Postgraduate Diploma
Structural Analysis

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Postgraduate Diploma
Structural Analysis

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/engineering/postgraduate-diploma/postgraduate-diploma-structural-analysis**

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01

Introduction

Structural Analysis is one of the most important pillars of Structural and Construction Engineering. So much so that the generation of high-quality standard drawings and virtual environments in which to visualize projects have been key to the work of engineers around the world. The most advanced professionals must maintain a high level of updating, knowing both the technology and the most innovative contributions in their field. Therefore, this qualification was born, which compiles the principles of structural analysis, mechanics of the deformable solid, uses of structural steel, and the most advanced structural concrete. All of this in a 100% online format, with no in-presential classes or restricted schedules.

Join the elite in Structural and Construction Engineering by enrolling in this Postgraduate Diploma"

The various advances and uses that concrete and structural steel have acquired throughout history have allowed engineers to shape increasingly complex and technically challenging buildings. Structural Analysis plays a vital role in this avant-garde work, representing a valuable point of distinction for the career of every engineer.

For this reason, TECH has developed this Postgraduate Diploma, which is an opportunity of great value for any engineer who wants to stand out through innovation and vanguard. This program precisely reviews the most important uses of concrete and structural steel, assessing issues such as economical design, service life, typical structural elements, and other issues of special relevance in Structural Analysis.

A unique academic opportunity offered in a completely online format, with a Virtual Campus available to the engineer at any time of the day. All contents are downloadable from any device with an Internet connection so that the teaching load can be assumed and adapted to the student's own requirements.

This **Postgraduate Diploma in Structural Analysis** contains the most complete and up-to-date program on the market. The most important features include:

- The development of case studies presented by experts in Civil Engineering
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Stand out thanks to your contributions of value, based on the structural analyses and constructive dispositions of greater repercussion at the moment"

Specialize in the latest Structural Analysis and revitalize your value proposition as a cutting-edge engineer of the highest relevance"

Learn about the most important mechanics of deformable solids, including deformations, kinematic relations, beam theory and stresses.

Decide how to distribute the entire course load without having to adhere to complicated schedules or attend classes in person.

The program's teaching staff includes professionals from the sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

Its multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide an immersive education programmed to learn in real situations.

The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different professional practice situations that are presented throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.

02

Objectives

As Structural Analysis is a vital field in the daily work of every engineer, this Postgraduate Diploma reviews the main innovations and areas of knowledge relevant today. In an exhaustive and meticulous way, the student will deepen in those advances that will mean a differential value in their professional career, being the objective of this degree a distinctive value to their own proposal.

Master the most advanced technique of Structural Analysis after completing this Postgraduate Diploma"

General Objectives

- Autonomous learning of new knowledge and techniques suitable for Civil Engineering
- To know in detail the nature, characteristics, and performance of the new construction materials that have been investigated in recent years
- Understand and use the language of engineering and the terminology of Civil Engineering
- Delve in a scientific and technical way in the activity of the profession of Public Works Technical Engineer with knowledge of the functions of consultancy, analysis, design, calculation, project, construction, maintenance, conservation, and operation

Immediately incorporate the most distinguished uses of structural steel and concrete into your daily practice"

Specific Objectives

Module 1. Structural Analysis

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods
- Define the basic stresses in structural sections: Axial and shear forces, bending moments, and torsional moments
- Calculate stress diagrams

Module 2. Mechanics of the deformable solid

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

Module 3. Structural Steel

- Design, plan, build and maintain reinforced concrete and steel structures based on knowledge of the fundamentals of the behavior of these structures
- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

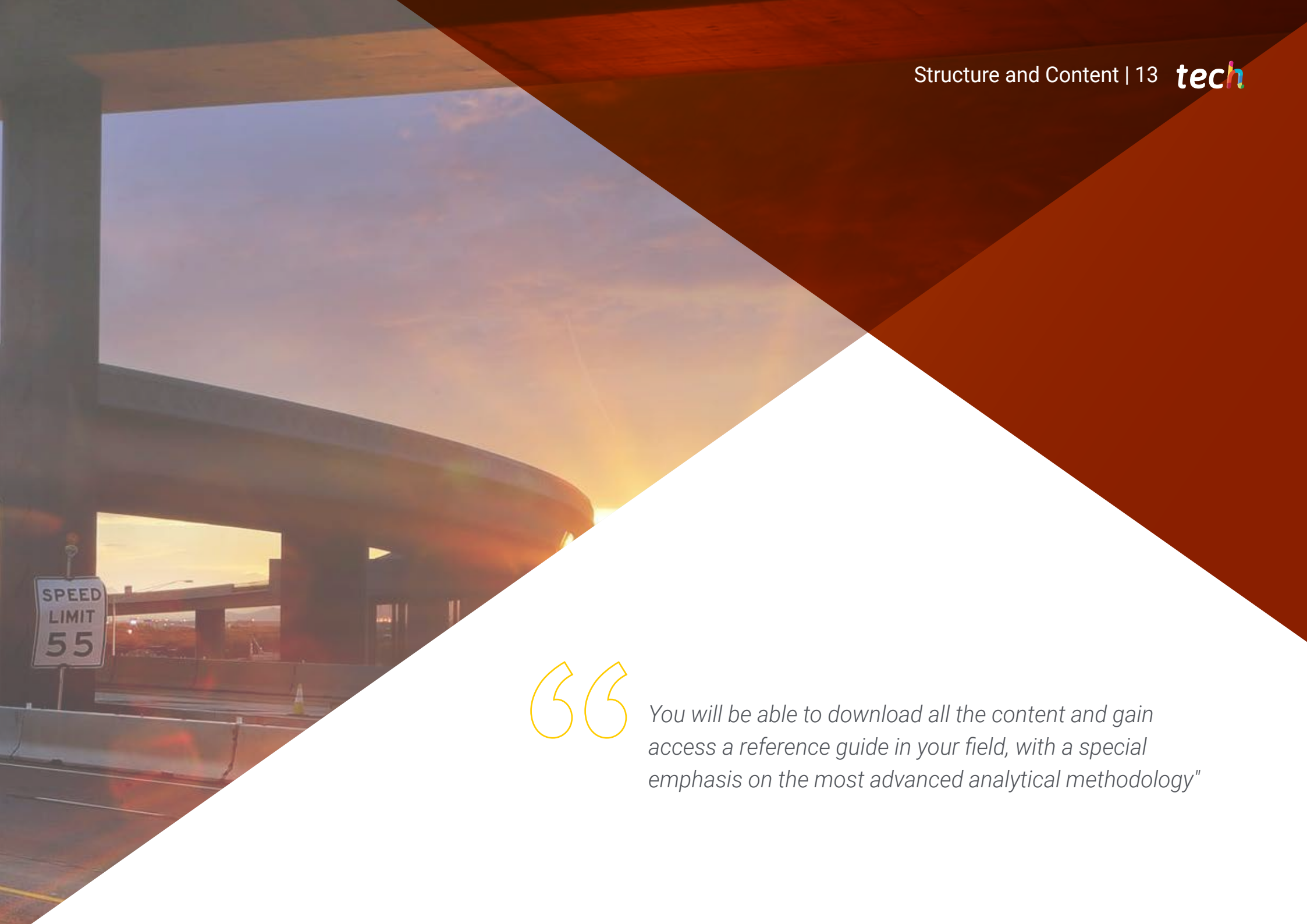
Module 4. Structural Concrete

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

03

Structure and Content

Through the Relearning methodology, TECH has endowed the entire syllabus with a distinguished value. The engineer will go through the main advances and novelties in Structural Analysis in a progressive and natural way, resulting in a much more fruitful and effective academic experience. All this updating work is complemented by a multitude of videos in detail, interactive summaries, and complementary readings with which to delve deeper into the topics of greatest interest.



You will be able to download all the content and gain access a reference guide in your field, with a special emphasis on the most advanced analytical methodology"

Module 1. Structural Analysis

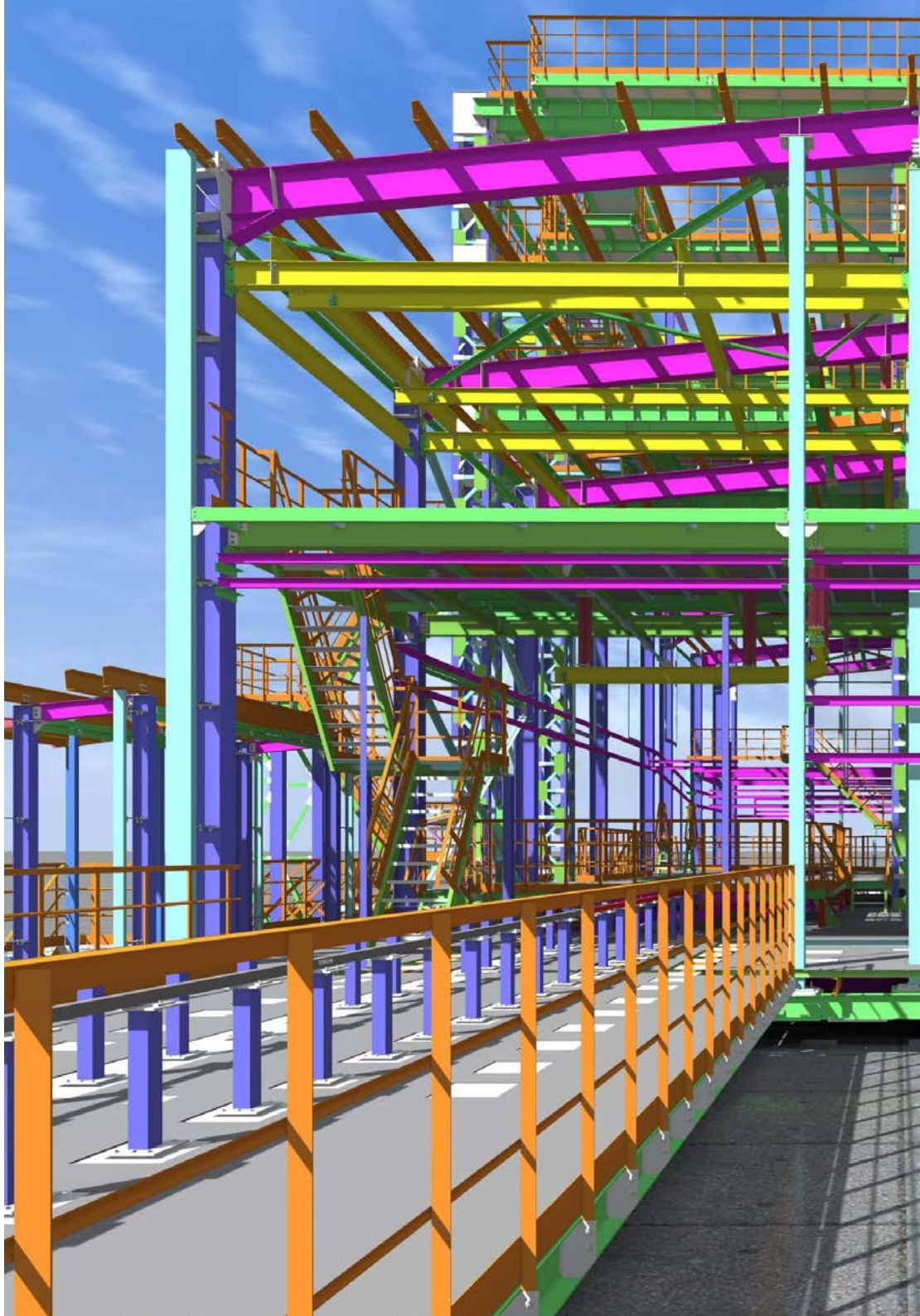
1.1. Introduction to Structures
- 1.1.1. Definition and Classification of Structures
- 1.1.2. Design process and practical and ideal structures
- 1.1.3. Equivalent systems of forces
- 1.1.4. Centers of Gravity. Distributed loads
- 1.1.5. Moments of inertia. Products of inertia. Inertia matrix. Main axes
- 1.1.6. Equilibrium and stability
- 1.1.7. Analytical Statics

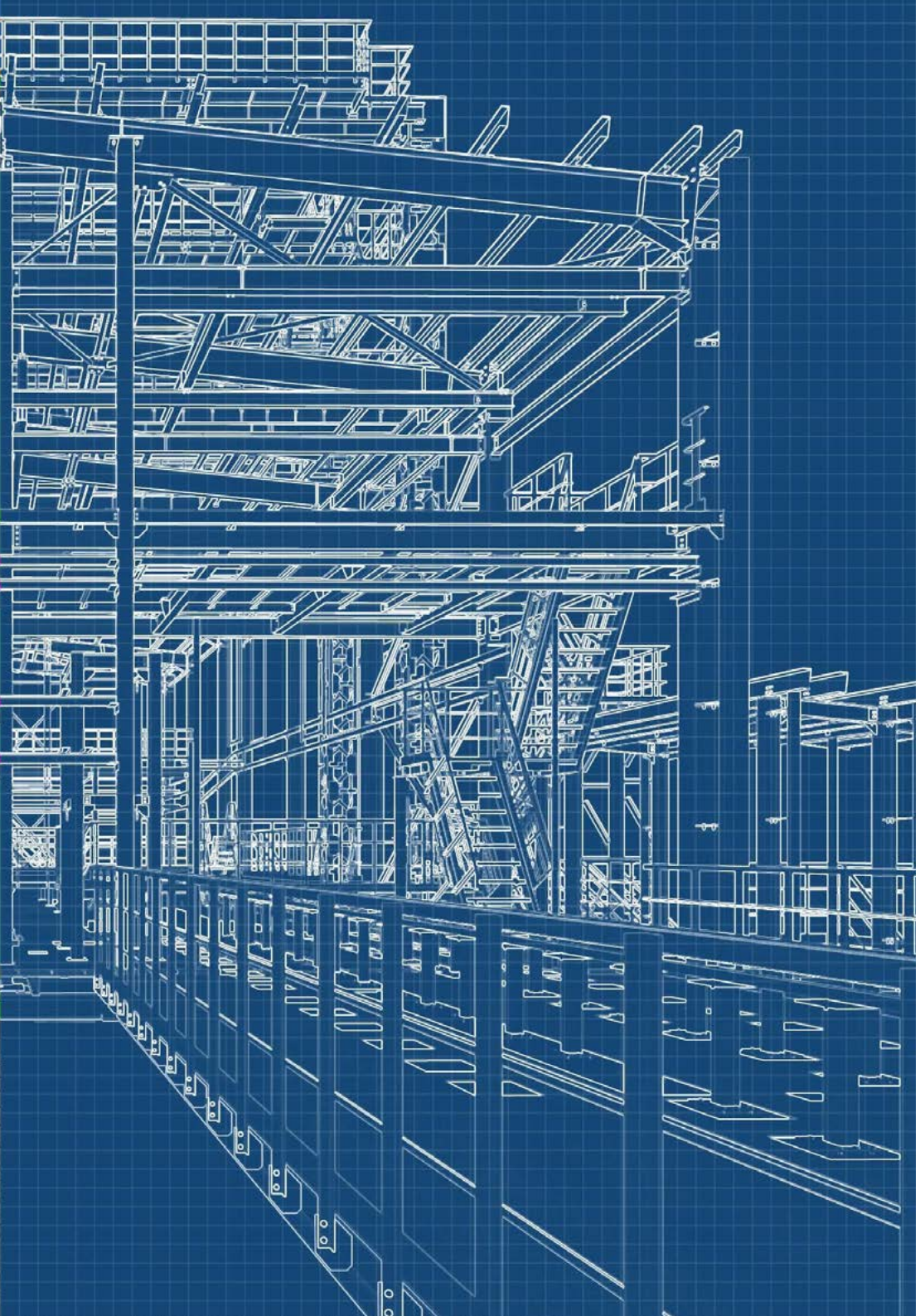
1.2. Actions
- 1.2.1. Introduction
- 1.2.2. Permanent actions
- 1.2.3. Variable actions
- 1.2.4. Accidental actions

1.3. Tension, compression and shear
- 1.3.1. Normal strain and linear deformation
- 1.3.2. Mechanical Properties of Materials
- 1.3.3. Linear elasticity, Hooke's law, and Poisson's ratio
- 1.3.4. Tangential strain and angular deformation

1.4. Equilibrium equations and stress diagrams
- 1.4.1. Calculation of forces and reactions
- 1.4.2. Equilibrium equations
- 1.4.3. Compatibility equations
- 1.4.4. Stress diagram

1.5. Axially loaded elements
- 1.5.1. Length changes in axially loaded elements
- 1.5.2. Length changes in non-uniform bars
- 1.5.3. Hyperstatic elements
- 1.5.4. Thermal effects, misalignments and previous deformations





1.6. Torsion
- 1.6.1. Torsional deformations in circular bars
- 1.6.2. Non-uniform torsion
- 1.6.3. Strain and deformation in pure shear
- 1.6.4. Relation between the modulus of elasticity E and G
- 1.6.5. Hyperstatic torsion
- 1.6.6. Thin wall tubing

1.7. Bending moment and shear stress
- 1.7.1. Beam types, loads, and reactions
- 1.7.2. Bending moments and shear forces
- 1.7.3. Relations between loads, bending moments, and shear forces
- 1.7.4. Bending moment and shear forces diagrams

1.8. Analysis of structures in flexibility (force method)
- 1.8.1. Dynamic classification
- 1.8.2. Principle of superposition
- 1.8.3. Definition of flexibility
- 1.8.4. Compatibility equations
- 1.8.5. General solution procedure

1.9. Structural safety. Limit state method
- 1.9.1. Basic requirements
- 1.9.2. Causes of unsafety. Probability of collapse
- 1.9.3. Ultimate Limit States
- 1.9.4. Serviceability Limit States of deformation
- 1.9.5. Vibration and cracking serviceability limit states

1.10. Structural stiffness analysis (displacement method)
- 1.10.1. Fundamentals
- 1.10.2. Stiffness matrix
- 1.10.3. Nodal forces
- 1.10.4. Displacement calculation

Module 2. Mechanics of the deformable solid

2.1. Basic Concepts
- 2.1.1. Structural Engineering
- 2.1.2. Continuum Model Concept
- 2.1.3. Surface and Volume Forces
- 2.1.4. Lagrangian and Eulerian formulations
- 2.1.5. Euler's laws of motion
- 2.1.6. Integral Theorems

2.2. Deformities
- 2.2.1. Deformation: Concept and Elementary Measurements
- 2.2.2. Field of displacements
- 2.2.3. The Small Displacement Hypothesis
- 2.2.4. Kinematic equations. Deformation tensor

2.3. Kinematic Relations
- 2.3.1. Deformation State in the Environment of a Point
- 2.3.2. Physical Interpretation of the Strain Tensor Components
- 2.3.3. Principal Deformations and Main Deformation Directions
- 2.3.4. Cubic Deformation
- 2.3.5. Elongation of a Curve and Change in Body Volume
- 2.3.6. Compatibility equations

2.4. Stresses and Static Relations
- 2.4.1. Tension Concept
- 2.4.2. Relations Between Stresses and External Forces
- 2.4.3. Local Stress Analysis
- 2.4.4. Mohr's circle

2.5. Constitutive Relations
- 2.5.1. Concept of Ideal Behavioral Model
- 2.5.2. Uniaxial Responses and One-Dimensional Ideal Models
- 2.5.3. Classification of Behavioral Models
- 2.5.4. Generalized Hooke's Law
- 2.5.5. Elastic constants
- 2.5.6. Deformation Energy and Complementary Energy
- 2.5.7. Limits of the elastic model

2.6. Elastic Problem
- 2.6.1. Linear Elasticity and the Elastic Problem
- 2.6.2. Local Formulation of the Elastic Problem
- 2.6.3. Global Formulation of the Elastic Problem
- 2.6.4. Overall results

2.7. Beam Theory: Fundamental Assumptions and Results I
- 2.7.1. Derived Theories
- 2.7.2. Beam: Definitions and Classifications
- 2.7.3. Additional Hypotheses
- 2.7.4. Kinematic Analysis

2.8. Beam Theory: Fundamental Assumptions and Results II
- 2.8.1. Static Analysis
- 2.8.2. Constitutive Equations
- 2.8.3. Deformation Energy
- 2.8.4. Formulation of the Stiffness Problem

2.9. Bending and Stretching
- 2.9.1. Interpretation of the Results
- 2.9.2. Estimation of Displacements out of Guideline
- 2.9.3. Estimation of Normal Stresses
- 2.9.4. Estimation of the Tangential Stresses due to Bending

2.10. Theory of Beams: Torsion
- 2.10.1. Introduction
- 2.10.2. Coulomb Torsion
- 2.10.3. Saint-Venant Torsion
- 2.10.4. Introduction to Non-Uniform Torsion

Module 3. Structural Steel

3.1. Introduction to Structural Steel Design
- 3.1.1. Advantages of Steel as a Structural Material
- 3.1.2. Disadvantages of Steel as a Structural Material
- 3.1.3. First Uses of Iron and Steel
- 3.1.4. Steel Profiles
- 3.1.5. Stress-Strain Relationship of Structural Steel
- 3.1.6. Modern Structural Steels
- 3.1.7. Use of High-Strength Steels

3.2. General Principles for the Project and Construction of Steel Structures
- 3.2.1. General Principles for the Project and Construction of Steel Structures
- 3.2.2. Structural Design Work
- 3.2.3. Responsibilities
- 3.2.4. Specifications and Building Codes
- 3.2.5. Economical Design

3.3. Calculation Basis and Structural Analysis Models
- 3.3.1. Calculation Basis
- 3.3.2. Structural Analysis Models
- 3.3.3. Determination of Areas
- 3.3.4. Sections

3.4. Ultimate Limit States I
- 3.4.1. General Aspects. Strength Limit State of the Sections
- 3.4.2. Equilibrium Limit State
- 3.4.3. Strength Limit State of the Sections
- 3.4.4. Axial Force
- 3.4.5. Bending Moment
- 3.4.6. Shear Sress
- 3.4.7. Torsion

3.5. Ultimate Limit States II
- 3.5.1. Instability Limit State
- 3.5.2. Elements Subjected to Compression
- 3.5.3. Elements Subjected to Bending
- 3.5.4. Elements Subjected to Compression and Bending

3.6. Ultimate Limit States III
- 3.6.1. Ultimate Limit States of Stiffness
- 3.6.2. Longitudinally Stiffened Elements
- 3.6.3. Shear Web Buckling
- 3.6.4. Web Resistance to Transverse Loads
- 3.6.5. Web Buckling Induced by the Compressed Flange
- 3.6.6. Stiffeners

3.7. Serviceability Limit States
- 3.7.1. General Aspects
- 3.7.2. Deformation Limit States
- 3.7.3. Vibrations Limit States
- 3.7.4. Limit State of Transverse Deformations in Thin Panels
- 3.7.5. Local Plasticization Limit State

3.8. Joining Methods: Screws
- 3.8.1. Joining Methods: General Aspects and Classifications
- 3.8.2. Bolted Joints - Part 1: General Aspects. Screw Types and Constructive Arrangements
- 3.8.3. Bolted Joints - Part 2: Calculation

3.9. Joining Methods: Welds
- 3.9.1. Welded Joints - Part 1: General Aspects. Classifications and Defects
- 3.9.2. Welded Joints - Part 2: Constructive Arrangements and Residual Stresses
- 3.9.3. Welded Joints - Part 3: Calculation
- 3.9.4. Design of Beam and Pillar Joints
- 3.9.5. Bearing Apparatus and Pillar Bases

3.10. Steel Structures Facing Fire
- 3.10.1. General Considerations
- 3.10.2. Mechanical and Indirect Actions
- 3.10.3. Properties of Materials Under Fire
- 3.10.4. Strength Testing of Prismatic Elements under Fire
- 3.10.5. Joint Strength Testing
- 3.10.6. Calculation of Temperatures in Steel

Module 4. Structural Concrete

4.1. Introduction
- 4.1.1. Subject Introduction
- 4.1.2. Historical Notes about Concrete
- 4.1.3. Mechanical Behavior of Concrete
- 4.1.4. Combined behavior of steel and concrete that has led to its success as a composite material

4.2. Project Basis
- 4.2.1. Actions
- 4.2.2. Concrete and Steel Characteristics
- 4.2.3. Durability-Oriented Calculation Basis

4.3. Structural Analysis
- 4.3.1. Structural Analysis Models
- 4.3.2. Data Required for Linear, Plastic, or Nonlinear Modeling
- 4.3.3. Materials and Geometry
- 4.3.4. Prestressing Effects
- 4.3.5. Calculation of In-Service Sections
- 4.3.6. Shrinkage and Creep

4.4. Service Life And Maintenance Of Reinforced Concrete
- 4.4.1. Concrete Durability
- 4.4.2. Concrete Mass Deterioration
- 4.4.3. Steel Corrosion
- 4.4.4. Identification of Factors of Aggressiveness on Concrete
- 4.4.5. Protective Measures
- 4.4.6. Concrete Structures Maintenance

4.5. Serviceability Limit State Calculations
- 4.5.1. The Limit States
- 4.5.2. Concept and Method
- 4.5.3. Verification of Cracking Requirements
- 4.5.4. Verification of Deformation Requirements

4.6. Relative Calculations for Ultimate Limit States
- 4.6.1. Resistance Behavior of Linear Concrete Elements
- 4.6.2. Bending and Axial
- 4.6.3. Calculation of Second-Order Effects with Axial Loading
- 4.6.4. Shear
- 4.6.5. Flush
- 4.6.6. Torsion
- 4.6.7. Regions D

4.7. Sizing Criteria
- 4.7.1. Common Application Cases
- 4.7.2. The knot
- 4.7.3. The Cantilever
- 4.7.4. The Large-Edge Beam
- 4.7.5. Concentrated Load
- 4.7.6. Dimension changes in Beams and Columns

4.8. Common Structural Elements
- 4.8.1. The Beam
- 4.8.2. The Pillar
- 4.8.3. The Slab
- 4.8.4. Foundation Elements
- 4.8.5. Introduction to Prestressed Concrete

4.9. Constructive Arrangements
- 4.9.1. General Aspects and Terminology
- 4.9.2. Coatings
- 4.9.3. Hooks
- 4.9.4. Minimum Diameters

4.10. The Execution of Concreting
- 4.10.1. General Criteria
- 4.10.2. Previous Processes to the Concreting
- 4.10.3. Elaboration, Assembly and Erection of Reinforcements
- 4.10.4. Preparation and Placement of Concrete
- 4.10.5. Post-Concreting Processes
- 4.10.6. Premade Elements
- 4.10.7. Environmental Aspects

A program in which you will be able to delve into crystallography and the different properties of materials"

04

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"

You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.

The student will learn to solve complex situations in real business environments through collaborative activities and real cases.

A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

> *Our program prepares you to face new challenges in uncertain environments and achieve success in your career"*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

Relearning Methodology

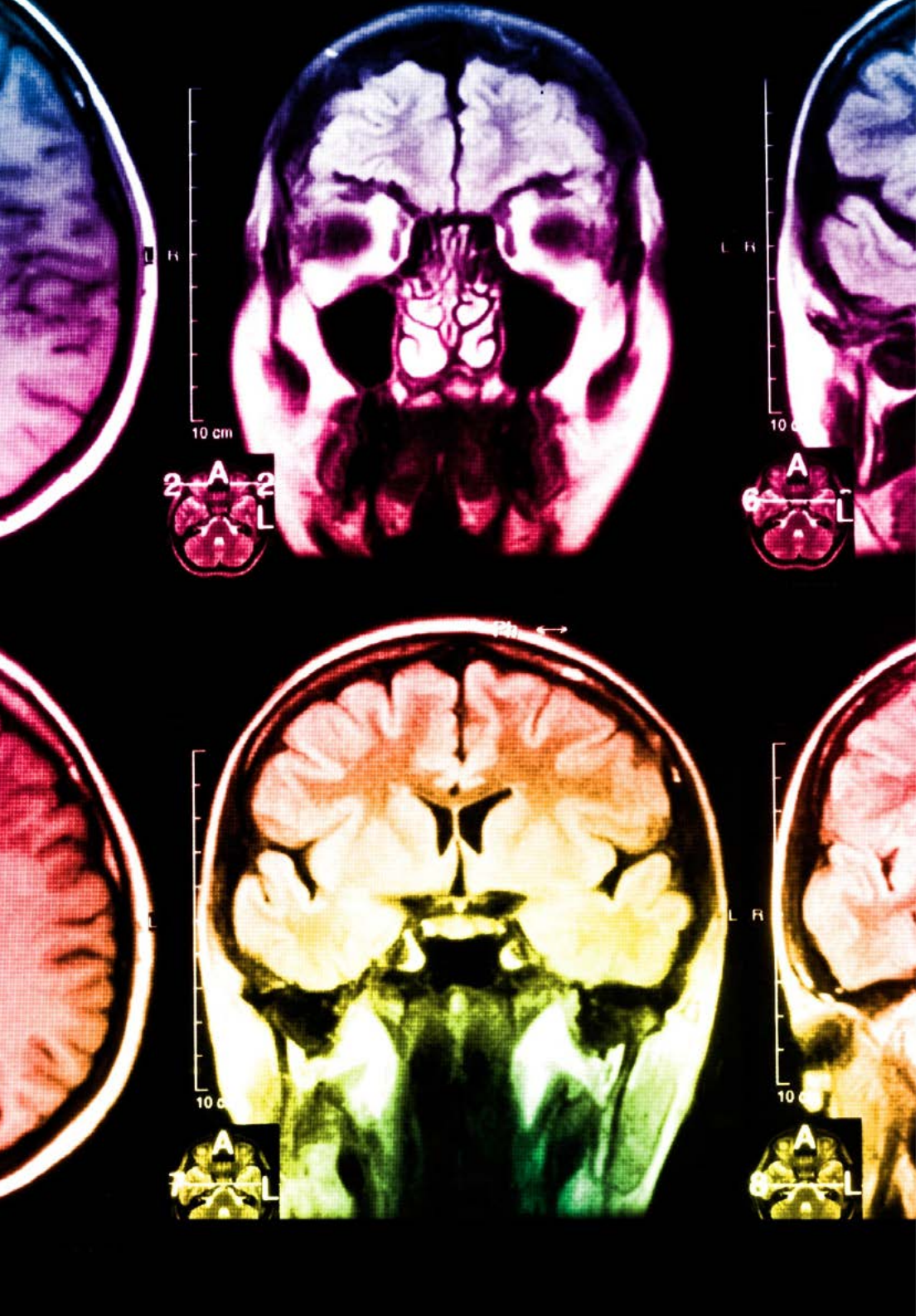
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

In 2019, we obtained the best learning results of all online universities in the world.

At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

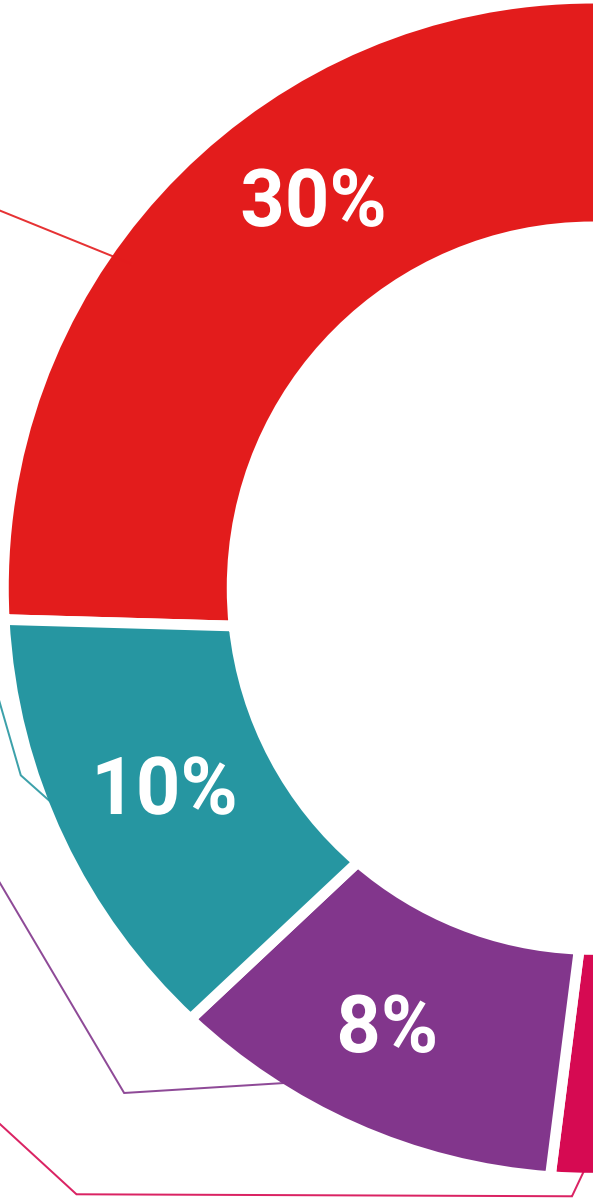
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

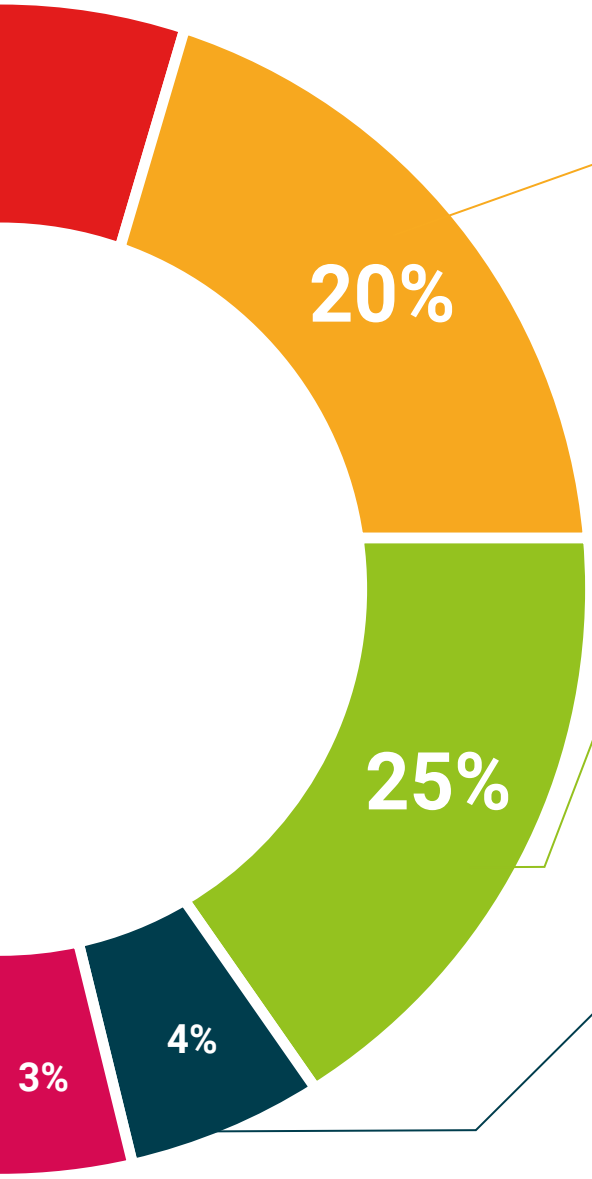
Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

05

Certificate

The Postgraduate Diploma in Structural Analysis guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Technological University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This **Postgraduate Diploma in Structural Analysis** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma** issued by **TECH Technological University** via tracked delivery*.

The diploma issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma in Structural Analysis**

Official N° of Hours: **600 h.**


tech technological university

Awards the following

DIPLOMA

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Structural Analysis

This is a qualification awarded by this University, equivalent to 600hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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