(Structural Steel Design) Course Catalogue

2023-2024

College	**Erbil Technology College**	
Department	**Construction and Materials Technology Eng.**	
Module Name	**Structural Steel Design**	
Module Code	**SSD473**	
Semester	**7**	
Credit	**7**	
Module type	**Prerequisite** ● **Core** ☐ **Assist.** ☐	
Weekly hours	**4**	
Weekly hours (Theory)	**(4)hr Class**	**(189) hr Workload**
Weekly hours (Practical)	**( )hr Class**	**() hr Workload**
Lecturer (Theory)		
E-Mail	**Saad.essa@epu.edu.iq**	
Lecturer (Practical)		
Email	**Saad.essa@epu.edu.iq**	

Course Book

Course overview:

Structural Steel is one of the most popular materials for construction of buildings, bridges, and other structures. This class is about studying properties of steel, behavior of structural steel elements, and design procedures for these elements to withstand structural loads. Both Allowable Stress Design (ASD) and Load and Resistance Factor Design (LRFD) will be introduced to the students and will be used throughout the class. Tension members, compression members, flexural members, and finally members subject to combined bending and axial load will be studied. In addition, simple and eccentric steel connections will be discussed.

Course objective:

SSD473 is an introductory course in the reinforced steel structures. This course is recommended for fourth students in the Construction and Materials Engineering Dept. at Erbil Technology College who are interested in learning the design of steel structures. The objectives of this course are:

1. To learn the behavior and design of structural steel components, for example, members and connections in two - dimensional (2D) truss, and frame structures.
2. To gain an educational and comprehensive experience in the design of simple steel structures.

Student's obligation

The student should attend the class so as to practice the software, absent student will lose activity marks, he/she must draw different drawings as a homework whenever required.

Forms of teaching

The form of teaching will be through using data show and white board for explanation, students will follow steps to use specific commands in the software to draw any sketch or model.

Assessment scheme

Breakdown of overall assessment and examination

Quiz (4 Quiz):4% Home Work (5 Home Work): 14%

Reports& Seminar (5 Reports):10%

Absences: 2 % Mid-Term :30%

Pre-Final:60 m

Final: 40 m

Student learning outcome:

This course contributes to the Construction and Materials Engneering student outcomes by developing:

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(3) The students will understand the behavior of steel elements under structural loading.

(4) Will be familiar with AISC-LRFD steel design procedures.

(5) Will be able to design primary steel structural elements of a building and their connections.

Course Reading List and References:

- STEEL DESIGN, William T. Segui, Cengage Learning, 5th Edition, 2013.
- Manual of Steel Construction, 13th Edition, American Institute of Steel Construction, 2005 (**BRING TO EVERY CLASS**).

The Topics:	**Lecturer's name**
Practical Topics (If there is any)	

Chapter 1. Introduction to Steel Design	Week 1
Chapter 2. (1) Specifications, Loads, and Methods of Design	Week 2
Chapter 3 Analysis of Tension Members	Week 5,6
Chapter 4: Design of Tension Members	Week 4
Chapter 5: Introduction to Axially Loaded Compression Members	Week 5
Chapter 6: Design of Axially Loaded Compression Members	Week 6
Chapter 7: Design of Axially Loaded Compression Members (continued)	Week 7
Chapter 8: Introduction to Beams	Week 8

Chapter 9: Design of Beams for Moment	Week 9
Chapter 10: Design of Beams – Miscellaneous Topics (Shear, Deflection)	Week 10
Chapter 11: Bending and Axial Force	Week 11
Chapter 12: Bolted Connections In this section, the students learn: (1) The behavior and various possible failure modes for bolted connections (2) To calculate the shear strength, bearing strength, and minimum edge distance and spacing requirements for bolted connection (3) To design a bolted connection and gusset plate for given design forces (4) The behavior of a slip-critical connection and how to calculate the slip-strength of a fully tensioned bolted connection. (5) To design a slip-critical bolted splice connection for a tension member.	Week 12

Chapter 13: Bolted Connections (continued)	Week 13
Chapter 14: Welded Connections In this section, the students learn: (1) Different types of welding procedures, welds, and welded connection (2) To calculate the shear strength of a fillet weld considering weld and base metal strength To design a fillet welded connection considering issues such as minimum weld size, maximum weld size, etc.	Week 14

19. Examinations:

Example 6.1 **Design of Axially Loaded Compression Members**

Using $F_y = 50$ ksi, select the lightest W14 available for the service column loads $P_D = 130$ k and $P_L = 210$ k. $KL = 10$ ft.

Solution

LRFD	ASD
$P_u = (1.2)(130\text{ k}) + (1.6)(210\text{ k}) = 492\text{ k}$	$P_a = 130\text{ k} + 210\text{ k} = 340\text{ k}$
Assume $\frac{KL}{r} = 50$	Assume $\frac{KL}{r} = 50$
Using $F_y = 50$ ksi steel	Using $F_y = 50$ ksi steel
$\phi_c F_{cr}$ from AISC Table 4-22 $= 37.5$ ksi	$\frac{F_{cr}}{\Omega_c} = 24.9$ ksi (AISC Table 4-22)
A Reqd $= \frac{P_u}{\phi_c F_{cr}} = \frac{492\text{ k}}{37.5\text{ ksi}} = 13.12\text{ in}^2$	A Reqd $= \frac{P_a}{F_{cr}/\Omega} = \frac{340\text{ k}}{24.9\text{ ksi}} = 13.65\text{ in}^2$
Try W14 × 48 ($A = 14.1\text{ in}^2$, $r_x = 5.85$ in, $r_y = 1.91$ in)	Try W14 × 48 ($A = 14.1\text{ in}^2$, $r_x = 5.85$ in, $r_y = 1.91$ in)
$\left(\frac{KL}{r}\right)_y = \frac{(12\text{ in/ft})(10\text{ ft})}{1.91\text{ in}} = 62.83$	$\left(\frac{KL}{r}\right)_y = \frac{(12\text{ in/ft})(10\text{ ft})}{1.91\text{ in}} = 62.83$
$\phi_c F_{cr} = 33.75$ ksi from AISC Table 4-22	
$\phi_c P_n = (33.75\text{ ksi})(14.1\text{ in}^2)$ $= 476\text{ k} < 492\text{ k}$ N.G.	$\frac{F_{cr}}{\Omega_c} = 22.43$ ksi from AISC Table 4-22
Try next larger section W14 × 53 ($A = 15.6\text{ in}^2$, $r_y = 1.92$ in)	$\frac{P_n}{\Omega_c} = (22.43\text{ ksi})(14.1\text{ in}^2) = 316\text{ k} < 340\text{ k}$ N.G.
$\left(\frac{KL}{r}\right)_y = \frac{(12\text{ in/ft})(10\text{ ft})}{1.92\text{ in}} = 62.5$	Try next larger section W14 × 53 ($A = 15.6\text{ in}^2$, $r_y = 1.92$ in).
$\phi_c F_{cr} = 33.85$ ksi	$\left(\frac{KL}{r}\right)_y = \frac{(12\text{ in/ft})(10\text{ ft})}{1.92\text{ in}} = 62.5$
$\phi_c P_n = (33.85\text{ ksi})(15.6\text{ in}^2)$	$\frac{F_{cr}}{\Omega_c} = 22.5$ ksi
$= 528\text{ k} > 492\text{ k}$ **OK**	$\frac{P_n}{\Omega_c} = (22.5\text{ ksi})(15.6\text{ in}^2) = 351\text{ k} > 340\text{ k}$ **OK**
Use W14 × 53.	**Use W14 × 53.**

20. Extra notes:	
21. Peer review	