conventional lathe from 7.9 mm diameter stock.

C. Results:

This section contains calculated final results, graphs, tables, and final equations in a coherent and understandable manner. The order of the presented results should tell a logical story that progresses through the work performed and not be a scattering of information throughout your report. Explanations must be provided to the reader to explain how final results were obtained. Full detail on the calculation steps taken to reach the final results are proved in the Appendix. Each graph, table, etc. must have figure caption or table heading and must be referred to in the text with a description that summarizes the results. A good report layout has a figure is on the same page as its discussion text. Place raw data (such as table of measurements and data sheets) and intermediary calculations in the Appendix so that the results can be examined and verified.

Examples:

The primary test results from the room-temperature creep tests of the lead-tin solder are in the form of relative displacement versus time data tests (See Appendix A). The measured data was used to calculate the engineering strain ε as given by

$$\varepsilon = \frac{\Delta L}{L_0} \qquad (1)$$

where ΔL is the relative displacement and L_0 is the initial gage length. Sample calculations are provided in Appendix B.

The resulting strain versus time plots are show in Figure 3 for four different applied masses (4, 6, 7, and 8 lbs.), which corresponds to four different stresses (σ = 4.48, 6.64, 7.89, and 8.90 MPa). As expected by creep theory, as applied stress increased, both the levels and shape of the strain-time curves changed.

D. Discussion:

Present the results of the experiment or test through interpretation of data, error analysis, etc. Include all sources and discuss relative magnitude, probability, and mechanisms of the error would affect the experimental results (be quantitative). If obtaining material properties, compare your experimental results to published data (e.g., Table X.Y in a published handbook or www.matweb.com).

Example:

The use of Eq. 2 to fit the creep results was found to be an adequate match (R^2=0.988). Comparison of the A and n values obtained for the short term tests of this 60-40 lead-tine solder show the A value to be in reasonable agreement with the previous results (c.f., 7.4 ×10^{-8} versus 2.6 ×10^{-8} from the text, Mechanical Behavior of Materials, N.E. Dowling, 2007, Prentice Hall). Similarly, the n value was in reasonable agreement (2.9 versus 2.2 in Dowling).

The salient conclusive points of this exercise can be enumerated as following:

1. *Creep strain and strain rates can be determined for a lead-tin solder allow for various stress at room temperature.*
2. *The relation $\dot{\varepsilon} = A\sigma^n$ can be used to describe the isothermal creep behavior.*
3. *It was not possible to achieve good agreement between long term results and predictions of long term behavior from short-term results. This was because steady-state creep behavior had not been measured in short term tests.*

Appendix:

In the remaining sections it is expected to include equations, calculations, or work which are secondary to the report including all measured data and provided dimensions. If there is more than one appendix, each appendix should be clearly labeled. Each appendix should contain the calculations, measurements, and equations for one central calculation or figure (e.g., moment of inertia, 0.02% offset line, etc.)

FORMAL REPORT SCORE SHEET

Item	Points	Score	Comments
Grammar, spelling, and punctuation	10		
Title Page & Exec. Summary/Abstract:			
Limited sentences describing what was done, why it was done, and what resulted or what was the outcome. Report important numbers like %diff, E, etc.	5		
Objectives/Introduction:			
Very brief background and goals of the experiment. Clearly state the hypothesis.	5		
Test Description/Procedure:			
Indicate the test conducted and summarize the set-up. Do not repeat the lab instructions. Be specific about identifying apparatus used (make, model, S/N).	5		
Diagram or picture of the setup. Clear labels in the figure to identify the different parts of the system. Do not cut 'n' paste images from the instructions. No borders around the figures.	5		
Results and Appendices:			
Theory used to analyze data is described in sufficient detail and is correct.	10		
Analysis of the collected data is complete, clear, and correct. Sufficient descriptions for the steps in the calculations are given.	15		
Results in graphs and tables are accurate. Important features are described in the text.	20		
Format of graphs, equations, and tables is professional looking. Table caption at the top; figure caption at the foot. Appropriate units are indicated. Long equations are centered and numbered; Small equations are inline with the text. Reference to graphs, tables, and appendices are made in the text and are not left "dangling".	10		
Discussion/Conclusion:			
Describe engineering insight into the exercise and explain any errors or differences in measurement and theory. Report results of error analysis. Indicate how do material properties compare with published data. Salient points of the report findings are clearly designated.	10		
Recommendations:			
Summarize the lab results and describe implications from the study.	5		

Total: