Palestine Polytechnic University
Civil and Architectural Engineering Department

Course Title: Steel Structures

Course Scope: This course teaches the engineering thought process through the design of steel structures. The course uses fundamentals of statics, mechanics of materials, and structural analysis and applies them to the design of structural members, with emphasis on satisfying real-world needs. Topics include an introduction to the design of structural systems, design of steel tension and compression members, design of beams and beam-columns, and an introduction to connection design. All design is performed in accordance with codes and specifications used in current engineering practice. A comprehensive design problem requires development of a design methodology, consideration of alternative solutions, and design of an optimal steel structure to meet stated functional requirements.

Course Goals: This course is designed to enable civil engineering students to apply classic structural behavior principles, along with the AISC LRFD Specification, to the proper analysis and design of steel structures. Students are required to demonstrate proficiency in the analysis and design of tension members, tension connections, (both welded and bolted), compression members, flexural members, beam-columns and the complex structures comprised of such members. A concurrent and explicit goal is to develop the ability to take an engineering approach to problem solving, i.e., to define the problem, formulate and evaluate alternatives, and make rational, reasonable and economical decisions. The use of several PC- based software packages is emphasized throughout the course. Students are exposed to elements of the structural steel industry through a construction site visit and by a guest lecture.

Text Book and References

- Sequi, W. T. (2011). " LRFD Steel Design", Fifth Edition, Thomson Books.
- AISC 13th. *Manual of Steel Construction – Load and Resistance Factor Design*, , American Institute of Steel Construction, Chicago, IL.
- Salmon, C.G. and Johnson, J.E. *Steel Structures: Design and Behavior, Emphasizing Load and Resistance Factor Design*, 4th Edition, Harper College Publishers, New York, NY.
- Jack C. McCormac, James K. Nelson. (2002), *Structural Steel Design LRFD Method*, 3rd Edition, Prentice Hall.

COURSE CONTENT

1. Introduction to structural steel design

- Basic Structural Shapes
- Steel structures: Examples
- Structural Steel Cross Sections
- Structural Steel Materials
- Building Codes and Specifications
- Design philosophies
- Probabilistic Basis for LRFD
- Determining load and resistance factors
- AISC load and resistance factors

3. Design of Tension Members

- Typical tension members
- Design criteria
- Net and gross areas
- Effective area
- Staggered bolted connections
- Block shear
- Slenderness requirements

- How to design a tension member
- Threaded rods, Cables and pin connected members
- Examples.

4. Design of Simple Connections

- Types of connections
- Bolted shear connections
- Spacing and edge distance requirements
- High strength bolts (Bearing type connections)
- High strength bolts (Slip critical connections)
- Welded connections
- Fillet welded connections length and size requirements
- Examples

6. Design of Compression Members

- Buckling of and buckling failure modes
- Effective length
- Design of compression members
- Local buckling
- Buckling factor for rigid frames
- Torsional and flexural-torsional buckling
- Design of single angle compression member
- Design of base plates
- Examples

7. Design of Flexural Members

- Classification of sections
- Moment curvature
- Flexural stability and lateral torsional buckling
- Compact and non-compact section
- Shear strength of bending elements
- Serviceability requirements
- Design of beams
- Design of beam bearing plates
- Examples

8. Beam-Column Design

- Beam columns
- Moment amplification analysis
- Compact sections for beam columns
- Braced and unbraced frames
- Analysis/design of braced and un-braced frames
- Examples

Teaching Methods

The topics in the course will be presented using the overhead and LCD projector and the traditional lecture format. Students are encouraged to attend lectures to ensure that they appreciate what material is considered to be most important. Groups of two or three students will be given one or two design projects to practice the principles of the basic design of steel structures taken in the undergraduate level.

Assessment of Learning

The final grade will be assigned as follows:

Assignments:	15 %
Term Test:	35 %
Final Examination:	50 %