Postgraduate Diploma
Statistical Physics

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Postgraduate Diploma
Statistical Physics

- 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-statistical-physics**

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01

Introduction

There has been an extensive field of innovation in the industrial field, derived from the studies and search for new materials used for the manufacture of electronic devices or used in the construction sector. This opens up a wide range of possibilities for engineering professionals who wish to create unique and innovative projects. However, in order to achieve the most efficient result, advanced knowledge of statistical physics is required, making this branch a determining factor in any initiative. For this reason, TECH has designed this 100% online program, which will allow the graduates to acquire intensive learning about the materials physics, analog and digital electronics and statistics itself. All with the most avant-garde pedagogical tools in the educational market.

Thanks to this Postgraduate Diploma in Statistical Physics you will be able to improve efficiency in the development of new materials in the industrial field"

Undoubtedly, the industrial field is constantly changing, creating and developing new products that also have a quality that makes the difference with the rest of the competitors. Likewise, the scarcity of raw material resources has led to a search for more sustainable materials or to replace existing ones by improving their properties. A scenario of change, which requires highly qualified and knowledgeable professionals, especially in the field of engineering.

It is in this context where the graduates must have advanced and comprehensive knowledge of statistical physics, which will lead to the implementation of any engineering project. Their skills in this field will allow them to develop an efficient use of materials, whether structural, electronic, functional or biomaterials. That is why TECH has designed this Postgraduate Diploma in Statistical Physics, which will provide students in just 6 months the necessary learning to grow professionally in these fields such as construction, aeronautics, automotive or energy.

Thus, through a 100% online program, the engineering professionals will be able to delve into the materials physics or the latest developments and applications of digital and analog electronics. In addition, through multimedia resources, developed by specialists in this field, students will delve into Statistical Physics and its applications in their daily work.

A university education with a theoretical approach, but at the same time practical, which students can access comfortably from any electronic device (computer, mobile or Tablet) with internet connection. Likewise, the graduates can distribute the teaching load according to their needs, making this Postgraduate Diploma an ideal option for those who wish to combine a quality program with the most demanding responsibilities.

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

- Practical case studies are presented by experts in Physics
- 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 the self-assessment process can be carried out 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

A 100% online program that will take you in only 6 months to acquire advanced knowledge about the application of Statistical Physics in construction. Enroll now"

If you have a computer or tablet with an internet connection, you will have access, at any time of the day, to the extensive library of multimedia resources of this program"

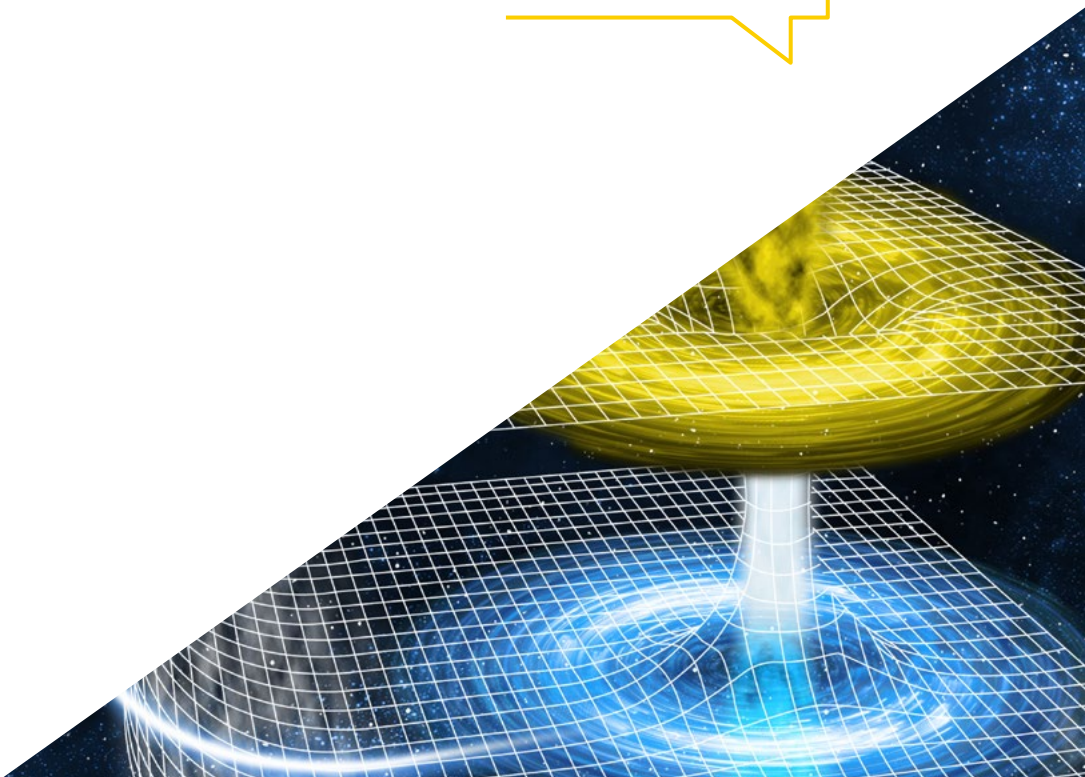
A program that allows you to delve into nanostructures, and the properties of light and matter, whenever you wish.

A Postgraduate Diploma that introduces you to bipolar digital circuits and the use of BiCMOS technology.

The program's teaching staff includes professionals from sector who contribute their work experience to this 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.

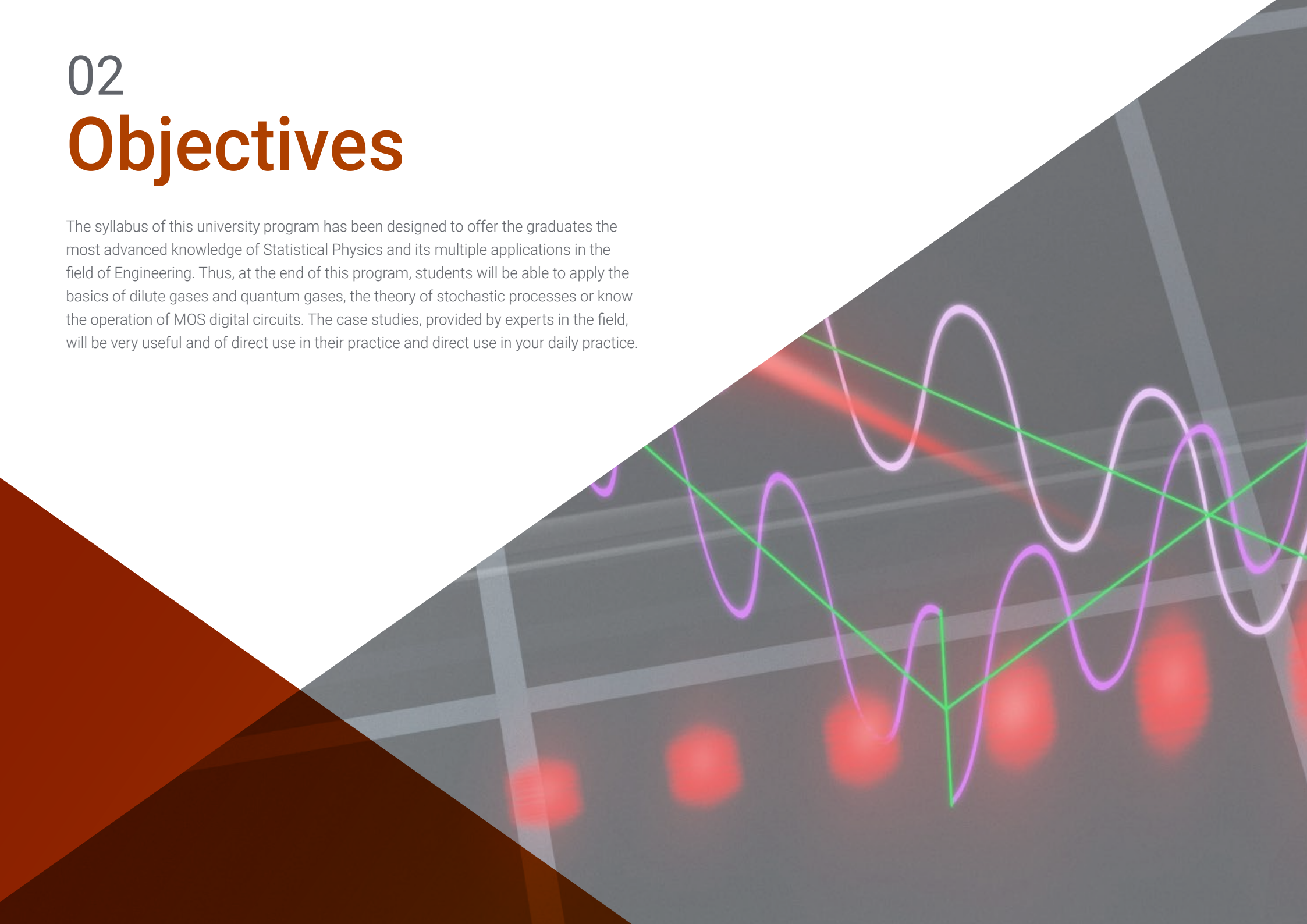
The design of this program focuses on Problem-Based Learning, by means of which the professionals must try to solve the different professional practice situations that are presented throughout the program. This will be done with the help of an innovative system of interactive videos made by renowned experts.

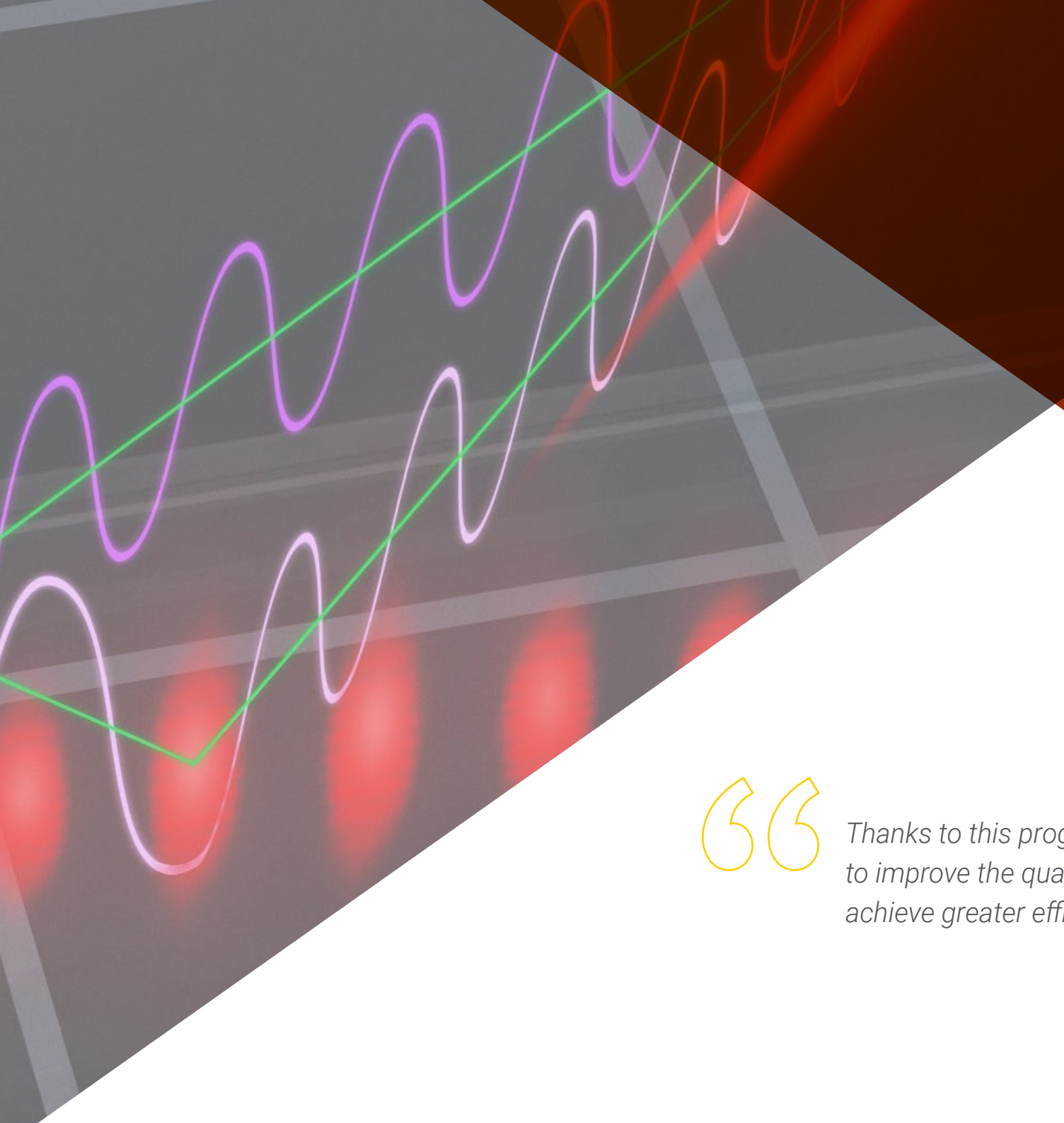


02

Objectives

The syllabus of this university program has been designed to offer the graduates the most advanced knowledge of Statistical Physics and its multiple applications in the field of Engineering. Thus, at the end of this program, students will be able to apply the basics of dilute gases and quantum gases, the theory of stochastic processes or know the operation of MOS digital circuits. The case studies, provided by experts in the field, will be very useful and of direct use in their practice and direct use in your daily practice.



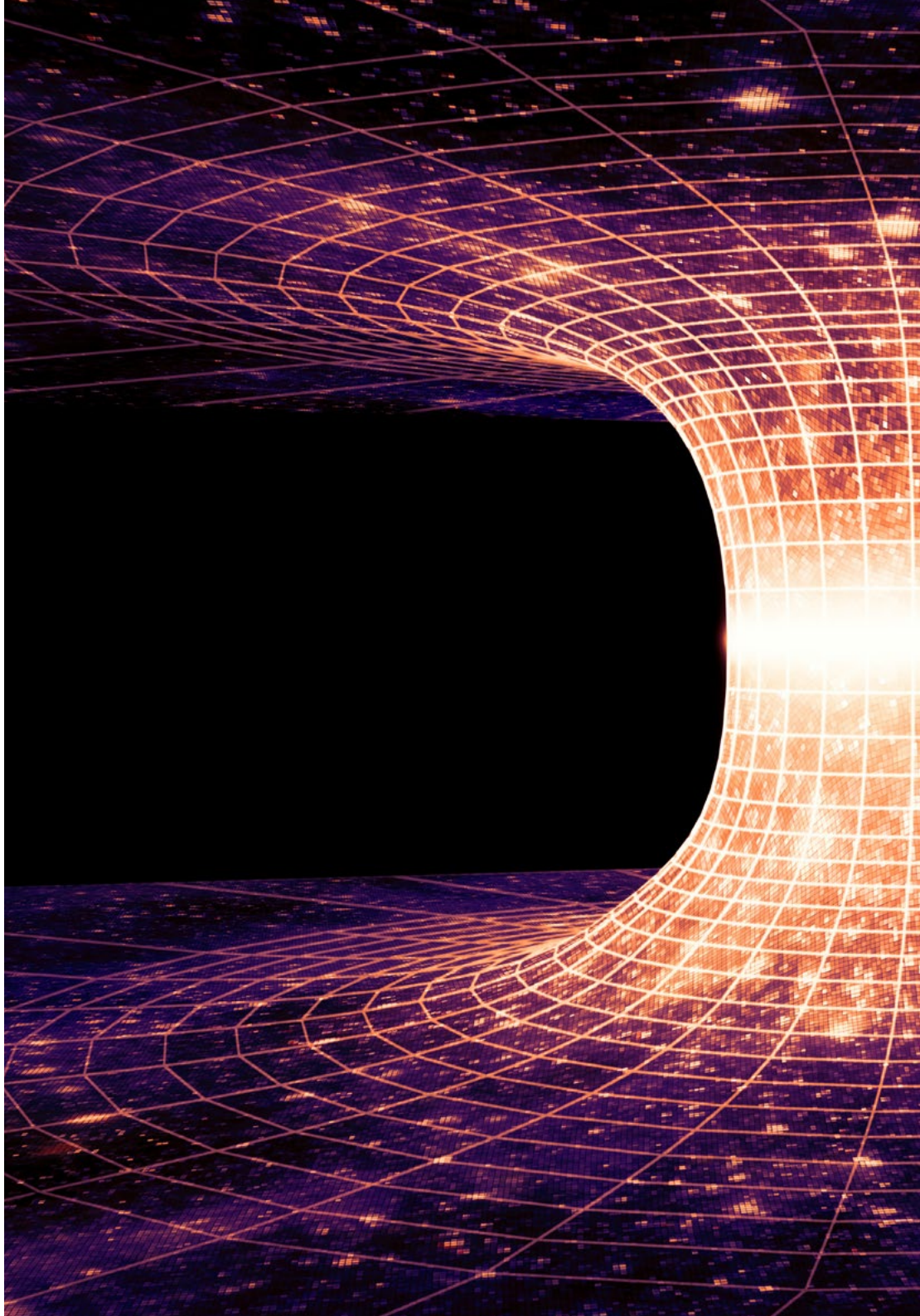


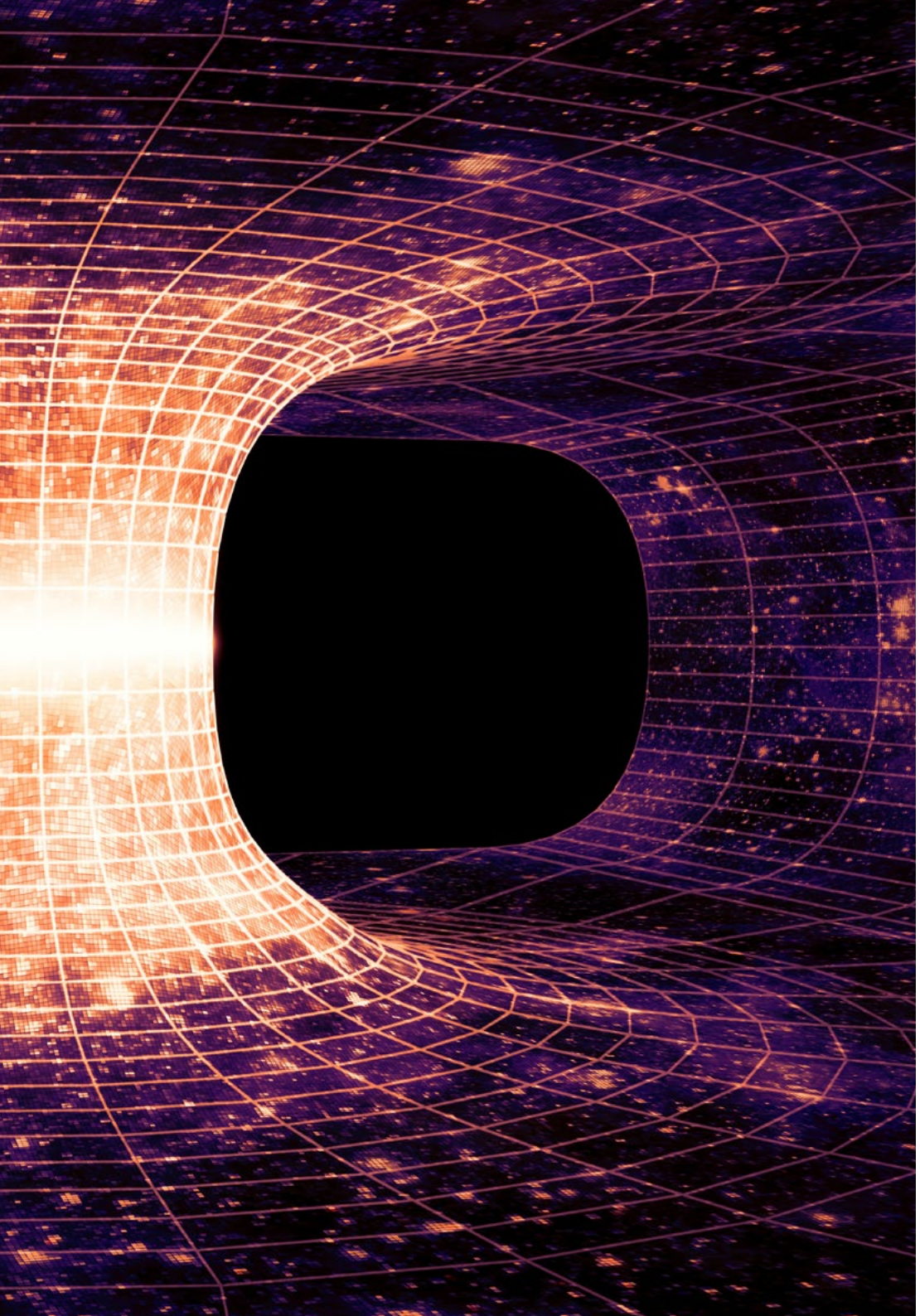
Thanks to this program, you will be able to improve the quality of the products and achieve greater efficiency of the work force"

General Objectives

- Obtain a basic knowledge of the electric field and its properties
- Delve into Collectivities Theories
- Understand the Elementary Kinetic Theory of Gases
- Understand the Stochastic Processes

With this program, you will be able to master the theory of Collectivities, Kinetics or stochastic processes and apply them in your professional performance"





Specific Objectives

Module 1. Material Physics

- Know the relationship between Materials Science and Physics, and the applicability of this science in today's technology
- Understanding the connection between the microscopic structure (atomic, nanometric or micrometric) and the macroscopic properties of materials, as well as their interpretation in physical terms
- Master the multiple properties of materials

Module 2. Analog and Digital Electronics

- Understand the operation of linear, nonlinear and digital electronic circuits
- Know the different forms of specification and implementation of digital systems
- Identify the different electronic devices and their operation
- Master the MOS digital circuits

Module 3. Statistical Physics

- Understand the theory of collectivities and be able to apply it to the study of ideal and interacting systems, including phase transitions and critical phenomena
- Know the theory of stochastic processes and be able to apply it to simple cases
- Be familiar with the elementary kinetic theory of transport processes and be able to apply it to dilute gases and quantum gases

03

Structure and Content

The effectiveness of the Relearning method, based on the reiteration of content, has led TECH to Integrate it in all its programs. In addition, thanks to this system, the engineering professionals will be able to progress through the course in a more natural and progressive way, even reduce the the long hours of study. In addition, multimedia resources (detailed videos, video summaries of each topic, diagrams) will facilitate the acquisition of advanced and intensive learning in Statistical Physics.

An ideal academic option for professionals who wish to balance their work responsibilities with a quality education. Enroll now"

Module 1. Material Physics

1.1. Materials Science and Solid State
- 1.1.1. Field of Study of Materials Science
- 1.1.2. Classification of Materials According to the Type of Bonding
- 1.1.3. Classification of Materials According to Their Technological Applications
- 1.1.4. Relationship between Structure, Properties and Processing

1.2. Crystalline Structures
- 1.2.1. Order and Disorder: Basic Concepts
- 1.2.2. Crystallography: Fundamental Concepts
- 1.2.3. Review of Basic Crystal Structures: Simple Metallic and Ionic Structures
- 1.2.4. More Complex Crystal Structures (Ionic and Covalent)
- 1.2.5. Structure of Polymers

1.3. Defects in Crystalline Structures
- 1.3.1. Classification of Imperfections
- 1.3.2. Structural Defects
- 1.3.3. Punctual Defects
- 1.3.4. Other Imperfections
- 1.3.5. Dislocations
- 1.3.6. Interfacial Defects
- 1.3.7. Extended Defects
- 1.3.8. Chemical Imperfections
- 1.3.9. Substitutional Solid Solutions
- 1.3.10. Interstitial Solid Solutions

1.4. Phase Diagrams
- 1.4.1. Fundamental Concepts
  - 1.4.1.1. Solubility Limit and Phase Equilibrium
  - 1.4.1.2. Interpretation and Use of Phase Diagrams: Gibbs Phase Rule
- 1.4.2. 1 Component Phase Diagram
- 1.4.3. 2 Component Phase Diagram
  - 1.4.3.1. Total Solubility in the Solid State
  - 1.4.3.2. Total Insolubility in the Solid State
  - 1.4.3.3. Partial Solubility in Solid State
- 1.4.4. 3 Component Phase Diagram

1.5. Mechanical Properties
- 1.5.1. Elastic Deformation
- 1.5.2. Plastic Deformation
- 1.5.3. Mechanical Testing
- 1.5.4. Fracture
- 1.5.5. Fatigue
- 1.5.6. Fluence

1.6. Electrical Properties
- 1.6.1. Introduction
- 1.6.2. Conductivity. Conductors
- 1.6.3. Semiconductors
- 1.6.4. Polymers
- 1.6.5. Electrical Characterization
- 1.6.6. Insulators
- 1.6.7. Conductor-Insulator Transition
- 1.6.8. Dielectrics
- 1.6.9. Dielectric Phenomena
- 1.6.10. Dielectric Characterization
- 1.6.11. Materials of Technological Interest

1.7. Magnetic Properties
- 1.7.1. Origin of Magnetism
- 1.7.2. Materials with Magnetic Dipole Moment
- 1.7.3. Types of Magnetism
- 1.7.4. Local Field
- 1.7.5. Diamagnetism
- 1.7.6. Paramagnetism
- 1.7.7. Ferromagnetism
- 1.7.8. Antiferromagnetism
- 1.7.9. Ferrimagnetism

1.8. Magnetic Properties II
- 1.8.1. Domains
- 1.8.2. Hysteresis
- 1.8.3. Magnetostriction
- 1.8.4. Materials of Technological Interest: Magnetically Soft and Hard
- 1.8.5. Characterization of Magnetic Materials

1.9. Thermal Properties
- 1.9.1. Introduction
- 1.9.2. Heat Capacity
- 1.9.3. Thermal Conduction
- 1.9.4. Expansion and Contraction
- 1.9.5. Thermoelectric Phenomena
- 1.9.6. Magnetocaloric Effect
- 1.9.7. Characterization of Thermal Properties

1.10. Optical Properties: Light and Matter
- 1.10.1. Absorption and Re-Emission
- 1.10.2. Light Sources
- 1.10.3. Energy Conversion
- 1.10.4. Optical Characterization
- 1.10.5. Microscopy Techniques
- 1.10.6. Nanostructures

Module 2. Analog and Digital Electronics

2.1. Circuit Analysis
- 2.1.1. Element Constraints
- 2.1.2. Connection Constraints
- 2.1.3. Combined Constraints
- 2.1.4. Equivalent Circuits
- 2.1.5. Voltage and Current Division
- 2.1.6. Circuit Reduction

2.2. Analog Systems
- 2.2.1. Kirchoff's Laws
- 2.2.2. Thévenin's Theorem
- 2.2.3. Norton's Theorem
- 2.2.4. Introduction to Semiconductor Physics

2.3. Devices and Characteristic Equations
- 2.3.1. Diode
- 2.3.2. Bipolar Transistors (BJTs) and MOSFETs
- 2.3.2. Pspice Model
- 2.3.4. Characteristic Curves
- 2.3.5. Regions of Operation

2.4. Amplifiers
- 2.4.1. Amplifier Operation
- 2.4.2. Equivalent Circuits of Amplifiers
- 2.4.3. Feedback
- 2.4.4. Frequency Domain Analysis

2.5. Amplification Stages
- 2.5.1. BJT and MOSFET Amplifier Function
- 2.5.2. Polarization
- 2.5.3. Equivalent Small-Signal Model
- 2.5.4. Single-Stage Amplifiers
- 2.5.5. Frequency Response
- 2.5.6. Connection of Amplifier Stages in Cascade
- 2.5.7. Differential Torque
- 2.5.8. Current Mirrors and Application as Active Loads

2.6. Operational Amplifier and Applications
- 2.6.1. Ideal Operational Amplifier
- 2.6.2. Deviations from Ideality
- 2.6.3. Sinusoidal Oscillators
- 2.6.4. Comparators and Relaxation Oscillators

2.7. Logic Functions and Combinational Circuits
- 2.7.1. Information Representation in Digital Electronics
- 2.7.2. Boolean Algebra
- 2.7.3. Simplification of Logic Functions
- 2.7.4. Two-Level Combinational Structures
- 2.7.5. Combinational Functional Modules

2.8. Sequential Systems
- 2.8.1. Concept of Sequential System
- 2.8.2. Latches, Flip-Flops and Registers
- 2.8.3. State Tables and State Diagrams: Moore and Mealy Models
- 2.8.4. Synchronous Sequential Systems Implementation
- 2.8.5. General Structure of a Computer

2.9. MOS Digital Circuits
- 2.9.1. Inverters
- 2.9.2. Static and Dynamic Parameters
- 2.9.3. Combinational MOS Circuits
  - 2.9.3.1. Step Transistor Logic
  - 2.9.3.2. Implementing Latches and Flip-Flops

2.10. Bipolar and Advanced Technology Digital Circuits
- 2.10.1. BJT Switch. BTJ Digital Circuits
- 2.10.2. TTL Transistor-Transistor Logic Circuits
- 2.10.3. Characteristic Curves of a Standard TTL
- 2.10.4. Emitter-Coupled Logic Circuits ECL
- 2.10.5. Digital Circuits with BiCMOS

Module 3. Statistical Physics

3.1. Stochastic Processes
- 3.1.1. Introduction
- 3.1.2. Brownian Motion
- 3.1.3. Random Walk
- 3.1.4. Langevin Equation
- 3.1.5. Fokker-Planck Equation
- 3.1.6. Brownian Engines

3.2. Review of Statistical Mechanics
- 3.2.1. Collectivities and Postulates
- 3.2.2. Microcanonical Collectivity
- 3.2.3. Canonical Collectivity
- 3.2.4. Discrete and Continuous Energy Spectra
- 3.2.5. Classical and Quantum Limits. Thermal Wavelength
- 3.2.6. Maxwell-Boltzmann Statistics
- 3.2.7. Energy Equipartition Theorem

3.3. Ideal Gas of Diatomic Molecules
- 3.3.1. The Problem of Specific Heats in Gases
- 3.3.2. Internal Degrees of Freedom
- 3.3.3. Contribution of Each Degree of Freedom to the Heat Capacity
- 3.3.4. Polyatomic Molecules

3.4. Magnetic Systems
- 3.4.1. Spin Systems ½
- 3.4.2. Quantum Paramagnetism
- 3.4.3. Classical Paramagnetism
- 3.4.4. Superparamagnetism

3.5. Biological Systems
- 3.5.1. Biophysics
- 3.5.2. DNA Denaturation
- 3.5.3. Biological Membranes
- 3.5.4. Myoglobin Saturation Curve. Langmuir Isotherm

3.6. Systems with Interaction
- 3.6.1. Solids, Liquids, Gases
- 3.6.2. Magnetic Systems. Ferro-Paramagnetic Transition
- 3.6.3. Weiss Model
- 3.6.4. Landau Model
- 3.6.5. Ising's Model
- 3.6.6. Critical Points and Universality
- 3.6.7. Monte Carlo Method. Metropolis Algorithm

3.7. Quantum Ideal Gas
- 3.7.1. Distinguishable and Indistinguishable Particles
- 3.7.2. Microstates in Quantum Statistical Mechanics
- 3.7.3. Calculation of the Macrocanonical Partition Function in an Ideal Gas
- 3.7.4. Quantum Statistics: Bose-Einstein and Fermi-Dirac Statistics
- 3.7.5. Ideal Gases of Bosons and Fermions

3.8. Ideal Boson Gas
- 3.8.1. Photons. Black Body Radiation
- 3.8.2. Phonons. Heat Capacity of the Crystal Lattice
- 3.8.3. Bose-Einstein Condensation
- 3.8.4. Thermodynamic Properties of Bose-Einstein Gas
- 3.8.5. Critical Temperature and Density

3.9. Ideal Gas for Fermions
- 3.9.1. Fermi-Dirac Statistics
- 3.9.2. Electron Heat Capacity
- 3.9.3. Fermion Degeneracy Pressure
- 3.9.4. Fermi Function and Temperature

3.10. Elementary Kinetic Theory of Gases
- 3.10.1. Dilute Gas in Equilibrium
- 3.10.2. Transport Coefficients
- 3.10.3. Thermal Conductivity of the Crystalline Lattice and Electrons
- 3.10.4. Gaseous Systems Composed of Moving Molecules

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.**

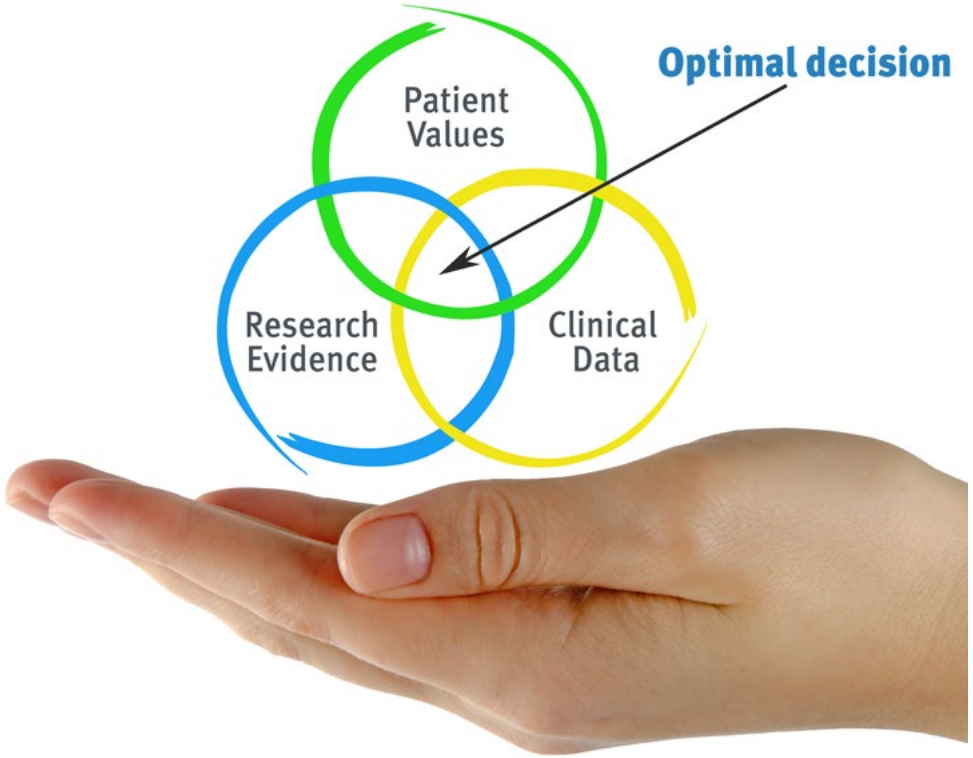
This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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

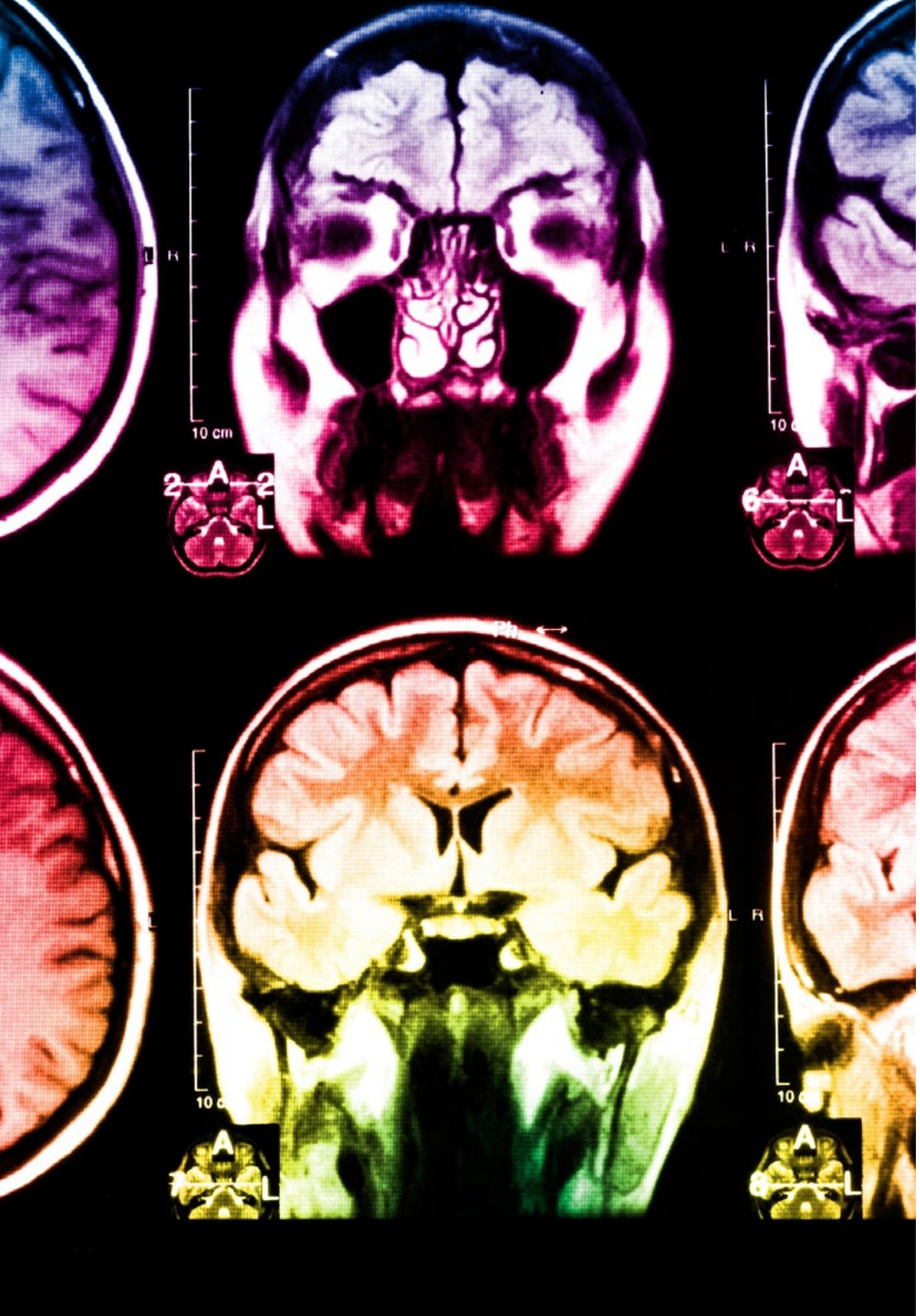
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

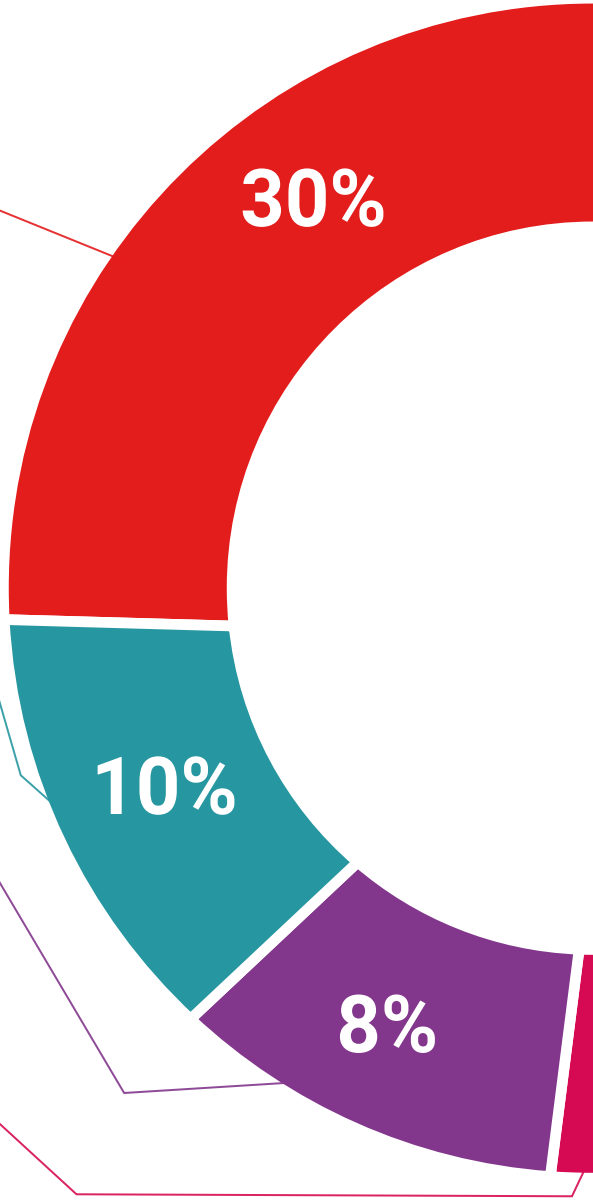
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

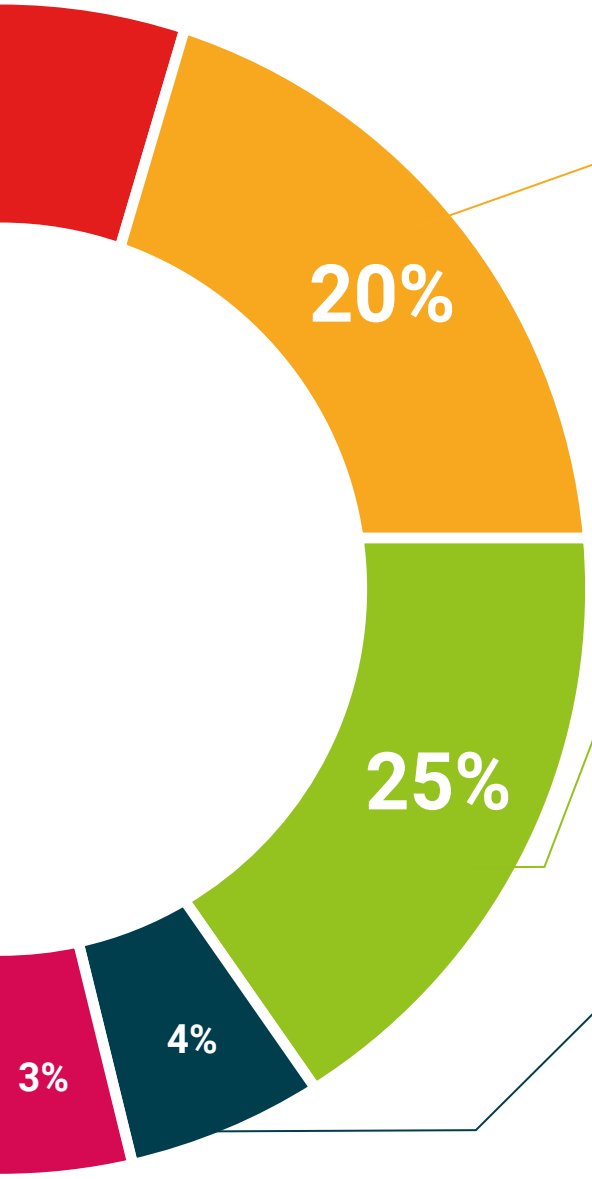
Practising Skills and Abilities

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 Statistical Physics 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 Postgraduate Diploma without having to travel or fill out laborious paperwork”

This **Postgraduate Diploma in Statistical Physics** 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 Statistical Physics**

Official Nº of Hours: **450 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

Statistical Physics

This is a qualification awarded by this University, equivalent to 450 hours, 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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