

**TECHNICAL ENGLISH**  
**FOR**  
**CIVIL ENGINEERING**



**Juan Manuel Izar Landeta**

Facultad de Ingeniería  
Universidad Autónoma de San Luis Potosí

San Luis Potosí, S.L.P., México, 1999

**TECHNICAL ENGLISH**  
**FOR**  
**CIVIL ENGINEERING**



**TECHNICAL ENGLISH**  
**FOR**  
**CIVIL ENGINEERING**

**Juan Manuel Izar Landeta**

Facultad de Ingeniería  
Universidad Autónoma de San Luis Potosí

---

San Luis Potosí, S.L.P., México, 1999

© Derechos Reservados by  
Juan Manuel Izar Landeta

© Universidad Autónoma de San Luis Potosí

ISBN 968-7674-66-0  
0637-99039-A 0185

---

Editorial Universitaria Potosina

# Prefacio

Ante la escasa literatura existente para la enseñanza del Inglés Técnico de las carreras del área de la Ingeniería, me ví precisado a elaborar esta obra, lo cual ciertamente no fue fácil, dado que mi profesión no es la Ingeniería Civil y que el aprendizaje del idioma Inglés que tengo no es suficiente para redactar algo que valga la pena; no obstante lo anterior, tuve el ánimo de hacerlo, dada su imperiosa necesidad en nuestra escuela. Debo agradecer la valiosa ayuda de las siguientes personas: Al Ing. Fernando Cervantes Rivera, para la organización de las lecciones y su elaboración en Español; al Sr. Obed Rodríguez y al Ing. Francisco González Hernández, para la redacción en Inglés. Sin el apoyo de ellos esta obra simple y sencillamente no hubiese sido posible.

Doy gracias también a los integrantes de mi familia: Mi esposa Ina, mis hijos Ana, Jorge y Juan por su paciencia y comprensión, ya que muchas veces fue necesario dedicar tiempo de ellos para realizar esto.

Finalmente debo comentar que tengo la esperanza que este trabajo pueda ser de utilidad en nuestra institución, lo cual me haría sentir altamente honrado.

**Juan Manuel Izar Landeta**



# Content

	<b>Page</b>
Lesson I <b>History of Engineering</b>	<b>9</b>
Lesson II <b>History of Mathematics</b>	<b>15</b>
Lesson III <b>Computers in Engineering</b>	<b>25</b>
Lesson IV <b>Surveying</b>	<b>33</b>
Lesson V <b>Strength of Materials</b>	<b>37</b>
Lesson VI <b>Soil Mechanics</b>	<b>41</b>
Lesson VII <b>Foundations</b>	<b>47</b>
Lesson VIII <b>Structural Analysis and Design</b>	<b>51</b>
Lesson IX <b>Hydraulics and Hydraulic Works</b>	<b>55</b>
Lesson X <b>Surface Ways</b>	<b>61</b>

---



Lesson XI	
<b>Bridges</b>	<b>67</b>
Lesson XII	
<b>Construction Materials</b>	<b>73</b>
Lesson XIII	
<b>Buildings</b>	<b>81</b>
Lesson XIV	
<b>Sanitary and Environmental Engineering</b>	<b>85</b>
<b>Appendix</b>	<b>91</b>
<b>Bibliography</b>	<b>105</b>



# Lesson 1

## History of Engineering

### TOPIC 1.- READING

Since the early times of mankind, man has been searching for a better living and it is due to his spirit for fighting that he has gone a long way in Engineering. In this manner the wheel appeared as one of the engineering achievements of primitive man.

Some of the first evidences of engineering works were the Great Egyptian Pyramids in the third century b.C., other works of the time are the Great Chinese Rampart and constructions, roads and hydraulic works of Babylon. Some centuries later, the architectural works and roads from Greeks and Romans, the magnificent Gothic cathedrals in Europe in the Middle Ages from XIII to XVI centuries and the Incan and Mayan pyramids and aqueducts in America probably built between the X and XV centuries are beautiful examples of the above stated.

However formal engineering, as we know it now, appeared in the last part of the XVIII Century in France with Napoleon Bonaparte, who developed military strategies based on time and motion studies, had to construct bridges, roads and fortifications, that enabled him to get his conquests. Almost at the same time in England Civil Engineering came out, which is the oldest engineering branch applied to build edifications and other works that were necessary for the development of society in peaceful times. Later in 1775, the industrial revolution emerged in this country, which brought up the invention of machinery for production of goods and transportation, this was the origin of Mechanical Engineering. One century later, the search for new and better goods gave birth to Chemical Engineering. At the same time, Electrical Engineering came with the inventions of Thomas Alva Edison in

the United States; and Industrial Engineering based on Frederick W. Taylor theories in the last part of the XIX Century.

Nowadays, Engineering has a multitude of branches in several specialized fields and it has been developing very fastly. Everyday new and sophisticated equipments seek to help man in his struggle for making a more happy and lasting life. Some examples of this are the great communication systems by satellite, the atomic energy, computers, solar energy utilization, the great space ships, biomedical Engineering, the submarine train that connects Great Britain with Europe, and so on. All these engineering works have been possible thanks to the spirit that man has within himself and moves him to obtain the best from his intelligence.

Nevertheless the above stated, man is still facing great challenges and problems such as overpopulation, lackness of food, the damages to the environment, new and unknown sicknesses, etc., which will give birth to new and better improvements in the engineering of tomorrow.

**TOPIC 2.- VOCABULARY.**

Word	Spanish Meaning
almost	casi
beautiful	bello, hermoso
best	el mejor
better	mejor
between	entre, en medio de dos
branch	rama
bridge	puente
century	siglo
challenge	reto, desafío
country	país, región, tierra
damage	daño, estropeo
development	desarrollo
early	temprano, antiguo
engineering	ingeniería
environment	medio ambiente
fastly	rápidamente
fields	campos
fight	pelea, lucha
food	comida, alimento

Word	Spanish Meaning
fortification	fuerte, fortaleza
goods	bienes, artículos
happy	feliz
however	sin embargo, no obstante
hydraulic	hidráulico
improvements	mejoras
lackness	falta, escasez
last	último(a)
lasting	duradero
later	más tarde
long	largo
mankind	humanidad
manner	manera
motion	movimiento
nevertheless	sin embargo, no obstante
nowadays	hoy en día
origin	origen
overpopulation	sobrepoblación
peaceful	pacífico(a)
pyramids	pirámides
rampart	muralla
roads	caminos, carreteras
search	búsqueda
several	varios, varias
sickness	enfermedad
ships	naves, barcos
society	sociedad
space	espacio
struggle	lucha, pelea
theories	teorías
times	veces, tiempos
tomorrow	mañana
train	tren
unknown	desconocido, no sabido
way	camino, forma
wheel	rueda, volante
works	trabajos, obras

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
and so on based on better living give birth to is due Middle Ages such as thanks to	etcétera, y así sucesivamente basado en vida mejor dar origen a es debido a Edad Media tal(es) como gracias a

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
appear apply connect construct develop emerge enable face help move obtain search state	appeared applied connected constructed developed emerged enabled faced helped moved obtained searched stated	aparecer aplicar conectar construir desarrollar emerger habilitar, capacitar encarar ayudar mover(se) obtener buscar establecer, aseverar

#### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
be bring up build come	was, were brought up built came	been brought up built come	ser, estar introducir, criar construir, edificar venir

## IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
come out	came out	come out	salir
get	got	got, gotten	obtener, conseguir
go	went	gone	ir
have	had	had	tener, haber
know	knew	known	saber, conocer
make	made	made	hacer, fabricar
seek	sought	sought	buscar

### TOPIC 5.- EXERCISES (answers on page 91)

Fill the blanks with the proper words to complete the sentences

- 1.- Some of the branches of engineering are \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_
- 2.- The industrial revolution happened in \_\_\_\_\_ in 1775.
- 3.- Frederick W. Taylor developed \_\_\_\_\_ engineering in the last part of XIX Century.
- 4.- The \_\_\_\_\_ connects Great Britain with Europe.
- 5.- The \_\_\_\_\_ of food is one of the problems, man is facing now.

### TOPIC 6.- QUESTIONS (answers on page 91)

- 1.- What was an engineering work of primitive man?
- 2.- State some evidences of the first engineering works.
- 3.- When did formal engineering appear?
- 4.- Name some of the works Napoleon Bonaparte made to get his conquests.
- 5.- What is the oldest engineering branch?
- 6.- What was the origin of Mechanical Engineering?
- 7.- What was the origin of Chemical Engineering?
- 8.- How did Electrical Engineering appear?
- 9.- What was Industrial Engineering based on?
- 10.- Describe some of the latest engineering works.
- 11.- State some of the challenges of the engineering of tomorrow.

**TOPIC 7.- COGNATES** (answers on page 91)

Identify 10 words in English (cognates), that are written very similarly to those in Spanish in the fourth paragraph of the lesson.

Example: mathematics.



# Lesson II

## History of mathematics

### TOPIC 1.- READING

Mathematics is inherent to man since the beginning of creation, which made Plato, the great Greek philosopher, claim: "God always does geometry", referring to the great variety of geometric figures in nature.

Mathematics is like a special language, perfect and abstract, although for others it might be an insuperable obstacle.

Mathematics appears in all situations of life: Philosophy, economy, military strategy, musical composition, artistic perspective, games, sports, atomic physics and, of course, engineering, where it plays a very important role.

The first historical evidence we have about this theme surged probably in Babylon with the abacus, 5000 years ago. Thereafter, Greeks with their logical reasoning got demonstrated theorems that they applied to several fields as geometry and trigonometry. Thales of Mileto, an outstanding man who lived between the years 600 and 550 before Christ, tried to establish the fundamentals of geometry in a definitive manner, without success. Almost at the same time, Pythagoras appeared in the scene, he was a partner of Thales and made important contributions such as his famous theorem, the discovery of irrational numbers and the relationship between mathematics and the musical scale. Later on, electics found the circle area by its division in an infinite number of triangles. The main representative of this school was Zenon, who was always thinking about infinite so that nowadays we still wonder his notable question: "How is it possible that an object in movement goes by an infinite number of points in a finite time?".

Later in Alexandria, Egypt, in the year 300 before Christ, Euclides, who was



not an innovator but a great organizer, rose up. He gathered work of Thales, Eudoxo, Democritus, Hipocrates of Quios and Arquitas and put them in his very famous book "Elements", that was the geometry text book in all the world for high school level until a hundred years ago.

Apolonio whose works referring to conical sections were very important, appeared in the following century. He took them for his book "Conics". At the same time in Syracuse, Italy, Archimedes surged with his talent for mathematics and mechanics so that he was considered the father of practical engineering. Archimedes made many useful works for us such as: hydraulic principles, pulleys law, lever law, the calculations of the gravity center of objects and so on. He is also considered one of the three greatest mathematicians of all ages, together with Newton and Gauss.

A few decades later Hipathia, a famous woman from the University of Alexandria, appeared in the year 400 A.D., as well as Diophantus who is known as "the father of algebra", because he was the first man in trying mathematical problems as equations.

Afterwards, there was a dark age all over the world which lasted for a thousand years.

In the year 825 A.D. in Baghdad al-Khowarizmi lived and published papers about the decimal numerical system and the first book of algebra, this term came from an Arabic word al-jabr that means to unite, because he tried to unite unknown quantities to get the value of a variable. He brought up a good question: "How do we have to understand negative numbers?":

Four centuries later, Leonardo from Pisa, better known as "Fibonacci", was the first man in managing negative numbers. He understood them like "financial loss".

Later on at the arrival of Renaissance, mathematics appeared with new creativity. One evidence of this was the challenge of Italians about getting the solution of cubic equations. In 1494 Luca Pacioli, a Franciscan father, wrote a book "Summa de arithmetica", which was a sample of the above stated. Thereafter, in 1545, Cardano published his book "Arts magna" where he put important works of Nicola Fontana, "Tartaglia", and Lodovico Ferrari for solving equations of third and fourth order. Cardano also discovered the existence of complex numbers.

Afterwards, in the beginning of the XVII Century in France, Renee Descartes

surged and created analytical geometry, taking into consideration arithmetic, algebra and geometry. Although Descartes was a philosopher, he made his fundamental book "Method to direct the reason correctly", which in its last part has "Geometry", which was the basis for analytical geometry.

At the same time in Scotland John Napier made the discovery of logarithms.

Fifty years later in England in 1660, it appeared the second great mathematician of all times: Isaac Newton, who made outstanding works. Newton is known as "The father of calculus", mathematics of motion, which is the main binding between this subject and engineering. Among his many works, Newton published the gravity laws. His principal book was "La Principia", about differential and integral calculus.

Another notable mathematician was the German von Leibniz, who was the first man in publishing a text book about calculus in 1684, twenty years before Newton did. Leibniz made the latest notation for derivatives,  $dy/dx$ . One of Leibniz's disciple, the Swiss Johann Bernoulli, had dispute with Newton and made important collaborations to extend calculus in Europe.

At the same time Pierre de Fermat and Blaise Pascal in France elaborated the Probability Theory to answer the uncertainty of chance events. Later, Pierre de Laplace promoted it, based on calculus, and with Joseph Louis Lagrange made works about usual and celestial mechanics.

In the XVIII Century, the Swiss Euler carried out several works to solve integrals and applications of calculus to curves and areas.

In the last part of this century, the third great mathematician of all ages appeared: this was the German Carl Friedrich Gauss, who made so many important contributions as well as all his predecessors together. Gauss developed the equation for the normal curve of probability, the fundamental theorem of algebra: "An algebraic equation of order  $n$ , has  $n$  solutions", the complex numbers and their graphical representation, vector analysis. He also changed the Euclidean geometry point of view by considering the existence of a third, fourth, fifth and more dimensions. Other contributions of Gauss were the theory of numbers, theory of functions, works of electromagnetism, the calculation of planet orbits, and so on. This wise man was a passionate of perfection. He also discovered a new and unknown subject of mathematics: the hypercomplex numbers. In this subject Hermann Grassmann in 1840 carried out important collaborations.

In the development of non Euclidean geometry, Riemann, who was a pupil of Gauss and the Russian Lobachevsky, made notable contributions in the first half of the XIX Century.

Thereafter in the last part of XIX Century, the English George Boole developed a new style of algebra by putting logic and mathematical equations together; and the German Georg Cantor developed the Set Theory in 1880.

Finally, in our century Albert Einstein appears, who discovered the theory of relativity which shocked the world tremendously, achieving with this fact the reduction of the gap between mathematics and people.

At present, other important mathematical works are the Games Theory, developed by John von Neumann, who, according to some scholars, is considered the greatest mathematician of our times, and the Simplex method invented by George B. Dantzig, both used for taking of decisions in business.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
abacus	ábaco
about	acerca de, aproximadamente
afterwards	después de eso
also	también
although	aunque
always	siempre
among	entre varios
arrival	llegada, arribo
because	porque
beginning	comienzo, inicio
binding	lazo, ligadura
both	ambos
business	negocio, comercio
chance	oportunidad, azar
circle	círculo
fact	hecho
few	poco(s), poca(s)
finally	finalmente
following	siguiente

Word	Spanish Meaning
games	juegos
gap	distancia, hueco, brecha
God	Dios
inherent	inherente
latest	lo último, lo más reciente
law	ley
lever	palanca
like	como
loss	pérdida
main	principal
nature	naturaleza
outstanding	sobresaliente, destacado
paper	papel, artículo
partner	camarada, compañero
passionate	apasionado
pulley	polea
pupil	alumno, discípulo
relationship	relación
Renaissance	Renacimiento
role	rol, papel
sample	muestra
scale	escala
scene	escena
science	ciencia
since	desde, puesto que
still	todavía, aún
sports	deportes
style	estilo
subject	materia, sujeto, asunto
theme	tema
thereafter	de ahí en adelante
together	juntos
uncertainty	incertidumbre, incerteza
until	hasta
useful	útil
without	sin
whose	cuyo(s)
wise	sabio
world	mundo

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
AD (Anno Domini) a hundred years ago all ages all over the world all the times  as well as better known dark age for a thousand years games theory of course point of view set theory so ..... as so that take into consideration  taking of decisions was not ..... but	d.C. (después de Cristo) hace cien años todas las eras en todo el mundo todos los tiempos, todas las veces  así como, al igual que mejor conocido época oscura, Edad Media durante mil años teoría de juegos por supuesto punto de vista teoría de conjuntos tan ..... como así que, de modo que tomar en cuenta, tener en consideración toma de decisiones no fue ..... pero sí

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
achieve answer carry out change claim consider create demonstrate	achieved answered carried out changed claimed considered created demonstrated	realizar, lograr responder, contestar llevar a cabo, aplicar cambiar demandar, reclamar considerar crear demostrar

<b>Infinitive (to ...)</b>	<b>Past and Past Participle</b>	<b>Spanish Meaning</b>
direct discover elaborate establish extend gather invent last live manage play promote publish refer shock solve surge try try to unite use wonder	directed discovered elaborated established extended gathered invented lasted lived managed played promoted published referred shocked solved surged tried tried to united used wondered	dirigir descubrir elaborar establecer extender juntar, recoger, reunir inventar durar, tardar vivir manejar, administrar jugar, tocar promover publicar referir chocar, sacudir resolver, solucionar surgir tratar tratar de unir usar 1) preguntarse, asombrarse; 2) maravilla

### IRREGULAR VERBS

<b>Infinitive</b>	<b>Past</b>	<b>Past Participle</b>	<b>Spanish Meaning</b>
do	did	done	hacer
find	found	found	hallar, encontrar
may	might	—	poder (permiso)
mean	meant	meant	significar
put	put	put	poner
rise up	rose up	risen up	surgir, elevarse
take	took	taken	tomar, llevar

Infinitive	Past	Past Participle	Spanish Meaning
think understand write	thought understood wrote	thought understood written	pensar comprender, entender escribir

### TOPIC 5.- EXERCISES (answers on page 92)

Fill the blanks with the proper words to complete the sentences

- 1.- The \_\_\_\_\_ appeared in Babylon, 5000 years ago.
- 2.- The main representative of \_\_\_\_\_ was Zenon.
- 3.- John Napier discovered the \_\_\_\_\_ in Scotland.
- 4.- The fundamental theorem of algebra is: " \_\_\_\_\_ ",  
and was developed by \_\_\_\_\_ .
- 5.- Albert Einstein discovered the \_\_\_\_\_ .

### TOPIC 6.- QUESTIONS (answers on page 92 and 93)

- 1.- State the first historical evidences of mathematics.
- 2.- Describe some works of Thales of Mileto.
- 3.- State some works by Pythagoras.
- 4.- How did electics find the circle area?
- 5.- Who was the main representative of electics?
- 6.- What book was written by Euclides?
- 7.- What did Apolonio do?
- 8.- Who is considered the father of practical engineering?
- 9.- Describe some works or Archimedes.
- 10.- Who was Hipathia?
- 11.- Who is known as "the father of algebra"?
- 12.- Who was the first man in publishing a book of algebra?
- 13.- Who was "Fibonacci"?
- 14.- Mention the name of some mathematicians that surged during the Renaissance.

- 15.- What work was the basis for analytical geometry?
- 16.- Who discovered logarithms?
- 17.- Who is considered "the father of calculus"?
- 18.- Enlist some works by Newton.
- 19.- Who was von Leibniz?
- 20.- Who was Johann Bernoulli?
- 21.- Who elaborated the probability theory?
- 22.- What did Laplace and Lagrange do?
- 23.- Who was Euler?
- 24.- Who are considered the three greatest mathematicians of all times?
- 25.- Enlist some works by Gauss.
- 26.- Who was Riemann?
- 27.- Who was Lobachevsky?
- 28.- What did George Boole do?
- 29.- Who developed the set theory?
- 30.- What did Einstein do?
- 31.- Who developed the games theory?
- 32.- Who invented the simplex method?

**TOPIC 7.- COGNATES** (answers on page 93)

Identify 10 words in English (cognates), that are written very similarly to those in Spanish in the sixth paragraph of the lesson.







## Lesson III

### Computers in Engineering

#### TOPIC 1.- READING

##### The Role of the Computer in Engineering

The computer is the tool which has caused a revolution among the scientific, technological and commercial fields, all over the world in this second half of the XX Century.

The computer age started in the early 50's with calculators, which in the beginning were of big size and only executed a few elementary arithmetic operations.

Before computers, any engineer or student had to use the slide rule, which required ability for its operation and took a longer time to accomplish calculations.

Nowadays, you have personal computers of small size, which make long and complex mathematical operations in only a few seconds, and are available for professionals as well as for students. This has notably improved the handling of information. Now with a computer one can process large quantities of data in a considerably shorter time, which reduces the cost in labor time and office supplies, thus increasing the enterprise profitability.

A computer can be of large, medium or small sizes, being the last ones which are the most common in our times.

Computers are able to perform the following functions:

- (a) Receiving data. This is to give access to information.
- (b) Processing data. That is combining information and giving it a meaning.
- (c) Storing data. This is the saving of information.
- (d) Providing results. This is to give the results of a problem.

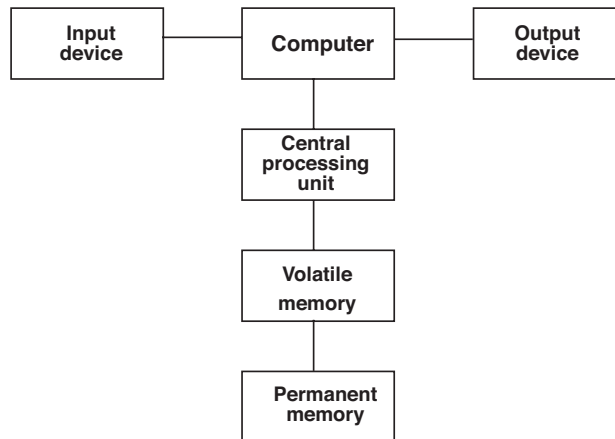
## Parts of a Computer

All computers contain the following components:

- 1.- Hardware. This is the physical equipment of the computer system, for example the keyboard, mouse, central processing unit, monitor, printer and so on.
- 2.- Software. These are a series of programs and instructions that direct the operation of a computer.
- 3.- Human elements. Since being man who manages the data processing system, because the computer would not produce any result by itself.

The hardware of the computer consists of three parts, which are illustrated in figure III.1, these are: (a) Input device - this can be the keyboard or the mouse for personal computers; (b) the computer itself - which is composed of three parts, they are also illustrated in figure III.1, and are classified in the following way: (b<sub>1</sub>) the central processing unit, where logic and arithmetic operations are carried out; (b<sub>2</sub>) the random access memory (RAM), also known as volatile memory, which is the part of the computer that stores data while one is working with the equipment and is deleted when the computer is turned off; and (b<sub>3</sub>) the permanent memory, this is the place to storage programs and information that we want to save in the machine, these operations are usually made in special devices known as hard disks; and (c) an output device, that is usually a printer - this gives us the opportunity of getting results in a printed form, called "hard copy".

Figure III.1. Parts Of Computer



Nowadays the software which is more used in personal computers consists of the following possibilities: the operating system (DOS), which is a series of instructions known as commands that permit the user to utilize the machine in an efficient way; and applications such as: (a) word processors, which are packages of programs that are occupied for text management (they have advantages over the traditional typewriter because the information they generate can be stored, corrected and modified easily for further uses); (b) spreadsheets, which permit us to make a series of calculations and arithmetic operations in a fast, convenient and opportune manner; and (c) data base managers, which constitute an electronic classifier of files to save, change and retrieve useful information that is frequently used.

### **Computer Programs**

A computer program is a series of well-written instructions that tells the machine step by step what should be done. Each user of the data processing system can design his/her own programs to carry out the necessary operations for him/her.

### **Computer Languages**

Computer languages are a series of characters, words, numbers and syntactic rules that should be followed for the elaboration of a program.

Nowadays there is a great amount of computer languages, which are adequate for all types of applications; some are disappearing, others are being born, and still others cling to life for an unexpected future time.

## **TOPIC 2.- VOCABULARY**

<b>Word</b>	<b>Spanish Meaning</b>
ability	habilidad, capacidad
able	capaz, hábil
adequate	adecuado
advantage	ventaja
also	también
amount	cantidad
available	disponible
big	grande
classifier	clasificador
commands	comandos
complex	complejo, complicado

Word	Spanish Meaning
device easily files further handling hardware	dispositivo, mecanismo fácilmente archivos más lejano manejo equipo físico de un sistema de cómputo
input keyboard kind labor large meaning mouse output own packages place printer profitability random shorter size small software	entrada teclado clase, tipo mano de obra, trabajo grande significado ratón salida, producción propio paquetes, empaques lugar impresor(a) productividad, rentabilidad aleatorio más corto tamaño, medida pequeño(a) conjunto de programas y documentos para operar un sistema de cómputo
stable storage supplies thus tool typewriter unexpected user volatile while	estable almacén provisiones, mercancías así, de este modo herramienta máquina de escribir inesperado usuario volátil mientras

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
computer age	era de la computadora
hard disk	disco duro
second half	segunda mitad
slide rule	regla de cálculo
spreadsheet	hoja de cálculo
step by step	paso a paso
syntactic rules	reglas de sintaxis

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
accomplish	accomplished	efectuar, cumplir
cause	caused	causar
classify	classified	clasificar
combine	combined	combinar
compose	composed	componer (de composición)
consist	consisted	consistir
constitute	constituted	constituir
contain	contained	contener
correct	corrected	corregir
delete	deleted	borrar, suprimir
design	designed	diseñar
disappear	disappeared	desaparecer
execute	executed	ejecutar
exist	existed	existir
follow	followed	seguir
illustrate	illustrated	ilustrar
improve	improved	mejorar
increase	increased	incrementar, aumentar
modify	modified	modificar
occupy	occupied	ocupar

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
perform permit print process produce provide receive reduce require retrieve save start store turn off utilize want work	performed permitted printed processed produced provided received reduced required retrieved saved started stored turned off utilized wanted worked	realizar, efectuar permitir imprimir procesar producir proveer, proporcionar recibir reducir requerir componer, restaurar salvar, ahorrar, guardar arrancar, iniciar almacenar, guardar apagar utilizar querer trabajar

### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
be born	was/were born	been born	nacer
can	could	—	poder (físico)
cling	clung	clung	apegarse, adherirse
tell	told	told	decir

### TOPIC 5.- EXERCISES (answers on page 93)

Fill the blanks with the proper words to complete the sentences

- 1.- The \_\_\_\_\_ is a very useful tool for the scientific and technological development.
- 2.- \_\_\_\_\_ is a function of computer, which consists of giving access to information.

- 3.- The volatile memory of computer is also known as \_\_\_\_\_ memory.
- 4.- The \_\_\_\_\_ are programs for text management.
- 5.- Computer languages are a series of \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ to elaborate a program.

**TOPIC 6.- QUESTIONS** (answers on page 93 and 94)

- 1.- When did the computer age begin?
- 2.- Why have computers increased the enterprise profitability?
- 3.- State some functions of computers.
- 4.- What is hardware?
- 5.- What is software?
- 6.- What are the parts of a computer?
- 7.- What is an input device?
- 8.- What is the central processing unit?
- 9.- What is an output device?
- 10.- What is the difference between the permanent and volatile memory?
- 11.- What is the software more used in these times?
- 12.- What are word processors?
- 13.- What is a spreadsheet?
- 14.- What is a data base?
- 15.- What is a computer program?
- 16.- What is a computer language?

**TOPIC 7.- COGNATES** (answers on page 94)

Identify 10 words in English (cognates), that are written very similarly to those in Spanish in the fourth paragraph of the lesson.







# Lesson IV

## Surveying

### TOPIC 1.- READING

Surveying is the science concerning the required data in order to determine either the relative or absolute position of any point on Earth, as well as the location of an area on a plane.

Surveying has to do with methods and procedures to carry out measurements on ground and its graphical representation to a given scale.

This subject requires knowledge on mathematics, arithmetic, geometry and trigonometry and skills on the use of measuring instruments.

Surveying has a close relationship with Geodesy and Cartography. The first one is the science which studies the shape and dimensions of Earth; differing from Surveying because the later is applied to small parts of terrain and it claims the terrestrial surface to be flat, while Geodesy takes into consideration the curvature of Earth. Cartography is the science related to the graphical representation of Earth or a portion of it on a plane or a map.

The birth of surveying dates back to the ancient Egyptians, five thousands years ago, who had to take land measurements when floodings of the Nilo took place. There are evidences that Persians and Greeks knew about Surveying. Among the Greeks, Heron, Ptolomy and Papo were outstanding. Later on, Romans used surveying to carry out engineering works such as roads, cities, bridges and so on. Nowadays, with the great technological and scientific advances, Surveying has gone a long way. Optical and electronical theodolites of a very high precision, as well as laser colimators and other sophisticated equipment of great accuracy and resolution, are used by surveyors.

Measurements are taken by surveyors on terrestrial surfaces considering two distances and one elevation to locate an area correctly. Either magnetic or astronomic North are usually taken as reference points to carry out such measurements.

Surveying plays an important role in civil engineering, because every construction needs measurements of the land on which the constructions will be situated, like buildings, bridges, railroads, dams, highways, skyscrapers, etc.; facilities which are necessary today for the advancement of science and technology.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
accuracy	precisión, exactitud
advancement	avance
ancient	antiguo, remoto
birth	nacimiento
building	edificios, construcciones
cities	ciudades
close	estrecha, cercana
colimators	colimadores
concerning	relativo a, referente a
dam	presa
Earth	Tierra
facilities	instalaciones
flat	plano(a)
floodings	inundaciones
ground	tierra, suelo
high	alto(a)
highways	carreteras
knowledge	conocimiento
land	tierra
location	localización, sitio
measurements	medidas
procedures	procedimientos
railroads	vías férreas
relationship	relación

Word	Spanish Meaning
shape	figura, forma
skills	habilidades
skyscrapers	rascacielos
surface	superficie
surveying	medición del terreno
terrain	terreno
theodolites	teodolitos
usually	usualmente

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
either ..... or the first one have to do in order to related to there are this one	ya sea que ... o; o ... o el primero tiene que ver, tiene que hacer para poder relacionado con hay (plural) ésta(e)

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
date back determine locate need situate study suppose	dated back determined located needed situated studied supposed	remontarse determinar localizar, situar necesitar situar estudiar suponer

## IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
take place	took place	taken place	tener lugar

### TOPIC 5.- EXERCISES (answers on page 94)

Fill the blanks with the proper words to complete the sentences

- 1.- Surveying requires knowledge of \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ .
- 2.- \_\_\_\_\_ is the science related to the graphical representation of Earth on a plane.
- 3.- \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ , were outstanding men in Surveying.
- 4.- Every construction needs \_\_\_\_\_ of \_\_\_\_\_ on which it will be situated.

### TOPIC 6.- QUESTIONS (answers on page 94)

- 1.- What is Surveying?
- 2.- What kind of knowledge does surveying require?
- 3.- What is the difference between surveying and geodesy?
- 4.- What is the difference between surveying and cartography?
- 5.- When did surveying appear?
- 6.- Mention some outstanding men in surveying.
- 7.- Name some of the new equipment designed to carry out measurements.
- 8.- What are the usual reference points to carry out the measurements?
- 9.- State the importance of surveying for constructions.

### TOPIC 7.- COGNATES (answers on page 94)

Identify 7 cognates in the fourth paragraph of the lesson.



# Lesson V

## Strength of materials

### TOPIC 1.- READING

Strength of Materials is a very important part of Engineering, it deals with the relationship between the external loads and their effects on solid materials. Strength of Materials is very important for the adequate design of structures, machines and other engineering works like buildings, cars, air-planes, bridges and so on, in order to fulfill the objectives for which they are attempted. Because of this, it is of vital importance to know the qualities of the materials to be used, since a failure could be of serious consequences in the safety and economical concerns.

The science of Strength of Materials began in the ancient Greece where several wise men involved themselves in its study. However, it did not mean much at the time. It was not until the XVIII Century that Coulomb and Navier made important discoveries on this field.

Strength of Materials deals with the causes affecting solids due to loads on them, watching carefully the occurring deformations which can be either of two types: Temporary deformations, which occur when materials get back to their original size and shape after they are released of the load or loads. This is not the case for the second type; that is to say, permanent deformations. Sometimes when the forces are overexceeded, the material can break.

Robert Hooke (1638-1702) developed the famous law which is the basis for Strength of Materials, it states that "the deformation of a body is in direct proportion to the stress applied onto it". The mathematical equation for this law is as follows:

$$\varepsilon = \sigma / E$$

where  $\epsilon$  is the deformation of the body  
 $\sigma$  is the applied stress  
 and  $E$  is the Elasticity constant, which is a particular property of the solid body.

Another important fact about this aspect of engineering is the Flexure Equation, which is useful to calculate the normal stress onto the parts of a solid when its dimensions and mechanical characteristics are known.

As we can see, Strength of Materials is extremely important for civil engineering, since every work involves efficient and well designed structures.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
airplanes	aeroplanos, aviones
body	cuerpo
carefully	cuidadosamente
charges	cargos, cargas
concern	asunto, negocio
consequences	consecuencias
effect	efecto
elasticity	elasticidad
extremely	extremadamente
failure	fracaso, falla
flexure	flexión
forces	fuerzas
load	carga
objectives	objetivos
onto	encima de, sobre, en
property	propiedad
qualities	calidades, cualidades
resistance	resistencia
safety	seguridad
stress	esfuerzo
temporary	temporal
until	hasta

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
because of this Strength of Materials	a causa de esto Resistencia de Materiales

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
affect attempt calculate fulfill involve occur overexceed release treat watch	affected attempted calculated fulfilled involved occurred overexceeded released treated watched	afectar intentar, procurar calcular cumplir, consumir involucrar ocurrir, suceder sobrepasar, exceder liberar tratar observar, mirar

#### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
begin break deal with	began broke dealt with	begun broken dealt with	empezar romper tratar de, versar sobre
get back	got back	got back, gotten back	volver
say see	said saw	said seen	decir ver



### **TOPIC 5.- EXERCISES** (answers on page 95)

Fill the blanks with the proper words to complete the sentences

- 1.- For a construction, it is of vital importance, to know the \_\_\_\_\_ of \_\_\_\_\_ to be used.
- 2.- \_\_\_\_\_ and \_\_\_\_\_ made important discoveries on Strength of Materials.
- 3.- The \_\_\_\_\_ law states: "The \_\_\_\_\_ of a body is in direct proportion to the \_\_\_\_\_ applied onto it".

### **TOPIC 6.- QUESTIONS** (answers on page 95)

- 1.- What does Strength of Materials deal with?
- 2.- Why is Strength of Materials important?
- 3.- When did Strength of Materials begin?
- 4.- Who were Coulomb and Navier?
- 5.- What are the two types of deformations?
- 6.- What is a temporary deformation?
- 7.- What is a permanent deformation?
- 8.- State Hooke's law.
- 9.- What is the elasticity constant?
- 10.- Why is flexure equation useful?

### **TOPIC 7.- COGNATES** (answers on page 95)

Identify 8 cognates in the third paragraph of the lesson.



# Lesson VI

## Soil mechanics

### TOPIC 1.-READING

#### Definition

Soil Mechanics is the science concerned with the laws of Mechanics and Hydraulics applied to engineering problems, dealing with sediments and other accumulations not consolidated of solid particles, produced by mechanical disintegration or chemical decomposition of rocks with or without an organical matter content.

This definition is due to the great Hungarian geologist Karl Terzaghi, who is considered as the father of this branch of engineering.

#### History of Soil Mechanics

Lately, soil has been a matter of systematic studies to find out its features and the variations due to different existing conditions. Even so, the soil characteristics have not been quite understood so far, since the elasticity theory is not enough to describe its behavior.

As a result, investigators have been forced to state hypothesis which must be supported by experimental tests.

Another important circumstance to consider because it worsens the problem, is the great variety of the existing soils as well as the fact that soil properties change as its composing materials vary.

#### Classification of Soil Mechanics

Soil Mechanics splits for the purpose of study into three categories, as follows:

- 1.- Theory of soil behavior while supporting loads.
- 2.- Research of soil physical properties.
- 3.- The application of theoretical and empirical knowledge to real problems.

### **Soil features**

According to Arturo Casagrande a researcher from Harvard University, the main soil plasticity properties are compressibility, permeability, resistance, and the timing of volume changes.

In order to determine these properties it is necessary to take a good sample and to have a correct classification of soil.

Soil is a mixture of both organic and inorganic particles with a defined organization, its properties are more likely to change in the vertical than in the horizontal direction. A very important factor to be considered is the amount of air and humidity contained in the soil.

The definition of soil changes according to its purpose, since soil is not the same for the agronomist as for the geologist or the builder.

### **Soil generating agents**

There are two main soil generators:

- 1.- Mechanical disintegration, due to physical factors, such as temperature changes.
- 2.- Chemical decomposition caused by water, air or plants. The more important chemical reactions occurring in soils are oxidation, hydration and carbonation, forming clays as a final result.

### **Soil classification**

Residual soils are the ones which remain at the very place where changes have occurred; and transported soils, which are the soils that have been carried away from its original place. The most important transportation agents are glaciers, winds, rivers, water streams, seas and gravity. Transported soils are usually very different from those found in deeper stratus.

### **Soil composition**

The most important components of thick soils are silicates, micas, oxides, carbonates and sulphates. Their mechanical and hydraulic behavior depends on their compacity and particle orientation.

Fine soils or clays, are usually composed by hydrated silicates of aluminum,

magnesium and iron. They can vary in different and contrasting manners, for example kaolinites are practically impermeable, while bentonites are highly expansible in the presence of humidity.

Because of the afore mentioned, it is easy to see that soil is the result of a multitude of factors, which makes its study and understanding very difficult.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
behavior	comportamiento
builder	constructor, edificador
chemical	químico(a) - sustancia
clays	arcillas
compacity	compacidad
compressibility	compresibilidad
content	contenido
deeper	más profundo
empirical	empírico
enough	suficiente, bastante
features	rasgos, características
fine	fino, bueno
glaciers	glaciares
lately	recientemente
likely	probable
mixture	mezcla
most	mayoría, lo más
permeability	permeabilidad
physical	físico(a)
quite	bastante
purpose	propósito
research	investigación
rivers	ríos
seas	mares
soil	suelo
stratus	estrato
streams	corrientes, arroyos

Word	Spanish Meaning
test	prueba
thick	grueso
understanding	comprensión
variety	variedad
water	agua
winds	vientos

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
according to	de acuerdo con
afore mentioned	antes mencionado
as a result	como resultado
depends on	depende de
even so	aún así
so far	hasta aquí
soil generating agent	agente generador de suelo
timing of volume change	tiempo de cambio de volumen

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
carry away	carried away	llevarse, quitar
describe	described	describir
remain	remained	permanecer, quedarse
support	supported	soportar
vary	varied	variar
worsen	worsened	empeorar

#### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
find out	found out	found out	averiguar
split	split	split	dividir(se)

### **TOPIC 5.- EXERCISES** (answers on page 95)

Fill the blanks with the proper words to complete the sentences

- 1.- Karl Terzaghi is considered as the \_\_\_\_\_ of \_\_\_\_\_ .
- 2.- As the composing materials of soil vary, the \_\_\_\_\_ change.
- 3.- The main soil plasticity properties are \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ .
- 4.- Mechanical disintegration and \_\_\_\_\_ are the two main \_\_\_\_\_ .
- 5.- Clays are composed of silicates of \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ .

### **TOPIC 6.- QUESTIONS** (answers on page 96)

- 1.- State the definition of soil mechanics.
- 2.- Who is considered as the father of soil mechanics?
- 3.- Why is the theory of elasticity not enough to describe soil behavior?
- 4.- How is soil mechanics classified?
- 5.- What are the main soil plasticity properties?
- 6.- Why is it necessary to determine soil properties?
- 7.- What are the two main soil generators?
- 8.- What are the more important chemical reactions that occur in soil?
- 9.- What are residual soils?
- 10.- What are transported soils?
- 11.- What are the main transportation agents?
- 12.- What are the most important components of thick soils?
- 13.- What are the most important components of fine soils?
- 14.- Why is it very difficult the study of soil?

### **TOPIC 7.- COGNATES** (answers on page 96)

Identify 8 cognates in the first paragraph of the lesson.





# Lesson VII

## Foundations

### TOPIC 1.- READING

Foundations are the structural elements used to transfer charges to the ground generated by the weight of constructions.

Foundations must be calculated based on two main features: The magnitude of the loads to be distributed on the surface, and the ground qualities.

Because of the above stated, it is essential to have an accurate knowledge of the ground on which civil works will be carried out, since this aspect will determine its loading capacity and therefore the design of foundations.

Foundations are classified into two categories: Low deep and deep foundations, being the first ones used when soil has high loading capacity and/or when the charge to be supported is not too heavy. Otherwise, deep foundations will be necessary.

Among low deep foundations, civil engineers use the following types: Shoes, continued shoes and foundation slabs. Shoes are structural elements usually square or rectangular and less frequently circular in shape, built of reinforced concrete to distribute the loads of construction on a larger area. This kind of foundations is used to support one or more columns. The continued shoes type is similar to the afore mentioned type, the only difference being that their length is greater than their width. These shoes can be built of reinforced concrete or masonry and they are utilized to support the weight of several columns and/or walls.

Foundation slabs are built from reinforced concrete, their purpose is to distribute the charges on the ground. They are either used when the weight



of civil works is too heavy, and/or when the soil loading capacity is not adequate.

Finally deep foundations are used either under conditions of extremely high weights or when the ground load capacity doesn't meet the requirements. Piles constructed from either concrete, steel or wood joined on their top with foundation slabs are involved in its design. Piles are slender elements with small cross section and big length.

A safety factor for the foundations must be included when civil works are to be done on seismic places in order to protect the constructions against occasional overloading.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
against	en contra de
foundations	cimientos
heavy	pesado
length	longitud, largo
low	bajo
masonry	mampostería
otherwise	de otra manera
overloading	sobrecarga
piles	pilotes
reinforced	reforzado
requirements	requerimientos
seismic	sísmico(a)
shoes	zapatas
slabs	losas
slender	esbelto(a)
square	cuadrado
steel	acero
therefore	por eso, por tanto
too	también, demasiado
top	superior, parte alta
under	bajo, debajo de
walls	paredes, muros
weight	peso

Word	Spanish Meaning
width wood	ancho, anchura madera

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
continued shoes foundation slabs loading capacity safety factor	zapatillas continuas losas de cimentación capacidad de carga factor de seguridad

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
distribute generate join protect transfer	distributed generated joined protected transferred	distribuir generar unir, juntar proteger transferir

#### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
meet must	met ---	met ---	encontrarse, reunirse deber

### TOPIC 5.- EXERCISES (answers on page 96)

Fill the blanks with the proper words to complete the sentences.

- 1.- \_\_\_\_\_ are structural elements used to transfer charges to the \_\_\_\_\_ generated by the weight of \_\_\_\_\_ .
- 2.- \_\_\_\_\_ are necessary to support heavy charges.
- 3.- Shoes are usually \_\_\_\_\_ or \_\_\_\_\_ in shape.
- 4.- When civil works are to be done on seismic places, a \_\_\_\_\_ must be included.

### **TOPIC 6.- QUESTIONS** (answers on page 97)

- 1.- What are foundations?
- 2.- What are the factors to be considered to calculate foundations?
- 3.- Why is it necessary to know the ground on which constructions will be built?
- 4.- How are foundations classified?
- 5.- When are low deep foundations used?
- 6.- When are deep foundations necessary?
- 7.- Name the 3 types of low deep foundations.
- 8.- What are shoes?
- 9.- What are continued shoes?
- 10.- What are foundation slabs?
- 11.- What are piles?
- 12.- Why is it necessary to include a safety factor on seismic places?

### **TOPIC 7.- COGNATES** (answers on page 97)

Identify 5 cognates in the third paragraph of the lesson.



## Lesson VIII

### Structural analysis and design

#### TOPIC 1.- READING

Structural analysis and design are very important fields of civil engineering because any construction needs an adequate structure to support loadings during its useful life. This subject deals with the evaluation of existent structures - which is a step for analysis - and the calculation of new structures - which is a corresponding step for design.

A structure can be defined as an assembly of parts that are allied in an ordered way to carry out its function, which can be the saving of a clear space, as in the case of a bridge; the containing of space, which case is a building; or the supporting of pressures, as is the case of a dam.

Structures will always have as their main function to support high loads; therefore, they need the best and most adequate design for their working conditions. Other factors that engineers should keep in mind are the cost of the structure and the esthetic requirements.

Nowadays the most frequently used are the reinforced concrete and steel structures.

The loadings that a structure has to support can give place to three different types of stresses: compression stress, that is, the effort of compacting or compressing the structure; tensile stress, this is the effort for stretching the structure; and finally, torsion stress, that represents the twisting effort.

The procedure of structural design should begin by having a very precise and defined construction project. Likewise the designer should have a correctly specified architectural plan. The following step is to calculate the loads the

structure is going to resist; these loadings are classified into two categories: live loadings, which are those weights that change with time, when people go in and out of the construction making it very difficult to estimate; and dead loadings, which are constant with time.

Finally the engineer has to calculate the structure dimensions according to the architectural plan, taking into consideration the rules of design, so that structure works appropriately.

It is very important, in this step of design, to emphasize that calculations for structures cannot be generalized, since there are too many parameters to consider. However an engineer with experience on the subject will have the "know how" to be successful on structure design.

### TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
appropriately	apropiadamente
assembly	ensamble, montaje
effort	esfuerzo
esthetic	estético
likewise	asimismo, del mismo modo
pressures	presiones
saving	ahorro
successful	exitoso
twist	torcer, girar

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
clear space	claro, espacio libre
compression stress	esfuerzo de compresión
dead load	carga muerta, carga fija
keep in mind	tener presente, tener en mente
know how	saber cómo
live load	carga viva
ordered way	forma ordenada

Expression	Spanish Meaning
tensile stress torsion stress too many	esfuerzo de tensión esfuerzo de torsión demasiados

## TOPIC 4.- VERBS

### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
ally compact emphasize estimate generalize resist stretch	allied compacted emphasized estimated generalized resisted stretched	unir, aliar, juntar compactar, apretar enfaticar estimar, calcular generalizar resistir estirar, extender, dilatar

### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
give place keep	gave place kept	gave place kept	dar lugar, dar origen guardar, conservar

## TOPIC 5.- EXERCISES (answers on page 97)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ deals with the calculations of new structures.
- 2.- A \_\_\_\_\_ is an assembly of parts to support high loads.
- 3.- The calculation of \_\_\_\_\_ cannot be generalized, because there are too many parameters to be considered.

**TOPIC 6.- QUESTIONS** (answers on page 97 and 98)

- 1.- What is structural analysis?
- 2.- What is structural design?
- 3.- Why are structure analysis and design very important for any construction?
- 4.- What is a structure?
- 5.- Name some functions of a structure.
- 6.- What are the more common types of structures?
- 7.- How are stresses divided?
- 8.- What is compression stress?
- 9.- What is tensile stress?
- 10.- What is torsion stress?
- 11.- What are the steps of the structural design procedure?
- 12.- How are loadings classified?
- 13.- What are live loads?
- 14.- What are dead loads?
- 15.- Why can structural design not be generalized?

**TOPIC 7.- COGNATES** (answers on page 98)

Identify 8 cognates in the first paragraph of the lesson.



# Lesson IX

## Hydraulics and hydraulic works

### TOPIC 1.- READING

#### Hydraulics.

Hydraulics is the science dealing with physical laws that describes water behavior. It splits up in two parts: Hydrostatics, that studies static water, that is to say, when it is found stored in a place used for this purpose; and Hydrodynamics, that deals with water in motion, flowing from one place to another.

Hydraulics is the branch of Fluid Mechanics that studies exclusively water, its physical properties and the manner how they influence different situations where this vital liquid plays very important roles.

The fundamental equation of Hydraulics was developed by the great Swiss mathematician Bernoulli, who states that the energy between two points of a given system where water flows remains constant. This energy is present in the following ways: Kinetics, which is caused by the movement of liquid; pressure, which is due to different pressures that water can exert; potential, which is the energy due to location of a fluid in regard to a given level, arbitrarily fixed; and other external forms of energy like heat, which can be given to or taken away from water and is shown by the different temperatures at which water can be, or work that is usually given to or taken from water by mechanical devices such as pumps and turbines.

This equation is applied to all systems and/or processes involving water. This fact gives us an idea of the wide range of its uses where water takes part. It is frequently used in all fields of engineering.

Other scientists that made outstanding collaborations to Hydraulics development were Prandtl, Reynolds and Froude.



### **Hydraulic Works.**

The main hydraulic works that the civil engineer builds for men are the following:

**Dams.** These are big constructions used for storing water, coming from rain or natural streams like rivers. The objective is to provide water for several purposes as irrigation, recharging of wells and supplying of water in times of scarcity or drought.

**Hydroelectric Plants.** These are mechanical systems for the purpose of using the hydraulic energy of rivers and big waterfalls to convert it into electricity.

**Wells.** They are constructions which consist of drilled holes in the ground, to a given diameter, to permit the water extraction by electromechanical equipments of pumping. These are very important works, since a high percentage of the water we use, is obtained by these means.

**Channels.** These are ditches in the open air utilized for transporting water from one place to another. They are lined with concrete to avoid losses by infiltrations to the soil. They are commonly used to irrigate agricultural lands with the water taken from rivers, lakes or lagoons.

**Drinking Water Systems.** These are ducts made to convey water from wells or other sources to urban places. Nowadays, it is of a great importance that drinking water networks provide water of a high physicochemical and bacteriological quality to prevent sicknesses, therefore it is a common practice to give water a physical and chemical treatment before sending it to the cities.

**Drainage Systems.** These are conduits made to carry residual or waste water from urban places toward natural places. There are three kinds of them: Black waters drainages, which transport waters that have given services to houses; rain drainages, which have as an objective, to contain rain waters, therefore they should be designed taking into consideration rain falls; the last type of drainages are mixed systems, which perform simultaneously the two functions above mentioned.

In Mexico it is common to find cities with mixed drainage systems. In many cases they are not enough for their duty.

**Pumping Systems.** They are machines or equipment used to pump water

out from any source like rivers, lakes, lagoons and dams to other places for further applications.

In this article we can see the enormous importance of these works in our daily living, since we use water in almost every activity.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
channels	canales
conduits	conductos
diameter	diámetro
ditches	zanjas
drought	sequía
duty	ocupación, obligación
heat	calor
hydrodynamics	hidrodinámica
hydrostatics	hidrostática
infiltration	infiltración
irrigation	riego
kinetics	cinética
lagoon	laguna
lake	lago
liquid	líquido
means	medios
network	red
pump	bomba
pumping	bombeo
rain	lluvia
range	rango
recharging	recarga
scarcity	escasez
sources	fuentes
urban	urbano(a)
waterfalls	cataratas, cascadas
wells	pozos

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
agricultural lands	tierras agrícolas
black water drainages	drenaje de aguas negras
daily living	vida diaria
drainage systems	sistemas de drenaje
drill holes	perforar agujeros
drinking water (tap water) systems	sistemas de agua potable
Fluid Mechanics	Mecánica de Fluidos
high percentage	alto porcentaje
hydraulic works	obras hidráulicas
in regard to	respecto a, en cuanto a
in the open air	al aire libre
rainfalls	precipitación pluvial
waste waters	aguas residuales
water extraction	extracción de agua

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
avoid	avoided	evitar, eludir
carry	carried	llevar, transportar, acarrear
convert	converted	convertir
convey	conveyed	transportar
exert	exerted	ejercer
flow	flowed	fluir
influence	influenced	influir
line	lined	cubrir, alinear, rayar
prevent	prevented	prevenir
supply	supplied	suministrar, proveer
transport	transported	transportar

## IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
drink	drank	drunk	beber, tomar
send	sent	sent	enviar, mandar
show	showed	shown	mostrar
split up	split up	split up	dividirse
take away	took away	taken away	quitar, sacar, llevarse

### TOPIC 5.- EXERCISES (answers on page 98)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ is the science dealing with physical laws that describes water behavior.
- 2.- Bernoulli states that \_\_\_\_\_ of a given system where water flows, remains \_\_\_\_\_ .
- 3.- Dams are big constructions used for \_\_\_\_\_ .
- 4.- \_\_\_\_\_ are drilled holes in the ground, to permit the water extraction.
- 5.- \_\_\_\_\_ transport waters, that have given services to houses.

### TOPIC 6.- QUESTIONS (answers on page 98 and 99)

- 1.- What is hydraulics?
- 2.- How is hydraulics divided?
- 3.- What does hydrostatics study?
- 4.- What does hydrodynamics study?
- 5.- What is the fundamental equation of hydraulics?
- 6.- Who were the scientists that made collaborations to hydraulics development?
- 7.- What are dams?
- 8.- What are hydroelectric plants ?
- 9.- What are wells?
- 10.- What are channels?

- 11.- What are drinking water systems?
- 12.- What are drainage systems?
- 13.- What are the 3 kinds of drainage systems?
- 14.- What are pumping systems?

**TOPIC 7.- COGNATES** (answers on page 99)

Identify 8 cognates in the second paragraph of the lesson.



# Lesson X

## Surface ways

### TOPIC 1.- READING

#### Definition

Surface ways are the means used by man for his own transportation or for carrying materials from one place to another.

Surface ways should be designed in an adequate manner in accordance to standards of resistance, uniformity and safety, established by experience and research.

In order to build a surface way, some aspects such as location, cost, population effects, type of traffic, environmental impact, property acquisition, construction materials availability, weather conditions and qualities of soil should be considered by the engineer in charge.

#### Types of surface ways

There are two types of surface ways: Highways and Railroads:

#### Highways

Highways are the surface ways mostly used by man, to travel or to carry materials to and from different places in the fastest manner.

Every highway is to have two fundamental parts:

- 1.- The foundation base or cover, is composed of a filling material, meant to level the surface and to distribute evenly the loads of the way on the ground.
- 2.- The rolling surface, can be built of several materials such as cement mortar, paved with tile or enameled asphalt, depending on its use.

A perfectly well compacted ground is a must if we are to obtain a highly resistant and durable pavement.

The most common pavement types are the following:

- Asphaltic concrete
- Asphaltic macadam
- Asphaltic treatments
- Block paving
- Stone slabs
- Concrete
- Pavement sheet
- Industrial pavement

### **Railroads**

This is the most efficient manner to handle big volumes of freight, because of its low energy requirements, its fewer terrain needs, its low pollutant features and low frequency, and severity rates of accidents.

The railroad system consists of rails, which are the guides on which the vehicles run. This system includes the rail bed, bridges, fords, drains, yards, terminal stations, offices, terrestrial signals, and safety devices.

The three most important types of systems of transportation are passenger and freight, commuter, and rapid transit type.

The vehicles for transportation on rails, depend on steel wheels, because they have good resistance to rolling and can support heavier weights.

The power supply for this system is usually diesel-electric, electric, gas turbine, hydraulic turbine, jet propulsion and pneumatic induction motor.

The levitating suspension can be that provided by an air cushion or by a magnet. This last type is the most expensive one.

Rails are constructed of several types such as double rail, monorail and welded continuous rail, which are designed according to the system requirements and its characteristics.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
acquisition	adquisición
asphaltic	asfáltico(a)
availability	disponibilidad
bed	cama
cover	cubierta, tapa
cushion	colchón, cojín
drains	desagües
evenly	uniformemente
expensive	caro
fastest	lo más rápido
filling	relleno
ford	vado
freight	carga
guides	guías
mostly	en su mayor parte, esencialmente
must	necesidad, deber
pavement	pavimento
pollutant	contaminante
population	población
rails	rieles
stone	pedra
tile	azulejo, baldosa, teja
traffic	tráfico
vehicle	vehículo
weather	tiempo, clima
yards	patios

## TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
block paving	adoquinado
cement mortar	mortero enlucido
enameled asphalt	esmalte asfáltico



Expression	Spanish Meaning
foundation base in accordance to in charge jet propulsion levitating suspension rapid transit rolling surface severity rates of accidents pavement sheet welded continuous rail	base de cimentación de acuerdo con a cargo propulsión a chorro suspensión por levitación tránsito rápido superficie de rodaje índice de accidentes graves capa de pavimento riel continuo soldado

#### TOPIC 4.- VERBS

##### REGULAR VERBS

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
handle level pave travel	handled leveled paved traveled	manejar nivelar pavimentar viajar

##### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
run	ran	run	correr

#### TOPIC 5.- EXERCISES (answers on page 99)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ are the surface ways mostly used by man.
- 2.- The \_\_\_\_\_ is used to distribute evenly the loads of the way on the ground.

- 3.- Five common pavement types are: \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ .
- 4.- Railroads are the most efficient manner \_\_\_\_\_ of freight.

**TOPIC 6.- QUESTIONS** (answers on page 99and 100)

- 1.- What are surface ways?
- 2.- What are the factors to take into consideration for designing surface ways?
- 3.- What are the types of surface ways?
- 4.- What are highways?
- 5.- What are the two fundamental parts of every highway?
- 6.- What are the most common pavement types?
- 7.- What are railroads?
- 8.- What do railroad systems consist of?
- 9.- What are the three most important railroad systems?
- 10.- Why do railroad systems use steel wheels?
- 11.- State some types of power supply for railroad systems.
- 12.- Name some types of rails for railroad systems.

**TOPIC 7.- COGNATES** (answers on page 100)

Identify 7 cognates in the third paragraph of the lesson.





# Lesson XI

## Bridges

### TOPIC 1.- READING

#### Definition

Bridges are structures to facilitate motion of people, animals or materials over natural or artificial obstacles. Bridges can be made of wood, masonry, concrete and steel.

#### Types of Bridges

There are two general types of bridges: Stationary and movable. They also can be classified according to the following features:

**Supported services or installations.** For the use on highways, railroads, channels or aqueducts, as a path for people or cattle, for the transportation of goods or as a tubing support.

**Bridges for natural accidents.** For highways, railroads, bays, lakes, rivers, valleys and so on.

**Basic geometry.** Bridges used at a ground level, can be curved, straight, L-shaped, square and protractile; at elevated height (which can be of low level like the ones constructed over swampy terrain), trestle bridges and high-level bridges.

**Structural systems.** Continuous girder bridges, arched bridges (which can be composed of one or multiple arches), hanging bridges and steel-armor-plated bridges.

#### Design Considerations

Their design is always based on specific standards for highway bridges of the American Association State Highway and Transportation Official (AASHTO),

the manual for Railway Engineering published by the American Railway Engineering Association (AREA), standard plans for highway bridges, Federal Highway Administration (FHWA) and other rules and regulations published by several highway administrations and railroad companies.

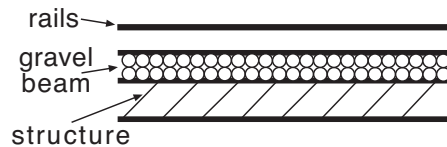
The length, width, alignment and intersecting angles for bridges should satisfy the functioning needs of the installations to be built.

The geometric requirements, hydraulic specifications, selection of structural systems and construction materials, safety standards, esthetics, economical aspects and, ease for operation and maintenance are other important factors to take into consideration.

Highway bridges should be of a smooth asphalt surfaces with sufficient drainage. Both the longitude slope and the cross section are subject to similar restrictions as for those used for open highways. Long bridges must be supplied with an adequate lighting, signs and service, and emergency stations. The protective railings should keep vehicles within the bridge and if necessary, away from pedestrians. Installations over or under bridges should be able to absorb both expansions or contractions of the structure.

Most of railroad bridges require a gravel beam between structure and rails as is shown in figure XI.1 to absorb vertical movements.

Figure XI.1. Scheme of railroa bridge



### Design Loads

Bridges should support the following loads without failures:

**Dead loads.** They include permanent installations.

**Live loads.** These are caused by the vehicles, animals or people crossing over bridges and making a variable weight.

These loads can be of different types such as centrifugal, pressure, longitudinal, seismic, hydraulic, and so on.

## TOPIC 2.- VOCABULARY

Word	Spanish Meaning
alignment	alineamiento, alineación
arch	arco
away	lejos
bays	bahías
cattle	ganado
contraction	contracción
curved	curvos
ease	facilidad
expansion	expansión
height	altura
lighting	alumbrado
movable	móvil
obstacle	obstáculo
path	camino
pedestrians	peatones
protractile	alargado, extendido
railing	rieles
railway	vía férrea
signs	señales, firmas
slope	pendiente, inclinación
smooth	liso, terso
straight	recto, derecho
swampy	pantanosos
tubing	tubería
valleys	valles

## TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
continuous girder bridge	puente de viga continua
gravel beam	cama de grava
hanging bridge	puente colgante
intersecting angle	ángulo de intersección

Expression	Spanish Meaning
L-shaped steel-armor-plated bridge trestle bridge	forma de L puente de estructura de acero puente de caballete

#### TOPIC 4.- VERBS

##### REGULAR VERBS

Infinitive	Past and Past Participle	Spanish Meaning
absorb facilitate satisfy	absorbed facilitated satisfied	absorber facilitar satisfacer

#### TOPIC 5.- EXERCISES (answers on page 100)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ are structures to facilitate motion of people, animals or materials over natural or artificial \_\_\_\_\_ .
- 2.- The geometric requirements, hydraulic specifications and selection of structural systems are some of the factors to take into consideration to \_\_\_\_\_ .
- 3.- The railroad bridges require a \_\_\_\_\_ between structure and \_\_\_\_\_ .

#### TOPIC 6.- QUESTIONS (answers on page 100)

- 1.- What are bridges?
- 2.- What are the materials more used for bridges?
- 3.- What are stationary bridges?

- 4.- What are movable bridges?
- 5.- State some of the usual structural systems for bridges.
- 6.- Name some factors to take into consideration to design a bridge.
- 7.- What are highway bridges?
- 8.- What are railway bridges?
- 9.- Why is it necessary a gravel beam for railroad bridges?
- 10.- Name some of the typical loads a bridge has to support.

**TOPIC 7.- COGNATES** (answers on page 100)

Identify 5 cognates in the second paragraph of the lesson.







# Lesson XII

## Construction materials

### TOPIC 1.- READING

Since the beginning of mankind, man has had housing needs, this fact caused the primitive man to look for shelter so as to protect himself from wild beasts and extreme weather. Centuries later, he began to construct his first houses, which were rudimentary huts. Nowadays, man builds residential houses, mansions, edifications, skyscrapers and other great civil works of a main importance for society development.

Among the constructions of our age, we have a wide variety of terrestrial ways, bridges, hydraulic works and industrial buildings.

Safety, economical and esthetic aspects are the basis for the study and project of every civil work and should have the following documents:

- 1.- Architectural plans. They are the drawings to scale of the project to be built.
- 2.- The calculation record. This is a log-book where technical estimations are kept.
- 3.- Budget. It contains the economical considerations of the project.
- 4.- Specifications. They contain all factors concerning the resistance, design and finishing works.

### Construction materials

The most common are the following:

**Binders.** Binders are materials which get plasticity properties when mixed

with water, and become of a greater mechanical resistance when dry. This feature makes them appropriate for construction. The drying process is known as setting.

The more common binders are the following:

**Clays.** They are among the oldest materials used by man, because of their well known qualities since early times. Clays are hydrated aluminum silicate of a variable chemical composition. They are easily obtainable and have the quality of being very moldable when mixed with water. Because of this fact, clays are the raw materials for bricks, some types of floors and wall tiles in the construction industry.

**Plaster.** It is a very old construction material used since thousand of years ago. Egyptians utilized it to build their pyramids. Greeks and Romans used plaster to build monuments, and Arabians gave it an ornamental use.

Plaster is basically bihydrated calcium sulphate, obtained from semihydrated calcium sulphate which produces the bihydrated calcium sulphate when mixed with water, obtaining with this chemical reaction its binding qualities.

Currently its main use is for inside finishing works, making smooth surfaces appropriate to absorb paints and other wall dressings.

**Lime.** Lime is mostly used in civil works, specially for finishing works. Chemically it is calcium oxide, which reacts with water to produce hydrated lime or slaked lime, which is the commercial form used for construction. The slaked lime reacts very slowly to the contact with air, from which it takes the carbon dioxide to obtain calcium carbonate or limestone, being this the final chemical compound form. In the presence of water, this reaction is almost inhibited, so it is not fit for hydraulic works or for structures supporting big loads.

**Cement.** It is the mixture obtained by baking clay and lime, getting by mean of this process its binding qualities and very high resistance to support loads. It is the material mostly used all over the world. Its chemical composition depending on the quality of raw materials utilized, it generally contains calcium oxide, silica and alumina and in less quantities iron oxide, magnesia and sulphur trioxide.

Nowadays, there are some processes to make cement, which are applied according to the quality standards ruling in each country. In Mexico we have five different methods.

**Asphalt.** Asphalt is a mixture of hydrocarbons obtained by natural or artificial distillation of oil, this is produced in several types and qualities which vary, from hard and friable solids, to soft liquids.

The most common types of asphalts are: asphalt cement, light asphalts, of fast, medium or slow setting and asphalt emulsions.

**Aggregates.** These are inert materials which are added to binders for economical reasons, since they increase their volume without losing their properties. They are classified into fine and thick aggregates according to average particle size. The following table shows their classification:

**Table XII.1.- Aggregates Classification**

Common name	Minimum size,"	Maximum size, "
Sand	0.001	1/4
Pea gravel	1/4	1 1/2
Gravel	1 1/2	3 1/2
Pebble	3 1/2	6

These aggregates are obtained from natural sources such as rivers, and if necessary by size reduction of bigger stones and rocks.

**Stones and rocks.** They are materials from mineral origin which are used in construction for several purposes, such as resistance elements, ornamental purposes, and as raw materials to elaborate others.

In order to be used, they only need to be given the appropriate shape and size.

**Metals.** The most used metals in construction are iron and steel, which are adequate as structural elements because of their toughness and resistance. Aluminum is utilized as a decorative metal, because of its resistance to corrosion and its lightness. Lead and copper are used to convey water and carry electricity. Other metals occasionally used are tin and zinc.

**Wood.** It has been utilized since early times in the construction industry because of its resistance to traction, compression and flexure. It is also a light material of good toughness and athermal as well. Being the only disadvantage, its swelling when in contact with water and sun, which limits its use.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
aggregates	agregados
athermic	atérmico(a)
beasts	bestias, fieras
binders	aglomerantes
bricks	ladrillos
budget	presupuesto
cement	cemento
compound	componente
copper	cobre
disadvantage	desventaja
distillation	destilación
fit	apropiado, conveniente
floors	pisos
friable	quebradizo
hard	duro, difícil
housing	vivienda, alojamiento
hut	choza
iron	hierro
lead	plomo
lightness	ligereza
lime	cal
limestone	piedra caliza
liquids	líquidos
moldable	moldeable
oil	aceite, petróleo
paints	pinturas
particle	partícula
pebble	pedrecilla
plaster	yeso
sand	arena
setting	fraguado
shelter	cueva, refugio
so	así, de este modo
soft	blando
sun	sol
tin	estaño

Word	Spanish Meaning
toughness	dureza
traction	tracción
wild	salvaje

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
calculation record	registro de cálculo
drawings to scale	dibujos a escala
drying process	proceso de secado
finishing works	acabados
log-book	libro de registros, bitácora
pea gravel	confitillos
raw materials	materias primas
slaked lime	cal apagada
so as to	de manera de, para
wall tiles	azulejos
wall dressings	revestimientos
well known	bien sabido, familiar

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive	Past and Past Participle	Spanish Meaning
add	added	agregar, sumar
bake	baked	hornear, cocer
dry	dried	secar
inhibit	inhibited	inhibir
limit	limited	limitar
look for	looked for	buscar
mix	mixed	mezclar
react	reacted	reaccionar
rule	ruled	regir, rayar

## IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
become swell	became swelled	become swelled, swollen	llegar a ser hinchar, inflar

### TOPIC 5.- EXERCISES (answers on page 101)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ are the drawings to scale of a construction project.
- 2.- The budget contains \_\_\_\_\_ of a construction project.
- 3.- Chemically, clays are \_\_\_\_\_ .
- 4.- Lime is mostly used for \_\_\_\_\_ .
- 5.- The aggregates are added to binders for \_\_\_\_\_ .
- 6.- Iron and steel are \_\_\_\_\_ used in construction.

### TOPIC 6.- QUESTIONS (answers on page 101)

- 1.- Which fact caused primitive man to look for housing?
- 2.- What were first houses like?
- 3.- What are houses of present times like?
- 4.- What documents must be included in every civil work?
- 5.- What are binders?
- 6.- What is setting?
- 7.- What are clays?
- 8.- State some uses of clays.
- 9.- What is plaster?
- 10.- Name some uses of plaster.
- 11.- What is lime?
- 12.- State some uses of lime.
- 13.- What is cement?
- 14.- Name some uses of cement.
- 15.- What is asphalt?
- 16.- What are aggregates?

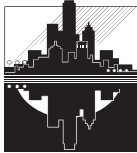
- 17.- How are aggregates classified?
- 18.- State some uses of stones and rocks.
- 19.- Name some metals used in construction.
- 20.- State some uses of wood.

**TOPIC 7.- COGNATES** (answers on page 101)

Identify 7 cognates in the last paragraph of the lesson.







# Lesson XIII

## Building

### TOPIC 1.- READING

Building is the planning of spaces assigned for construction. Constructions can serve for several purposes such as residential, commercial, industrial, schools, religious, hospitals, and other health facilities.

In order to get a well constructed building, the engineer in charge must consider important aspects such as esthetic, acoustics, lighting, electrical systems, elevators, plumbing, heating, air conditioning, gas installations, and structural design.

When selecting a terrain for a given building, the local zoning regulations must be consulted, since they rule the use of spaces for the different applications.

The urban construction regulations include standards and specifications on the functioning and intended use of the edifices. The standards point out the allowed construction materials and the minimum sizes for each work, while the specifications include the final result to be obtained, taking into consideration characteristics such as the permitted forces, stability, permeability of ground, fire resistance, and others.

The design of gas installations must be in accordance to the respective safety regulations, in order to keep accidents from happening.

For seismic zones, rules and regulations are more strict about the safety of people, buildings and general installations.

Demolitions also must be done in agreement to the urban construction regulations.

Urban edifications include a great variety of constructions such as fences, houses, parking lots, posts, pavements, scaffoldings, hospitals, hotels, shopping centers, meeting places, historical edifices, transport stations, dangerous constructions, and others.

Specifications regarding the foundations, height of walls and columns, allowed live loads, bracing, installations of ducts and tubing must be clearly specified.

Some industrial buildings require points for the supporting of heavier weights, such as hooks, trolley hoists, reels, traveling cranes and other load elements.

The walls built for several works can be structural, if they are intended for the use of loading, or they can be architectural, when they are utilized for decorative purposes only or for separating wards.

Slabs can be reticular (or light slabs), which can be used to cover greater clear spaces and lighter loads or plane slabs used to support larger loads.

Columns are structural elements also used for ornamental purposes. They are divided into short and long columns, according to their dimensions.

**TOPIC 2.- VOCABULARY.**

Word	Spanish Meaning
allowed	permitido(a)
bracing	arriostramiento
clearly	claramente
dangerous	peligroso
demolitions	demoliciones
ducts	ductos
elevators	elevadores
fences	cercas
fire	fuego, incendio
heating	calefacción
hooks	ganchos
planning	planeación
plumbing	plomería

Word	Spanish Meaning
posts reels reticular scaffoldings strict wards	postes carruchas reticular andamios estricto(a) paredes, muros

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
air conditioning health facilities in agreement to meeting places parking lots shopping centers traveling cranes trolley hoists zoning regulations	acondicionamiento de aire instalaciones de salud de acuerdo con lugares de reunión estacionamientos centros comerciales grúas móviles montacargas reglamentos de zonificación

### TOPIC 4.- VERBS

#### REGULAR VERBS

Infinitive	Past and Past Participle	Spanish Meaning
assign consult cover happen point out select separate serve	assigned consulted covered happened pointed out selected separated served	asignar, distribuir consultar cubrir suceder, acontecer indicar, señalar seleccionar, elegir separar servir

**TOPIC 5.- EXERCISES** (answers on page 102)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ is the planning of spaces assigned for construction
- 2.- Some aspects to be considered to get a well constructed building are:  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ .
- 3.- Hospitals, hotels, shopping centers, meeting places and historical edifices are some examples of \_\_\_\_\_ .
- 4.- \_\_\_\_\_ require points for supporting heavy weights.

**TOPIC 6.- QUESTIONS** (answers on page 102)

- 1.- What is building?
- 2.- Name some types of constructions.
- 3.- State some aspects to take into consideration in the design of a building.
- 4.- Who regulates urban constructions?
- 5.- Why is it necessary to be careful in the design of gas installations?
- 6.- Name some types of urban constructions.
- 7.- Why does industrial buildings require special aspects to be considered?
- 8.- How are slabs divided?
- 9.- How are columns divided?

**TOPIC 7.- COGNATES** (answers on page 102)

Identify 7 cognates in the second paragraph of the lesson.



## Lesson XIV

### Sanitary and Environmental Engineering

#### TOPIC 1.- READING

##### **Definition**

Sanitary and Environmental Engineering is a branch of Engineering, which studies the different environmental conditions, with the purpose of making them favorable for man and society.

Sanitary and Environmental Engineering has a close relationship with other fields of engineering such as chemistry and microbiology.

##### **Importance of Sanitary and Environmental Engineering**

From the definition afore mentioned, we realize the great importance of Sanitary and Environmental Engineering for mankind, since we face big problems in our daily living due to the lack of care and prevention on this matter.

The main aspects involved in Sanitary and Environmental Engineering are: Quality water control, since it is used for many purposes such as personal consumption and hygiene, and as a universal solvent to prepare other substances. Because of this, it is fundamental for water to have the appropriate physical, chemical and biological qualities for the attempted use. Even though this liquid is a renewable natural resource, it is a must to use it in the wisest manner, since pollution and other environmental threats make it more difficult to obtain with the required standards.

This subject is also concerned with water capture from rivers, lakes, lagoons, springs and other natural sources, or by extraction from wells. Likewise, it has to do with the design, construction and operation of drinking water networks, drainage systems and waste water treatment plants.

Air quality is another aspect of great interest, since vehicles and industries -in a lesser scale- produce great quantities of toxic gases which pollute the air. Protection of the environment by the establishment of rules and regulations to control forest felling, excessive hunting and cattle pasturing in prairies, is also an important part of this subject.

Noise is also an important pollutant, since it affects hearing and the nervous system, sometimes being the direct cause of accidents.

The treatment of solid residuals, their adequate handling and classification according to their uses, are also considered in Sanitary and Environmental Engineering, since garbage disposal has become a big problem today in some cities in our country. Solid residuals are divided in recyclable, biodegradable and rejectable.

Another situation that Sanitary and Environmental Engineering treats is the hygienic control of foods - milk, bread, tortilla, soda, meat and other basic Mexican foods - which is carried out by quality standards for the manufacturing companies.

Other topics of interest are: the control of rodent and insect plagues, which are transmitters of sicknesses; fitosanitary control of pesticides, used in agriculture; and the establishment of rules on industrial hygiene and accident prevention.

As a result of our lack of consciousness on the conservation of the environment, mankind is paying a high price now and will be in the years to come.

## TOPIC 2.- VOCABULARY.

Word	Spanish Meaning
bread	pan
capture	captación
case	caso
chemistry	química
establishment	establecimiento
hearing	auditivo
hunting	cacería
hygiene	higiene

Word	Spanish Meaning
meat	carne
milk	leche
nervous	nervioso
noise	ruido
pesticides	pesticidas
plagues	plagas
prairies	praderas
recyclable	reciclable
rejectable	desechable
renewable	renovable
resource	recurso
rodent	roedor
soda	bebida gaseosa, soda
solvent	solvente
springs	fuentes, manantiales
substances	sustancias
threats	amenazas
toxic	tóxico
transmitters	transmisores
wisest	lo más sabio

### TOPIC 3.- OTHER EXPRESSIONS.

Expression	Spanish Meaning
cattle pasturing	pastoreo de ganado
even though	aún cuando
forest felling	tala forestal
garbage disposal	disposición de basura
Sanitary and Environmental Engineering	Ingeniería Sanitaria y Ambiental
the years to come	los años por venir
waste water treatment plants	plantas de tratamiento de aguas residuales



## TOPIC 4.- VERBS

### REGULAR VERBS

Infinitive	Past and Past Participle	Spanish Meaning
pollute prepare realize	polluted prepared realized	contaminar preparar darse cuenta

### IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
pay	paid	paid	pagar

## TOPIC 5.- EXERCISES (answers on page 102)

Fill the blanks with the proper words to complete the sentences

- 1.- \_\_\_\_\_ studies the different environmental conditions.
- 2.- It is very important for water to have appropriate \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ qualities for the attempted use.
- 3.- Vehicles produce \_\_\_\_\_ which pollute the air.
- 4.- \_\_\_\_\_ is considered as a pollutant, because it affects the hearing and the nervous system.
- 5.- About solid residuals, Sanitary and Environmental Engineering considers their \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ .

## TOPIC 6.- QUESTIONS (answers on page 103)

- 1.- What does Sanitary and Environmental Engineering study?
- 2.- What subjects are related with Sanitary and Environmental Engineering?

- 3.- What problems are there with water quality?
- 4.- What problems are there with air pollution?
- 5.- Why is noise considered a pollutant?
- 6.- Why is forest felling dangerous for environment?
- 7.- Why is excessive pasturing dangerous for environment?
- 8.- Why is it important to handle solid residuals correctly?
- 9.- How are solid residuals classified?
- 10.- Why is it important to have hygienic control of foods?
- 11.- Mention other aspects to be considered for environmental care.

**TOPIC 7.- COGNATES** (answers on page 103)

Identify 7 cognates in the fourth paragraph of the lesson.



# Appendix

## Answers to Lessons I to XIV

### LESSON I

#### TOPIC 5

- 1.- Civil, Mechanical, Chemical and Industrial
- 2.- England
- 3.- Industrial
- 4.- submarine train
- 5.- lackness

#### TOPIC 6

- 1.- the wheel
- 2.- Egyptian pyramids, Chinese Rampart, Incan and Mayan pyramids
- 3.- in the last part of XVIII Century
- 4.- bridges, roads and fortifications
- 5.- Civil Engineering
- 6.- the industrial revolution
- 7.- the search for new and better goods
- 8.- with the inventions of Thomas Alva Edison
- 9.- the theories of Frederick W. Taylor
- 10.- biomedical engineering, the submarine train, computers, solar energy
- 11.- overpopulation, lackness of food, damages to the environment

#### TOPIC 7

multitude, sophisticated, equipment, examples, communication, systems, satellite, atomic, utilization, specialized

## LESSON II

### TOPIC 5

- 1.- abacus
- 2.- electrics
- 3.- logarithms
- 4.- "An algebraic equation of order  $n$ , has  $n$  solutions", Gauss
- 5.- theory of relativity

### TOPIC 6

- 1.- abacus in Babylon
- 2.- fundamentals of geometry
- 3.- discovery of irrational numbers, his theorem, and the relationship between mathematics and musical scale
- 4.- by its division in an infinite number of triangles
- 5.- Zenon
- 6.- "Elements"
- 7.- the book "Conics"
- 8.- Archimedes
- 9.- pulleys law, lever law, calculations of gravity center of objects, hydraulic principles
- 10.- a famous woman from the University of Alexandria
- 11.- Diophantus
- 12.- al – Khowarizmi
- 13.- the first man in managing negative numbers
- 14.- Luca Pacioli, Cardano, "Tartaglia"
- 15.- "Geometry" written by Descartes
- 16.- John Napier
- 17.- Isaac Newton
- 18.- the gravity laws, "La Principia"
- 19.- the first man in publishing a text book about calculus
- 20.- a Leibniz's disciple
- 21.- Pascal and de Fermat
- 22.- works about usual and celestial mechanics
- 23.- a Swiss mathematician, who made important applications of calculus to curves and areas
- 24.- Archimedes, Newton, and Gauss
- 25.- theory of numbers, theory of functions, complex numbers, vector analysis, works of electromagnetism, calculation of planet orbits, and so on

- 26.- a pupil of Gauss, who developed non Euclidean geometry
- 27.- a Russian, who developed non Euclidean geometry
- 28.- developed a new style of algebra
- 29.- Georg Cantor
- 30.- discovered the theory of relativity
- 31.- John von Neumann
- 32.- George B. Dantzig

### **TOPIC 7**

referring, conical, sections, important, talent, mathematics, mechanics, considered, practical, gravity

## **LESSON III**

### **TOPIC 5**

- 1.- computer
- 2.- receiving data
- 3.- random access
- 4.- word processors
- 5.- characters, words, numbers and syntactic rules

### **TOPIC 6**

- 1.- in the 50's
- 2.- reduction of cost in labor time and office supplies
- 3.- receiving, processing, and storing data, and providing results
- 4.- the physical equipment of the computer system
- 5.- a series of programs and instructions that direct the operation of a computer
- 6.- input device, central processing unit, and output device
- 7.- it is a device used to enter data to the computer system
- 8.- the part where the logic and arithmetic operations are carried out
- 9.- the part that gives us results in a printed form
- 10.- the volatile memory is deleted when the computer is turned off and the permanent memory keeps the information, when the computer is turned off
- 11.- operating systems, word processors, spreadsheets and data bases managers
- 12.- packages used for text management

- 13.- packages used for calculations
- 14.- packages used for classification of files
- 15.- it is a series of instructions to direct the computer
- 16.- they are a series of characters, words, numbers and syntactic rules used to elaborate a computer program

## **TOPIC 7**

personal, computers, complex, operations, professional, students, notably, information, process, data

## **LESSON IV**

### **TOPIC 5**

- 1.- mathematics, geometry, trigonometry and arithmetic
- 2.- Cartography
- 3.- Heron, Ptolomy and Papo
- 4.- measurements of land

### **TOPIC 6**

- 1.- the science concerning the related data to determine the position of any point on Earth
- 2.- mathematics, arithmetic geometry, and trigonometry
- 3.- Geodesy takes into consideration the curvature of Earth and Surveying suppose Earth is flat
- 4.- Surveying deals with the determination of position of any point of Earth and Cartography only refers to the graphical representation of Earth or a portion of it on a plane or a map
- 5.- 5000 year ago
- 6.- Heron, Ptolomy and Papo
- 7.- optical and electronial theodolites and laser colimators
- 8.- the magnetic or astronomic North
- 9.- every civil work needs measurements of the land on which the construction will be situated

### **TOPIC 7**

Geodesy, Cartography, studies, dimensions, differing, parts, terrain

## LESSON V

### TOPIC 5

- 1.- qualities of materials
- 2.- Coulomb and Navier
- 3.- Hook, deformation, stress

### TOPIC 6

- 1.- the relationship between the external loads and their effects on solid materials
- 2.- because if construction materials fail, it could be of serious consequences in the safety and economical concerns
- 3.- formally in the XVIII Century
- 4.- two wise men, who made important discoveries on this field
- 5.- temporary and permanent
- 6.- when materials get back to their original size and shape, after they are released of loads
- 7.- when materials doesn't get back to their original size and shape
- 8.- "the deformation of a body is in direct proportion to the stress applied onto it"
- 9.- a particular property of the solid body
- 10.- because it permit us to calculate the normal stress onto the parts of a solid, when its dimensions and mechanical characteristics are known

### TOPIC 7

materials, causes, affecting, solids, occurring, deformation, types, temporary

## LESSON VI

### TOPIC 5

- 1.- the father of Soil Mechanics
- 2.- soil properties
- 3.- compressibility, permeability, resistance, and the timing of volume changes
- 4.- chemical decomposition, soil generating agents
- 5.- aluminum, magnesium, and iron



## **TOPIC 6**

- 1.- Soil Mechanics is the science concerned with the laws of Mechanics and Hydraulics applied to engineering problems, dealing with sediments and other accumulations not consolidated of solid particles, produced by mechanical disintegration or chemical decomposition of rocks with or without an organical matter content
- 2.- Karl Terzaghi
- 3.- because it doesn't describe the soil behavior in different conditions
- 4.- Theory of soil behavior while supporting loads, Research of soil physical properties, and The application of theoretical and empirical knowledge to real problems
- 5.- compressibility, permeability, resistance, and the timing of volume changes
- 6.- because it is necessary to have a correct classification of soil
- 7.- mechanical disintegration and chemical decomposition
- 8.- oxidation, hydration, and carbonation
- 9.- are the ones which remain at the very place where changes have occurred
- 10.- the soils that have been carried away from its original place
- 11.- glaciers, winds, rivers, water streams, seas, and gravity
- 12.- silicates, micas, oxides, carbonates, and sulphates
- 13.- hydrated silicates of aluminum, magnesium, and iron
- 14.- because soil is the result of a multitude of factors

## **TOPIC 7**

sediments, accumulations, consolidated, particles, produced, disintegration, decomposition, rocks

## **LESSON VII**

### **TOPIC 5**

- 1.- foundations, the ground, constructions
- 2.- deep foundations
- 3.- square or rectangular
- 4.- safety factor

## TOPIC 6

- 1.- structural elements used to transfer charges to the ground generated by the weight of constructions
- 2.- the magnitude of the loads, and the ground qualities
- 3.- because this aspect determines the loading capacity of soil
- 4.- low deep and deep foundations
- 5.- when soil has high loading capacity and/or when the charges to be supported are not too heavy
- 6.- when soil hasn't high loading capacity and/or when the charges to be supported are too heavy
- 7.- shoes, continued shoes, and foundation slabs
- 8.- structural elements, built of reinforced concrete, to distribute the loads of construction on a larger area
- 9.- are shoes with their length greater than their width
- 10.- are structural elements, built of reinforced concrete, used when the weight of civil works is too big
- 11.- are structural elements with small cross section and big length, constructed from concrete, steel, or wood, joined on their top with foundation slabs, used to support heavier weights
- 12.- because it is possible to happen occasional overloadings

## TOPIC 7

essential, civil, aspect, determine, capacity

## LESSON VIII

### TOPIC 5

- 1.- structural design
- 2.- structure
- 3.- calculation of new structures

### TOPIC 6

- 1.- the subject that deals with the evaluation of existing structures
- 2.- the subject that deals with the calculation of new structures
- 3.- because every construction needs an adequate structure to support loadings during its useful life
- 4.- it is an assembly of parts that are allied in an ordered way to carry out its function

- 5.- the saving of a clear space, the containing of space, or the supporting of loads or pressures
- 6.- the reinforced concrete, and the steel structures
- 7.- compression, tensile, and torsion
- 8.- the effort of compacting or compressing the structure
- 9.- the effort of stretching the structure
- 10.- the effort of twisting the structure
- 11.- the construction project, the architectural plan, the calculation of loads the structure is going to resist, and the calculations of the dimensions of structure
- 12.- live and dead loadings
- 13.- those loads that change with time
- 14.- those loads that are constant
- 15.- because there are too many parameters to be considered

### **TOPIC 7**

structures, analysis, important, adequate, support, evaluation, calculation, corresponding

## **LESSON IX**

### **TOPIC 5**

- 1.- Hydraulics
- 2.- energy, constant
- 3.- storing water
- 4.- wells
- 5.- black waters drainages

### **TOPIC 6**

- 1.- it is the science dealing with physical laws that describe water behavior
- 2.- Hydrostatics and Hydrodynamics
- 3.- static water
- 4.- water in motion
- 5.- Bernoulli equation
- 6.- Prandtl, Reynolds, and Froude
- 7.- they are big constructions used for storing water
- 8.- they are mechanical systems to convert hydraulic energy of rivers and waterfalls into electricity

- 9.- they are drilled holes in the ground, to permit the water extraction by electromechanical equipments
- 10.- they are ditches in the open air, used for transporting water
- 11.- they are ducts, made to convey water from wells or other sources to urban places
- 12.- they are conduits made to carry residual or waste waters from urban places to natural places
- 13.- black waters, rain, and mixed drainages
- 14.- they are machines or equipments used to pump water out from any source

## **TOPIC 7**

fluid, exclusively, manner, influence, different, situations, liquid, roles

## **LESSON X**

### **TOPIC 5**

- 1.- Highways
- 2.- the foundation base
- 3.- asphaltic concrete, asphaltic macadam, asphaltic treatments, concrete, and block paving
- 4.- to handle big volumes

### **TOPIC 6**

- 1.- they are the means used by man for his own transportation, or for carrying materials from one place to another
- 2.- location, cost, population effects, type of traffic, environmental impact, property acquisition, construction materials availability, weather conditions, and qualities of soil
- 3.- Highways and Railroads
- 4.- they are the ways mostly used by man, to travel or to carry materials
- 5.- the foundation base and the rolling surface
- 6.- asphaltic concrete, asphaltic macadam, asphaltic treatments, concrete, stone slabs, pavement sheet, industrial pavement, and block paving
- 7.- they are the most efficient ways to handle big volumes of freight
- 8.- rails, rail bed, bridges, fords, drains, yards, terminal stations, offices, terrestrial signals, and safety devices
- 9.- passengers and freight, commuter, and rapid transit type

- 10.- because they have good resistance to rolling and can support heavier weights
- 11.- diesel – electric, electric, gas turbine, hydraulic turbine, jet propulsion, pneumatic induction motor
- 12.- double rail, monorail, and welded continuous rail

### **TOPIC 7**

location, cost, effects, traffic, impact, acquisition, conditions

## **LESSON XI**

### **TOPIC 5**

- 1.- bridges, obstacles
- 2.- to design a bridge
- 3.- gravel beam, rails

### **TOPIC 6**

- 1.- they are structures to facilitate motion of people, animals or materials, over natural or artificial obstacles
- 2.- wood, masonry, concrete, and steel
- 3.- they are fixed
- 4.- they can move
- 5.- continuous girder, arched, hanging, and steel – armor – plated bridges
- 6.- the geometric requirements, hydraulic specifications, selection of structural systems, construction materials, safety standards, esthetics, economical aspects, and ease for operation and maintenance
- 7.- those used in Highways
- 8.- those used in railroad systems
- 9.- to absorb vertical movements
- 10.- dead and live loads

### **TOPIC 7**

general, stationary, movable, classified, according

## LESSON XII

### TOPIC 5

- 1.- architectural plans
- 2.- the economical considerations
- 3.- hydrated silicates of aluminum, magnesium, and iron
- 4.- finishing works
- 5.- for economical reasons
- 6.- metals

### TOPIC 6

- 1.- to protect himself from wild beasts and extreme weather conditions
- 2.- rudimentary huts
- 3.- residential houses, mansions, skyscrapers
- 4.- the architectural plan, the calculation record, budget, and specifications
- 5.- they are materials which get plasticity properties when mixed with water, and become of a greater resistance when dry
- 6.- the drying process of binders
- 7.- they are materials very moldable when mixed with water, chemically, they are hydrated silicates of aluminum, magnesium, and iron
- 8.- as raw materials for bricks, floors, and tyles
- 9.- it is a construction material, chemically, it is bihydrated calcium sulphate
- 10.- ornamental purposes, inside finishing works
- 11.- it is a construction material, chemically, it is calcium oxide
- 12.- for finishing works
- 13.- it is a mixture obtained by baking clay and lime, of very high resistance to support loads
- 14.- for constructions, and structures to support heavy loads
- 15.- it is a mixture of hydrocarbons obtained from distillation of oil
- 16.- they are inert materials, which are added to binders for economical reasons, since they increase their volume without loosing their properties
- 17.- sand, pea gravel, gravel, and pebble, according to their size
- 18.- as resistance elements, as raw materials, or for ornamental uses
- 19.- iron, steel, aluminum, lead, and copper
- 20.- as a construction material, for decorative purposes

### TOPIC 7

industry, traction, compression, athermic, contact, limits, use

## LESSON XIII

### TOPIC 5

- 1.- Building
- 2.- the esthetic, acoustics, lighting, electrical systems, elevators, plumbing, heating, air conditioning, gas installations, and structural design.
- 3.- urban edifications
- 4.- industrial buildings

### TOPIC 6

- 1.- It is the planning of spaces assigned for construction
- 2.- residential, industrial, commercial, schools, religious, hospitals
- 3.- the esthetic, acoustics, lighting, electrical systems, elevators, plumbing, heating, air conditioning, gas installations, and structural design
- 4.- the urban construction regulations
- 5.- because they can cause accidents
- 6.- fences, houses, parking lots, posts, pavements, scaffoldings, hospitals, hotels, shopping centers, meeting places, historical edifices, transport stations
- 7.- because they need some aspects to be considered, as points for the supporting of heavier weights
- 8.- reticular and plane slabs
- 9.- short and long columns

### TOPIC 7

esthetic, acoustics, electrical, elevators, air, conditioning, installations

## LESSON XIV

### TOPIC 5

- 1.- Sanitary and Environmental Engineering
- 2.- chemical, physical and biological
- 3.- toxic gases
- 4.- noise
- 5.- treatment, handling, and classification

## **TOPIC 6**

- 1.- the different environmental conditions
- 2.- chemistry and microbiology
- 3.- pollution makes more difficult to obtain water with the required standards
- 4.- vehicles and industries produce toxic gases, which pollute the air
- 5.- because it affects hearing and the nervous system
- 6.- because the forest cleans the air, and it plays a very important role in the water cycle
- 7.- because pasture is a part of forest
- 8.- because they are pollutants, and they have to be treated in a different manner, according to their classification
- 9.- recyclable, biodegradable, and rejectable
- 10.- because if food is not hygienic, it can cause several sicknesses
- 11.- control of rodents and plagues, fitosanitary control of pesticides, industrial hygiene

## **TOPIC 7**

Sanitary, hygiene, universal, solvent, prepare, substances, biological





# BIBLIOGRAPHY

APHA, AWWA y WPCF, Standard Methods, American Public Health Association Inc., 11ª. Edición, 1960.

BERGAMINI D., Matemáticas, Colección Científica de Time Life, Ediciones Culturales Internacionales, 2ª Edición, 1986.

CASTILLO M. HEBERTO, Análisis y Diseño Estructural, Representaciones y Servicios de Ingeniería, S.A., 1973.

CRESPO V. C., Mecánica de Suelos y Cimentaciones, Limusa, 4ª. Edición, 1990.

CRESPO V. C., Vías de Comunicación: Caminos, Ferrocarriles, Aeropuertos, Puentes y Puertos, Limusa, 2ª. Edición, 1992.

ENCICLOPEDIA CEAC DEL DELINEANTE, Materiales y Elementos de Construcción, Ediciones CEAC, 4ª. Edición, 1984.

FURNAS C. C. Y MCCARTHY J., El Ingeniero, Colección Científica de Time Life, Ediciones Culturales Internacionales, 2ª Edición, 1986.

JOYANES A. LUIS, Programación Basic para microcomputadoras, Mc Graw Hill, 2ª Edición, 1990.

JUÁREZ B. E. Y RICO R. A., Mecánica de Suelos Volumen 1, Limusa, 3ª Edición, 1992.

MICROSOFT CORPORATION, Microsoft Windows 3.1 for the MS-DOS Operating System, Gateway 2000 Edition, 1992.

MONTES DE OCA M., Topografía, Representaciones y Servicios de Ingeniería S. A., 4ª Edición, 1983.

Reglamento de Construcciones y Reglamento de Servicios de Agua y Drenaje para el Distrito Federal, Editorial PAC S. A. De C. V., 1991.

SINGER F. L. Y PYTEL A., Strength of Materials, Harper and Row Publishers Inc., 3ª Edición, 1983.

SOTELO A. G., Hidráulica General Volumen 1, Limusa, 1989.

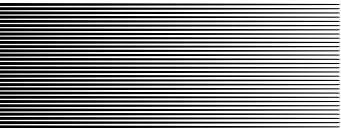
THIERAUF R. J., GROSSE R. A., Toma de decisiones por medio de Investigación de Operaciones, Limusa, 1990.

VAUGHN R. C., Introducción a la Ingeniería Industrial, Editorial Reverté, S. A., 1971.

WRIGHT A. L., Practice your English, American Book Company, 1960.

Por acuerdo del señor Rector  
de la Universidad Autónoma de San Luis Potosí,  
Ing. Jaime Valle Méndez,  
el libro *Technical English for Civil Engineering*  
de Juan Manuel Izar Landeta,  
se terminó de imprimir el 17 de octubre  
de 1999 en los Talleres Gráficos de la  
Editorial Universitaria Potosina.  
La edición estuvo al cuidado del autor  
Se imprimieron 500 ejemplares.





*Editorial  
Universitaria  
Potosina*