Each small group (2 to 4 students) will conduct an experiment outside of class (referred to as the "Independent Laboratory"). The following describes the experiments:

- Group A will conduct an experiment to study the effectiveness of protective sprays or coatings for preventing weathering of rubber bands
- Group B will conduct an experiment to study creep properties in plastic and steel coat hangers.
- Group C will conduct an experiment to study the effects of anode and cathode surface area ratio on galvanic corrosion.
- Group D will conduct an experiment to study pitting corrosion in 2024 aluminum alloy.
- Group E will conduct an experiment to study the effects of damaged zinc galvanization on corrosion prevention of steel.
- Group F will conduct an experiment to study the difference in corrosion of steel immersed or partially immersed in an aqueous solution.

All work for the Independent Laboratory will be conducted by the small group teams and will be done entirely outside of class. The following are the due dates for various assignments for the Independent Laboratory.

All submitted work must be single spaced (double space between paragraphs), 12 point Times New Roman font, and standard margins.

See Section IV – Tests and Experiments in the ME Laboratory Handbook for information on experiments and testing.

Problem statement and Background (due 3rd week of class at the beginning of your lab section; A, B, C, or D)

- Problem statement (one sentence): should explain why the experiment is being conducted (eg. *Problem Statement: determine effectiveness of protective spray to prevent weathering of rubber bands*).
- Background: describe similar test or experiments (including standardized tests) and any other information to "set the scene" for the experiment or test. It should discuss the basic principles behind the testing. For example, if you are going to do an experiment investigating galvanic corrosion, then your background MUST discuss corrosion in general, and specifically, what is galvanic corrosion, what causes it, and include any other relevant technical information. Don't forget to cite references! See the School of Engineering's *Writing for Engineers* for description of backgrounds in general.

One page *maximum*.

Must properly cite and reference using MLA, Chicago, or other common format Citations must include at least<u>one of each</u> of the following:

- ASTM test (include specific test number and title such as: ASTM E8 / E8M 09 Standard Test Methods for Tension Testing of Metallic Materials)
- ASM Handbook (except Group A ASM is mostly metals, but you still need at least 3 references)
- One other source (book, journal article, university web page)

Draft of Test Plan that includes the following (due the 5th week of class – beginning of lab sections A, B, C, or D):

- A clear description of the purpose (why is this being done) same or similar to that submitted in week 3, but includes revisions suggested by the instructor.
- Background information similar or same to that submitted in week 3, but includes revisions suggested by the instructor.
- Description of the controlled variable and their magnitudes/values and a list of response variables.
- Detailed description or list of required resources, including quantities (see last page in this document for list of available supplies).
 - Materials and test specimens (be sure to include extra materials and specimens for pre-test trials and mistakes that may occur during testing that may "ruin" the specimens).
 - Supplies and equipment
 - Anything else required
- Procedures and methods clearly described (list format)
 - Sketches of samples or specimens
 - Sketches of experimental setup
- Include the original problem statement and background submitted in week 3 and returned to you with comments.

Final Test Plan (due the 7th week of class – lab sections A, B, C or D) (7th wk=wk of Feb 24) Revise your test plan per instructor comments. When submitting the revised document, please **BE SURE TO INCLUDE both the first background and plan** with instructor's comments. The final test plan is due the 7th week of class and must include the above as well as a complete blank **data sheet**.

Data Sheets

"Data sheet" (a.k.a. "check sheet" or "run sheet" – a table or similar document showing the conditions of the experiment with blanks values to be recorded during the experiment. It must include variable names and units). A hardcopy of the run sheet should be created even if all data is to be recorded electronically.

Laboratory data sheets are used to record critical information prior to and during laboratory work. They are created during the planning stages of an experiment (pre-lab work). They should be sufficiently detailed so as to record all critical information including hardware to be used and the data recorded. They should include the following where applicable for EGR270:

- Name of the experiment
- The name of the participants
- The name of the person recording the data (or blank to be entered later)
- The date(s) that the laboratory was conducted (blank space for now).
- To assist with data taking, a sketch of the laboratory setup including location of the transducers *may be* required.

- A table or list with blank places to record the data. It must be clear in this table what the test conditions are for each set of data. The blanks should appear in the order they are to be filled in. The data may include extraneous, dependent, and independent variables.

Last week of class:

- Technical letter due for the independent lab.
- Formal oral technical presentation using PowerPoint (given last week of class), printout of the PowerPoint slides 6 slides per page

LIST of AVAILABLE SUPPLIES:

For conducting all of these experiments, the following can be provided:

Zinc plated steel nails "bright" steel nails (not plated) 2024-T351 aluminum (broken Charpy bars, broken tensile bars, heat treat "pieces") AISI 1018 and 1045 steel (broken Charpy bars, broken tensile bars) Commercially pure copper (coldworked then annealed) Aluminum foil (specific alloy is unknown) Rubber bands Armor All (or equivalent) Plastic and wire coat hangers NaCl Chlorine bleach Ammonia Ethel alcohol Vegetable oil Electrical wire Very dilute HNO₃

The following are also available, but must be returned upon completion of semester: Small wood boards with nails Ammeter/volt meter Small plastic containers (cups) Small weights

The following are available for use in the lab:

Microscopes Digital scale to measure weight Test oven with 200°F maximum, approximately 1mX1mX1m. Digital Single Lens Reflex (DSLR) camera and photography table