AL-MUSTAQBAL UNIVERSITY

College of Engineering & Technology

Building and Construction Techniques Engineering Department

Design of Steel Structures

Fourth Class

Lecture No. 1 - Introduction

Lecturer

Dr. Bareq Ali Abdulhadi

REFERENCES

1.	Specification for Structural Steel Buildings, AISC 2005.
2.	Steel Design, fourth edition by William T. Segui, 2007.
3.	Structural Steel Design, fourth edition by Jack C. McCormac, Prentice Hall
4.	Steel Structures: Design and Behavior. 5th ed. By Salmon, G. Charles, Johnson, E. John and Malhas A. Faris, Prentice Hall, 2008.
5.	Design of Steel Structures. 3rd ed. By Gaylord, E.H., Gaylord, C.N. and StallmeyerJ.E., McGraw-Hill, 1992.
6.	**American Institute of Steel Construction. *Steel construction manual*. American Institute of Steel Construction; 2005.**

Syllabus

No.	Heading	Units (Lecture - each unit is 3 Hours)
1.	Introduction and Concepts of Steel Design	2
2.	Tension Members	4
3.	Compression Members	4
4.	Beams	4
5.	Beam - Column	4
6.	Base Plates	2
7.	Simple Connections	2
8.	Eccentric Connections	2
9.	Plate Girders	2
10.	Composite Beams	2
	Sum.	28 (2 units for exams)

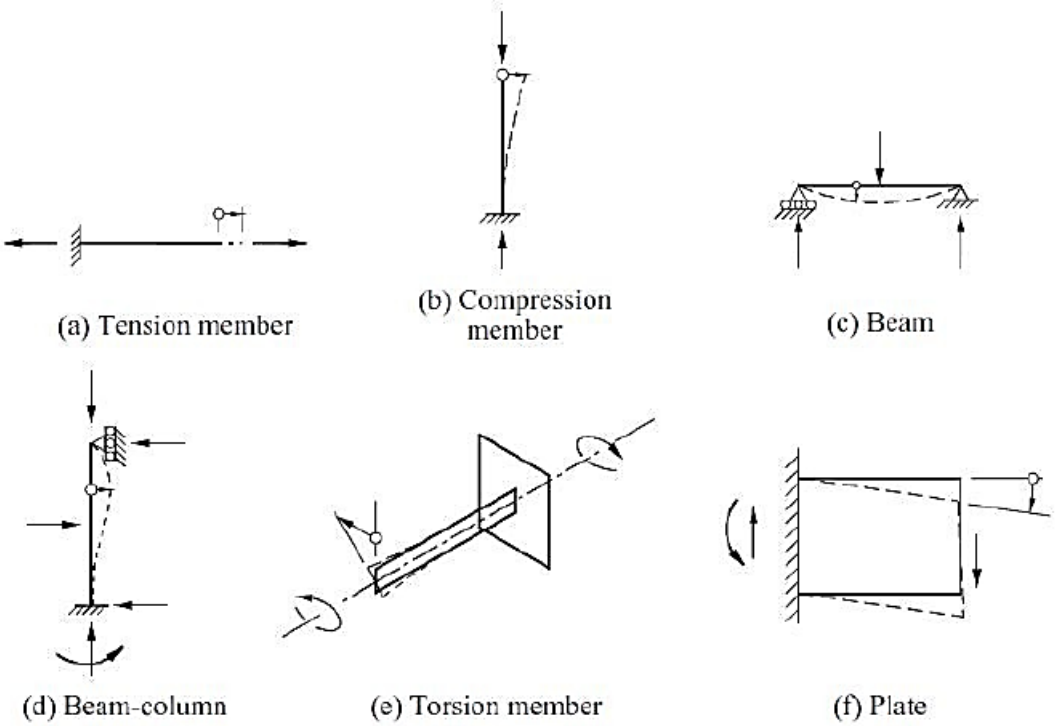
Module Evaluation

1.	First Term Exam	15%
2.	Second Term Exam	15%
3.	Quizzes	5%
4.	Class Attendance	5%
5.	Final Exam	60%
	Sum.	100%

Introduction

➢ Engineering Structures and structural members:

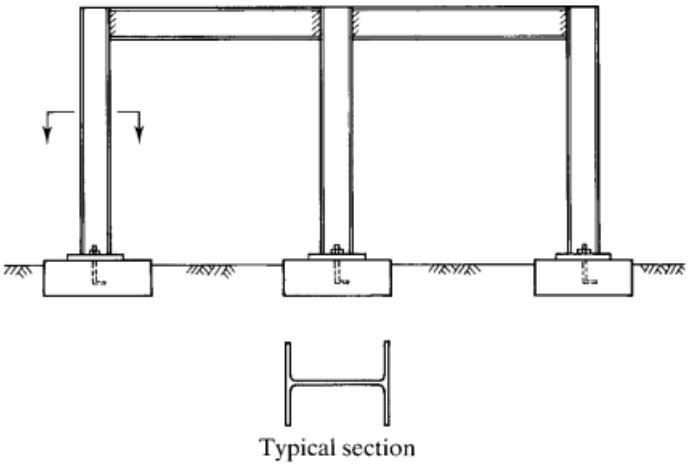
- Engineering structures are required to support loads and resist forces, and to transfer these loads and forces to the foundations of the structures.
- The structural design of buildings, whether of structural steel or reinforced concrete, requires the determination of the overall proportions and dimensions of the supporting framework and the selection of the cross sections of individual members.
- In most cases the functional design, including the establishment of the number of stories and the floor plan, will have been done by an architect, and the structural engineer must work within the constraints imposed by this design.
- The architect decides how the building should look; the engineer must make sure that it doesn't fall down.
- Steel Structural members can be classified as tension or compression members, beams, beam-columns, torsion members, or plates.



➢ Design process of structures:

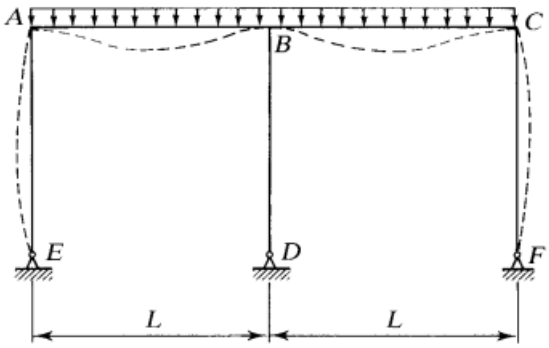
- The design and analysis of each frame in the system begins with the idealization of the frame as a two-dimensional structure.
- We are able to treat the frame as two-dimensional and represent the frame members by their centre-lines.

Real Structure



(a)

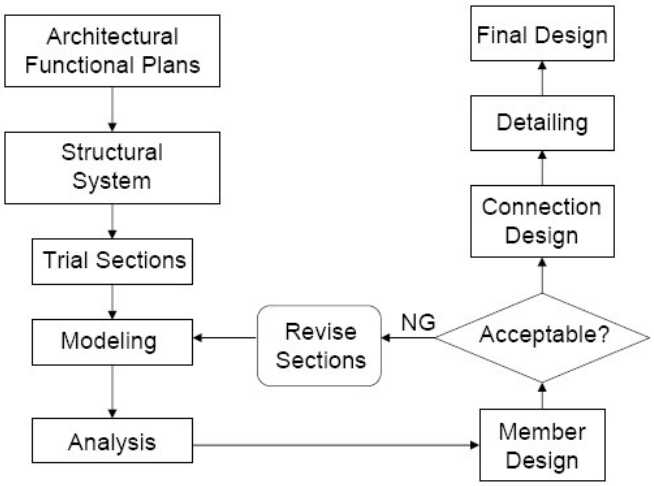
Idealized Structure



(b)

- The horizontal members AB and BC are subjected primarily to bending, or flexure, and are called beams. The vertical member BD is subjected only to axial compression arising from the vertical loads. In buildings, vertical compression members such as these are referred to as columns. The other two vertical members, AE and CF, must resist not only axial compression from the vertical loads but also a significant amount of bending. Such members are called beam-columns.

➢ Design flow chart:



Advantages of Steel Structures	**Disadvantages of Steel Structures**
High Strength and Light Weight Nature	High Maintenance Costs And More Corrosion
Lesser Construction Time / Greater Erection Speed	Fireproofing Costs
Uniformity, Durability and Performance (reliable)	Susceptibility To Buckling
Elasticity & Ductility (do not crack or deform)	Higher Initial Cost / Less Availability
Recyclable and scrap value	
Simple Connection Devices such as Welds, Rivets and Bolts	

➢ Types of Structural Steel:

- Carbon Steel:- the maximum content specified for alloying elements does not exceed the following: manganese—1.65%, silicon—0.60%, copper—0.60% and the specified minimum for copper does not exceed 0.40%.

Property	A36	A572 Gr. 50	A992
Yield point, min.	36 ksi	50 ksi	50 ksi
Tensile strength, min.	58 to 80 ksi	65 ksi	65 ksi
Yield to tensile ratio, max.	—	—	0.85
Elongation in 8 in., min.	20%	18%	18%

- High-Strength Low-Alloy Steels: Those steels which have specified minimum yield points greater than 40 ksi and achieve that strength in the hot-rolled condition.

• A242 steel is a weathering steel, used where resistance to atmospheric corrosion is of primary importance.

• A588 is the primary weathering steel for structural work. It provides a 50- ksi yield point in plates up to 4 in thick and in all structural sections.

- Loads: The forces that act on a structure are called loads. They belong to one of two broad categories: dead load and live load.

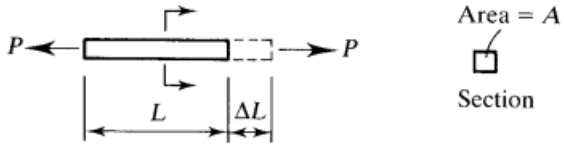
- Dead Load: weight of the structure, floor coverings, partitions, and suspended ceilings.
- Live Load: furniture, equipment, and occupants of buildings.
- Other types of Loads: Winds, Earthquakes and Snow.

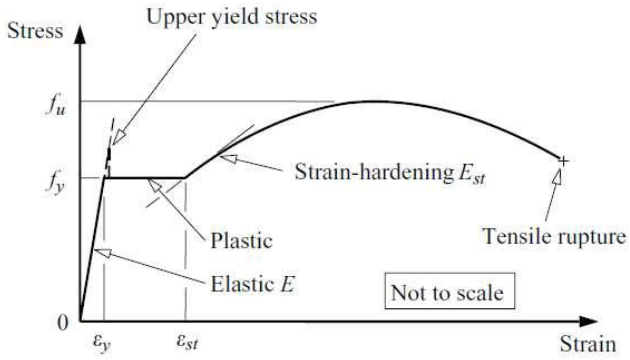
- Structural Steel Characteristics: the most interest to structural engineers can be examined by plotting the results of a tensile test. If a test specimen is subjected to an *axial load P*, as shown in Figure 1.3a, the *stress* and *strain* can be computed as follows (following Hook`s Law):

$$f = \frac{P}{A} \quad \text{and} \quad \varepsilon = \frac{\Delta L}{L}$$

where

f = axial tensile stress
A = cross-sectional area
ε = axial strain
L = length of specimen
ΔL = change in length





Ductility can be measured by the elongation, defined as:

$$e = \frac{L_f - L_0}{L_0} \times 100$$

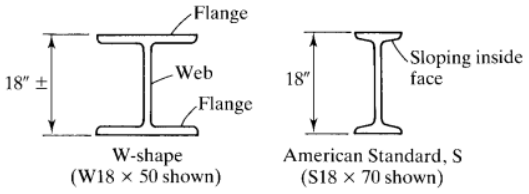
where

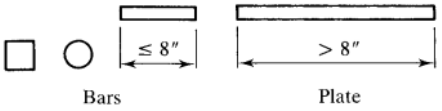
e = elongation (expressed as a percent)
L_f = length of the specimen at fracture
L_0 = original length

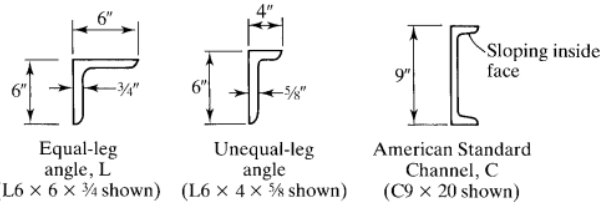
The yield point, defined by the stress Fy (Yield Strength). The other point of interest to the structural engineer is the maximum value of stress that can be attained, called the ultimate tensile strength, Fu.

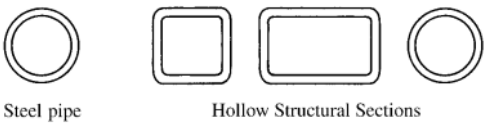
A36 Steel Yield stress: Fy = 36,000 psi (36 ksi), Tensile strength: Fu = 58,000 psi to 80,000 psi (58 ksi to 80 ksi). 1 Mpa = 1000 kn/m^2 = 145 psi

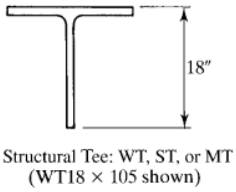
- STANDARD CROSS-SECTIONAL SHAPES:

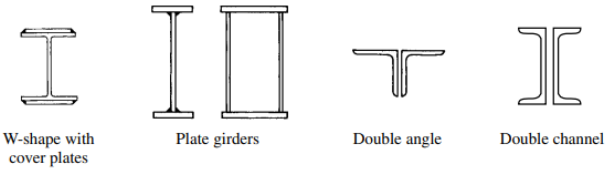












Shape	Preferred Steel
Angles	A36
Plates	A36
S, M, C, MC	A36
HP	A572 Grade 50
W	A992
Pipe	A53 Grade B (only choice)
HSS	A500 Grade B (round) or C (rectangular)

THE END. ..