

UNIVERSITY OF PLYMOUTH
DEPARTMENT OF MECHANICAL AND MARINE ENGINEERING
BSc IN MECHANICAL DESIGN AND MANUFACTURE

BSc 3 : Advanced Materials (MATS 340)

Laboratory Exercise

**Prediction and Investigation of
Failure Mechanisms in Engineered Artefacts**

**THE REPORT SHOULD BE HANDED IN BEFORE YOU LEAVE THE
LABORATORY.**

NAME: _____

DATE: _____

GROUP: _____

Introduction: Engineered components that are well designed should not fail unexpectedly. If they fail at all, they should fail in a 'safe' way, i.e. giving some warning they are about to fail, or failing in a way that is not injurious to any persons operating them or in the vicinity. It is a useful skill to be able to predict the failure mode and failure loads for a given artefact, and to be able to apply this to new designs.

Objective: The purpose of this laboratory exercise is to take an engineered artefact, to predict the possible failure modes and loads, to carry out a test to destruction and to discuss the results. The teams will brainstorm all the possible mechanisms of failure, writing up the report as they evolve their thinking, and hand in the report at the end of the period.

Tasks:

1. Collect from the technician the artefact that you will be considering in your investigation.
2. Examine the item carefully and write down your opinion, as the first part of the report, of the possible failure modes, using sketches where appropriate. Estimate the failure load for each mechanism of failure suggested. This can be done by carrying out a Standard Hardness Test on various parts of the component, and using a graph, which correlates hardness number with tensile strength and shear strength, together with measured dimensions. Support your opinion with technical argument. This part of the report, the next part and the final discussion to be carried out individually.
3. Devise a test programme for the item. This should, where possible contain tests that simulate the loading that would be experienced in service and should therefore be a true representation of the failure conditions in practice.
4. With the equipment available in the laboratory, in collaboration with the team and the technician, devise, set up and carry out the tests decided upon.
5. Finish compiling the report with an analysis of the results and discussion of how close you were to predicting failure modes and loads.

YOUR REPORT MUST BE SUBMITTED AT THE END OF THE LABORATORY PERIOD.

Your report may contain the following sections:

- (a) Description of the artefact tested.
- (b) Your individual assessment of how you think it will fail.
- (c) Your individual test programme.
- (d) Group description of the test carried out.
- (e) Results.
- (f) Discussion of the differences between your individual test programme and the actual tests carried out and the way in which the changes may have affected the results.
- (g) Discussion of the differences, if any, between your predicted failure and the actual failure obtained in the laboratory.