

# **Crane Design Project**

## **ENES 220 – Spring 2003**

The Crane Design Project will consist of 2 phases this semester. Phase I will allow each team to design and analyze a prototype overhead crane. Phase II will require that each team perform analyses on a typical model of a crane, and the results will be compared to experiments conducted on the model crane later in the semester.

### **Phase I: Design and Analysis of Prototype Overhead Crane**

- Each team will design a full-scale overhead travelling crane similar to the handout distributed at the beginning of the semester.
- Each crane must adhere to the following set of guidelines:
  - a) Maximum load capacity: 50 tons
  - b) Overall width of room: 80 ft
  - c) Overall height of room: 40 ft
  - d) Lift height: 30 ft
  - e) Column spacing along length of room: 30 ft
  - f) Maximum speed (crane, trolley, and hoist): 5 ft/sec
- Design details should include, but are not limited to, the following:
  - a) Total weight of crane (add 20% to account for features not considered)
  - b) Design of beams in crane span – shape, maximum stress, and maximum deflection
  - c) Design of trolley hoist – cables, drum, gear train, shaft, and motor (power required only)
  - d) Stress analyses of fasteners
  - e) Design of runway rails – shape, maximum stress, and maximum deflection
  - f) Buckling of support columns
- Specify material type for all components. Material property data (i.e. elastic modulus, yield strength, ultimate strength, etc.) should be obtained from appropriate tables.
- Structural members should be sized to support the specified load with a safety factor ranging from 2.0 to 4.0. Factors lower than 2.0 are unsafe, and factors higher than 4.0 are not optimized.
- Create drawings of the entire crane as well as individual components, including assembly details. All drawings should be generated with a computer (preferred) or NEATLY by hand.
- This crane design and analysis are due on **Friday, May 9, 2003** during class.

### **Phase II: Analysis of Model Crane and Testing**

- All groups will perform calculations on a model of a typical crane. Model geometry, material properties, and loading details will be provided.
- Tests will be performed on the model, and stresses and displacements will be measured at select points (to be determined).
- After testing is completed, students should compare the results from hand calculations and experimental data. Any disagreement between these results must be explained.

### **Criteria for Assessment:**

- Each team will produce a comprehensive final report, which shall include:
  - (a) Description of prototype crane, including design drawings, material property data, and loading method
  - (b) Hand calculations of all structural members
  - (c) Description of model tests and experimental results
  - (d) Comparison between calculations and experimental data
- The final report will be due on the last day of class – **Friday, May 9, 2003**

**NOTE:** You will receive a handout later in the semester detailing the contents of your final report.