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FOR

CIVIL ENGINEERING

Juan Manuel Izar Landeta

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.

TECHNICAL ENGLISH
FOR CIVIL ENGINEERING

C O N T E N T

LESSON I

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**	**Word**	**Spanish Meaning**
almost	casi	later	más tarde
beautiful	bello, hermoso	long	largo
best	el mejor	mankind	humanidad
better	mejor	manner	manera
between	entre, en medio de dos	motion	movimiento
branch	rama	nevertheless	sin embargo, no obstante
bridge	puente	nowadays	hoy en día
century	siglo	origin	origen
challenge	reto, desafío	overpopulation	sobrepoblación
country	país, región, tierra	peaceful	pacífico(a)
damage	daño, estropeo	pyramids	pirámides
development	desarrollo	rampart	muralla
early	temprano, antiguo	roads	caminos, carreteras
engineering	ingeniería	search	búsqueda
environment	medio ambiente	several	varios, varias
fastly	rápidamente	sickness	enfermedad
fields	campos	ships	naves. barcos
fight	pelea, lucha	society	sociedad
food	comida, alimento	space	espacio
fortification	fuerte, fortaleza	struggle	lucha, pelea
goods	bienes, artículos	theories	teorías
happy	feliz	times	veces, tiempos
however	sin embargo, no obstante	tomorrow	mañana
hydraulic	hidráulico	train	tren
improvements	mejoras	unknown	desconocido, no sabido
lackness	falta, escasez	way	camino, forma
last	último(a)	wheel	rueda, volante
lasting	duradero	works	trabajos, obras

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
be	was, were	been	ser, estar
bring up	brought up	brought up	introducir, criar
build	built	built	construir, edificar
come	came	come	venir
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 61)

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 61)

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?

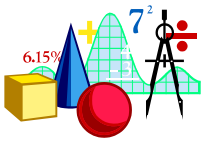
10.- Describe some of the latest engineering works.

11.- State some of the challenges of the engineering of tomorrow.

TOPIC 7.- COGNATES (answers on page 61)

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**	**Word**	**Spanish Meaning**
abacus	ábaco	nature	naturaleza
about	acerca de, aproximadamente	outstanding	sobresaliente, destacado
afterwards	después de eso	paper	papel, artículo
also	también	partner	camarada, compañero
although	aunque	passionate	apasionado
always	siempre	pulley	polea
among	entre varios	pupil	alumno, discípulo
arrival	llegada, arrivo	relationship	relación
because	porque	Renaissance	Renacimiento
beginning	comienzo, inicio	role	rol, papel
binding	lazo, ligadura	sample	muestra
both	ambos	scale	escala
business	negocio, comercio	scene	escena
chance	oportunidad, azar	science	ciencia
circle	círculo	since	desde, puesto que
fact	hecho	sports	deportes
few	poco(s), poca(s)	still	todavía, aún
finally	finalmente	style	estilo
following	siguiente	subject	materia, sujeto, asunto
games	juegos	theme	tema
gap	distancia, hueco, brecha	thereafter	de ahí en adelante
God	Dios	together	juntos
inherent	inherente	uncertainty	incertidumbre, incerteza
latest	lo último, lo más reciente	until	hasta
Word	**Spanish Meaning**	**Word**	**Spanish Meaning**
law	ley	useful	útil
lever	palanca	without	sin
like	como	whose	cuyo(s)

loss	pérdida	wise	Sabio
main	principal	world	Mundo

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

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

IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 61)

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 61 and 62)

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 62)
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.

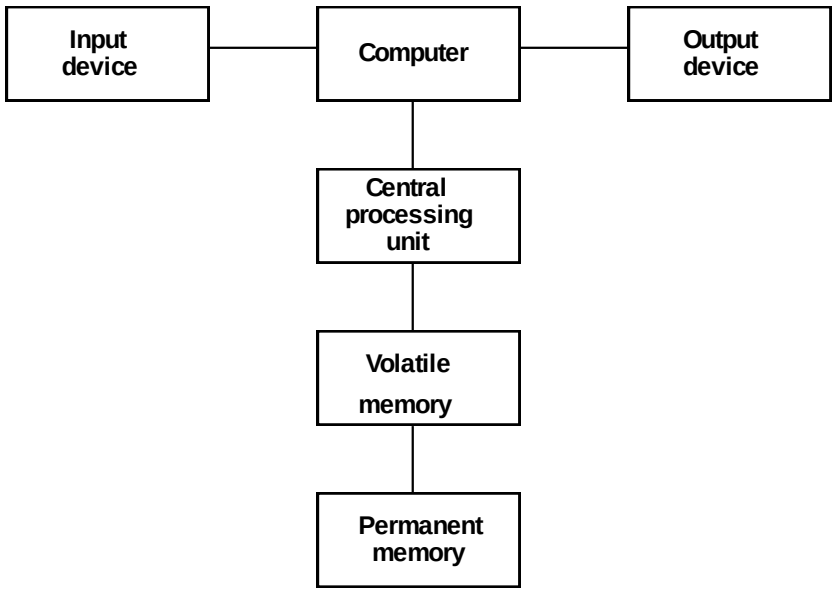
2.- Software. These are a series of programs and instructions that direct the operation of a computer.

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_1) the central processing unit, where logic and arithmetic operations are carried out; (b_2) 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_3) 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

Word	Spanish Meaning	Word	Spanish Meaning
ability	habilidad, capacidad	mouse	ratón
able	capaz, hábil	output	salida, producción
adequate	adecuado	own	propio
advantage	ventaja	packages	paquetes. empaques
also	también	place	lugar
amount	cantidad	printer	impresor(a)
available	disponible	profitability	productividad, rentabilidad
big	grande	random	aleatorio
classifier	clasificador	shorter	más corto
commands	comandos	size	tamaño, medida
complex	complejo, complicado	small	pequeño(a)
device	dispositivo, mecanismo	software	conjunto de programas y documentos para operar un sistema de cómputo
easily	fácilmente	stable	estable
files	archivos	storage	almacén
further	más lejano	supplies	provisiones, mercancías
handling	manejo	thus	así, de este modo
hardware	equipo físico de un sistema de cómputo	tool	herramienta
input	entrada	typewriter	máquina de escribir
keyboard	teclado	unexpected	inesperado
kind	clase, tipo	user	usuario
labor	mano de obra, trabajo	volatile	volátil
large	grande	while	mientras
meaning	significado		

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
perform	performed	realizar, efectuar
permit	permitted	permitir
print	printed	imprimir
process	processed	procesar
produce	produced	producir
provide	provided	proveer, proporcionar
receive	received	recibir
reduce	reduced	reducir

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
require	required	requerir
retrieve	retrieved	componer, restaurar
save	saved	salvar, ahorrar, guardar
start	started	arrancar, iniciar
store	stored	almacenar, guardar
turn off	turned off	apagar
utilize	utilized	utilizar
want	wanted	querer
work	worked	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 62 and 63)

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 63)

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?

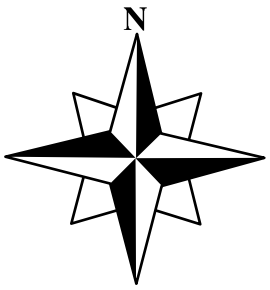
6.- What are the parts of a computer?

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 63)
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	Word	Spanish Meaning
accuracy	precisión, exactitud	highways	carreteras
advancement	avance	knowledge	conocimiento
ancient	antiguo, remoto	land	tierra
birth	nacimiento	location	localización, sitio
building	edificios, construcciones	measurements	medidas
cities	ciudades	procedures	procedimientos
close	estrecha, cercana	railroads	vías férreas
colimators	colimadores	relationship	relación
concerning	relativo a, referente a	shape	figura, forma
dam	presa	skills	habilidades
Earth	Tierra	skyscrapers	rascacielos
facilities	instalaciones	surface	superficie
flat	plano(a)	surveying	medición del terreno
floodings	inundaciones	terrain	terreno
ground	tierra, suelo	theodolites	teodolitos
high	alto(a)	usually	usualmente

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

Infinitive (to ...)	Past and Past Participle	Spanish Meaning
study	studied	estudiar
suppose	supposed	suponer

IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 63)

Fill the blanks with the proper words to complete the sentences

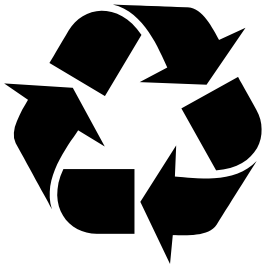
1.- Surveying requires knowledge of _____ , _____ , _____ , and _____ .
2.- _____ is the science related to the graphical representation of Earth on a plane.
3.- _____ , _____, and _____ , were outstanding men in Surveying.
4.- Every construction needs _____ of _____ on which it will be situated.

TOPIC 6.- QUESTIONS (answers on page 63 and 64)

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 64)

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

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

watch	watched	observar, mirar

IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 64)

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.

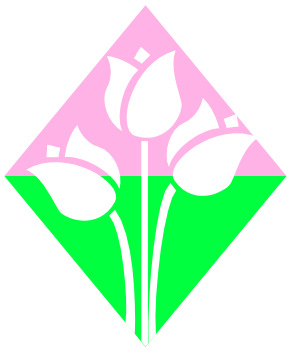
3.- The _____ law states: "The _____ of a body is in direct proportion to the _____ applied onto it".

TOPIC 6.- QUESTIONS (answers on page 64)

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 64)

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**	**Word**	**Spanish Meaning**
behavior	comportamiento	permeability	permeabilidad
builder	constructor, edificador	physical	físico(a)
chemical	químico(a) - sustancia	purpose	propósito
clays	arcillas	quite	bastante

Word	Spanish Meaning	Word	Spanish Meaning
compacity	compacidad	research	investigación
compressibility	compresibilidad	rivers	ríos
content	contenido	seas	mares
deeper	más profundo	soil	suelo
empirical	empírico	stratus	estrato
enough	suficiente, bastante	streams	corrientes, arroyos
features	rasgos, características	test	prueba
fine	fino, bueno	thick	grueso
glaciers	glaciares	understanding	comprensión
lately	recientemente	variety	variedad
likely	probable	water	agua
mixture	mezcla	winds	vientos
most	mayoría, lo más		

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	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 64)

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 64 and 65)

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 occurr 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 65)

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

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 65)

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 65)

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 66)

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

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
tensile stress	esfuerzo de tensión
torsion stress	esfuerzo de torsión
too many	demasiados

TOPIC 4.- VERBS

REGULAR VERBS

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

IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 66)

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 66)

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 66)

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

Word	Spanish Meaning	Word	Spanish Meaning
lagoon	laguna	wells	pozos
lake	lago		

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	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 66)

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 66 and 67)

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 67)

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

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

IRREGULAR VERBS

Infinitive	Past	Past Participle	Spanish Meaning
run	ran	run	correr

TOPIC 5.- EXERCISES (answers on page 67)

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 67 and 68)

1.- What are surface ways?
2.- What are the factors to take into consideration for designing surface ways?
3.- What are tha 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 68)

Identify 7 cognates in the third paragraph of the lesson

LESSON XI

B R I D G E S

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.

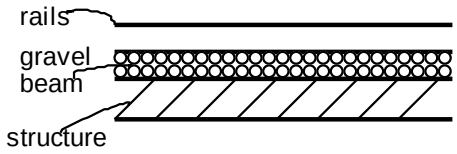
The geometric requirements, hydraulic specifications, selection of structural systems and construction materials, safety standards, esthetics, economical aspects and, ease for operation and maintenance are other important factors to take into consideration.

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

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

TOPIC 4.- VERBS

REGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 68)

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 68)

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 68)
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 loosing 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 athermic 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**	**Word**	**Spanish Meaning**
aggregates	agregados	lime	cal
athermic	atérmico(a)	limestone	piedra caliza
beasts	bestias, fieras	liquids	líquidos
binders	aglomerantes	moldable	moldeable
bricks	ladrillos	oil	aceite, petróleo
budget	presupuesto	paints	pinturas
cement	cemento	particle	partícula
compound	componente	pebble	piedrecilla
copper	cobre	plaster	yeso
disadvantage	desventaja	sand	arena
distillation	destilación	setting	fraguado
fit	apropiado, conveniente	shelter	cueva, refugio
floors	pisos	so	así, de este modo
friable	quebradizo	soft	blando
hard	duro, difícil	sun	sol
housing	vivienda, alojamiento	tin	estaño
hut	choza	toughness	dureza
iron	hierro	traction	tracción
lead	plomo	wild	salvaje
lightness	ligereza		

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

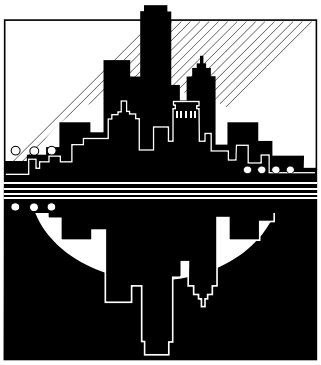
IRREGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 68)
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 68 and 69)
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 69)
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**	**Word**	**Spanish Meaning**
allowed	permitido(a)	hooks	ganchos
bracing	arriostramiento	planning	planeación
clearly	claramente	plumbing	plomería
dangerous	peligroso	posts	postes
demolitions	demoliciones	reels	carruchas
ducts	ductos	reticular	reticular
elevators	elevadores	scaffoldings	andamios
fences	cercas	strict	estricto(a)
fire	fuego, incendio	wards	paredes, muros
heating	calefacción		

TOPIC 3.- OTHER EXPRESSIONS.

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

TOPIC 4.- VERBS

REGULAR VERBS

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

TOPIC 5.- EXERCISES (answers on page 69)

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 69 and 70)

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 70)

Identify 7 cognates in the second paragraph of the lesson

LESSON XIV

Comentario [IEMS1]:

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**	**Word**	**Spanish Meaning**
bread	pan	prairies	praderas
capture	captación	recyclable	reciclable
case	caso	rejectable	desechable
chemistry	química	renewable	renovable
establishment	establecimiento	resource	recurso
hearing	auditivo	rodent	roedor
hunting	cacería	soda	bebida gaseosa, soda
hygiene	higiene	solvent	solvente
meat	carne	springs	fuentes, manantiales
milk	leche	substances	sustancias
nervous	nervioso	threats	amenazas
noise	ruido	toxic	tóxico
pesticides	pesticidas	transmitters	transmisores
plagues	plagas	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	polluted	contaminar
prepare	prepared	preparar
realize	realized	darse cuenta

IRREGULAR VERBS

Infinitive	**Past**	**Past Participle**	**Spanish Meaning**
pay	paid	paid	pagar

TOPIC 5.- EXERCISES (answers on page 70)

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 Enginnering considers their _____ , _____ , and _____ .

TOPIC 6.- QUESTIONS (answers on page 70)

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 70)

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.- electics
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.- dicovered 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 manegement
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 occured
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 tansfer 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 macadum, 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 macadum, 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, conmutator, 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.

Encilopedia 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.