***Structural engineering***

Structural engineering is that part of civil engineering in which structural engineers are educated to create the 'bones and muscles' that create the form and shape of man made structures. Structural engineers need to understand and calculate the stability, strength and rigidity of built structures for buildings and non-building structures. The structural designs are integrated with those of other designers such as architects and building services engineer and often supervise the construction of projects by contractors on site. They can also be involved in the design of machinery, medical equipment, and vehicles where structural integrity affects functioning and safety.

Structural engineering theory is based upon applied physical laws and empirical knowledge of the structural performance of different materials and geometries. Structural engineering design uses a number of relatively simple structural elements to build complex structural systems. Structural engineers are responsible for making creative and efficient use of funds, structural elements and materials to achieve these goals.

***History***

Structural engineering dates back to 2700 B.C. when the step pyramid for Pharaoh Djoser was built by Imhotep, the first engineer in history known by name. Pyramids were the most common major structures built by ancient civilizations because the structural form of a pyramid is stable and can be almost infinitely scaled.

The structural stability of the pyramid relies also on the strength of the stone from which it is constructed, and its ability to support the weight of the stone above it. The limestone blocks were often taken from a quarry near the build site and have a compressive strength from 30 to 250 MPa. Therefore, the structural strength of the pyramid stems from the material properties of the stones from which it was built rather than the pyramid's geometry.

Throughout ancient and medieval history most architectural design and construction was carried out by artisans, such as stonemasons and carpenters, rising to the role of master builder. No theory of structures existed, and understanding of how structures stood up was extremely limited, and based almost entirely on empirical evidence of 'what had worked before'. Structures were repetitive, and increases in scale were incremental.

No record exists of the first calculations of the strength of structural members or the behavior of structural material, but the profession of structural engineer only really took shape with the Industrial revolution and the re-invention of concrete. The physical sciences underlying structural engineering began to be understood in the Renaissance and have since developed into computer-based applications in the 1970s.

***Structural failure***

The history of structural engineering contains many collapses and failures. Sometimes this is due to obvious negligence. In other cases, structural failures require careful study, and the results of these inquiries have resulted in improved practices and greater understanding of the science of structural engineering.

***Theory***

Structural engineering depends upon a detailed knowledge of applied mechanics, materials science and applied mathematics to understand and predict how structures support and resist self-weight and imposed loads. To apply the knowledge successfully a structural engineer generally requires detailed knowledge of relevant empirical and theoretical design codes, the techniques of structural analysis, as well as some knowledge of the corrosion resistance of the materials and structures, especially when those structures are exposed to the external environment.

***Materials***

Structural engineering depends on the knowledge of materials and their properties, in order to understand how different materials support and resist loads. Common structural materials are: Iron, Concrete, Masonry, Aluminium, Composite materials.

***Profession***

Structural engineers are responsible for engineering design and structural analysis. Entry-level structural engineers may design the individual structural elements of a structure, such as the beams and columns of a building. More experienced engineers may be responsible for the structural design and integrity of an entire system, such as a building.

Structural engineers often specialize in particular types of structures, such as buildings, bridges, pipelines, tunnels, ships, aircraft and spacecraft. Structural engineers who specialize in buildings often specialize in particular construction materials such as concrete, steel, wood, masonry, alloys and composites, and may focus on particular types of buildings such as offices, schools, hospitals, and residential.

The role of a structural engineer today involves a significant understanding of both static and dynamic loading, and the structures that are available to resist them. The complexity of modern structures often requires a great deal of creativity from the engineer in order to ensure the structures support and resist the loads they are subjected to. A structural engineer will typically have a four or five year undergraduate degree, followed by a minimum of three years of professional practice before being considered fully qualified.

***I- Reading comprehension***

- Is it true or false that?

* Beams are a structural element
* Column are not a structural element
* Imhotep is an Algerian engineer
* Structural engineers are responsible for engineering design and structural analysis

***II- Terminology***

- Translate the underlined words into French and Arabic

***III- Written expression***

- Resume the text