A) COURSE

Course Id:	Course
5618	THERMODYNAMICS

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	1	5	11	80

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	IV	V	III	IV	III
Course Type (Required/Elective)	Required	Required	Required	Required	Required
Prerequisite Course:	Calculus D	Physics B y Calculus D	Physics B y Calculus D	Calculus D	Calculus D
CACEI Classification:	ES	ES	ES	ES	ES

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Resolver problemas inherentes a los procesos con gases ideales y vapor de agua, así como la transformación y propiedades de la energía en todas sus manifestaciones. También manejará y aplicará matemáticamente las expresiones correspondientes a la termodinámica en los diferentes sistemas de unidades.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- THE BASICS AND UNIT SYSTEMS.		**8 hrs**
Objetivo Especifico:	Students will master the basics on the properties of the substance, as well as units and systems to solve problems.	
1.1. - Definition of Thermodynamics. 1.2. - Working Substance. Thermodynamic system and types of systems. 1.3. - Surface and Volume Control. 1.4. - Properties, States and thermodynamic processes. 1.5. - Measurement Units and Systems of Units. 1.6. - Mass and Weight. 1.7. - Volume, specific volume, density and specific weight. 1.8. - Pressure, atmospheric pressure, absolute pressure and gauge pressure. 1.9. - Temperature and temperature scales. 1.10. - Archimedes Principle. 1.11. - Act Zero. 1.12 .. - Law of Conservation of Mass, types and Open Systems Flow in Pipes.		
Readings and other resources	Read the suggested topics of literature, and solve problems indicated by the teacher.	

Teaching Methodologies	It will be taught by expository sessions by the teacher, problem solving sessions and conducting case analysis.
Learning Activities	Solving exercises and problems, readings and research tasks.

2.- ENERGY CONCEPTS AND THE FIRST LAW OF THERMODYNAMICS		**12 horas**
Objetivo Especifico:	Students will master the concepts of the different manifestations of energy, distinguish the difference between amounts of stored energy and transition, learn and apply the First Law of Thermodynamics and master mathematical expressions that govern them and to solve problems.	
2.1. - Amounts of stored energy and amounts of energy in motion. 2.2. - Gravitational potential energy. 2.3. - Kinetic Energy. 2.4. - Internal Energy. 2.5. - Labour. 2.6. - Working on a Mobile Border 2.7. - Heats. 2.8. - Energy Flow. 2.9. - First Law of Thermodynamics. 2.10. - Diagram and Energy Balance. 2.11. - Equation of Conservation of Energy for the closed system and the open system. 2.12. - Enthalpy. 2.13. - Reversibility and irreversibility. 2.14. - Specific heat. Specific heat at constant volume and constant pressure. 2.15.-specific heat. Entropy and TS Diagram 2.16. - $\int pdV$ and $-\int vdP$		
Readings and other resources	Read the suggested topics of literature, and solve problems indicated by the teacher.	
Teaching Methodologies	It will be taught by expository sessions by the teacher, problem solving sessions and conducting case analysis.	
Learning Activities	Solving exercises and problems, readings and research tasks. Collection practices and data analysis.	

3.- 2 ND LAW OF THERMODYNAMICS.		**6 horas**
Objetivo Especifico:	The student will know, understand and apply the second law of thermodynamics and can solve problems.	
3.1. - Different statements of the second law of thermodynamics. 3.2. - Clausius inequality. 3.3. - Entropy production. 3.4. - Availability energy of a closed system. 3.5. - Availability energy of an open system. 3.6. - Potion available heat. 3.7. - Helmontz and Gibbs functions.		
Readings and other resources	Read the suggested topics of literature, and solve problems indicated by the teacher.	
Teaching Methodologies	It will be taught by expository sessions by the teacher, problem solving sessions and conducting case analysis.	
Learning Activities	Solving exercises and problems, readings and research tasks. Collection practices and data analysis.	

4.- IDEAL GAS AND PURE SUBSTANCE	**16 horas**

Objetivo Especifico:	Students will recognize the different phases of the substance; distinguish different types of substances, learn and master the use of tables and diagrams to various substances and phases, and can solve problems.

4 .1. - The Ideal Gas.
4 .2. - Ideal Gas Laws.
4 .3. - Boyle's Law (T = C).
4 .4. - 1st. Charles Law (or Gay-Lussac, p = C).
4 .5. - 2nd. Charles Law (V = C)
4.6. - Avogadro's Law
47. - Specific heats of an ideal gas.
4.8. - Dalton's Law of Partial Pressures
4.9. - Entropy Change of an Ideal Gas.
4.10. - Tables of Gases (consideration of Cp and Cv = f (T).
4.11., Phase changes at constant pressure.
4.12. - Comparison of liquid and vapor curves.
4.13. - Thermodynamic Surfaces
4.14. - Phase diagram.
4.15. - Phase rule
4.16. - Tables of liquid and vapor.
4.17. Compressed-Liquid.
4.18. - Diagrams Properties.
4.19. - Mollier Diagram
4.20. - P-H diagram

Readings and other resources	Read the suggested topics of literature, and solve problems indicated by the teacher.
Teaching Methodologies	It will be taught by expository sessions by the teacher, problem solving sessions and conducting case analysis.
Learning Activities	Solving exercises and problems, readings and research tasks. Collection practices and data analysis. Management of charts and graphs.

5.- PROCESSES IN FLUIDS.	**20 horas**
Objetivo Especifico:	To acquire the ability to analyze the various thermodynamic processes and can solve problems.

5 .1. - Isometric Process:
5.1.1. - Ideal Gas. Analysis under the consideration of constant and variable specific heats.
5.1.2 Vapor.
5 .2. - The isobaric process:
5.2.1. - Ideal Gas. Analysis under the consideration of constant and variable specific heats.
5.2.2 Vapor.
5 .3. - The isothermal process:
5.3.1. - Ideal Gas. Analysis under the consideration of constant and variable specific heats.
5.3.2 Vapor.
5. 4. - The isentropic process:
5.4.1. - Ideal Gas. Analysis under the consideration of constant and variable specific heats.
5.4.2 Vapor.
5 .5. - Adiabatic processes. Reversible and irreversible.
5 .6. - The polytropic process.
5.6.1. - Curves representing the process at the vp and Ts.
5.6.2 Analysis polytropic process:
a). - Ideal Gas. Analysis under the consideration of constant and variable specific heats.
b.) - Vapor.
5 .7. - Relations volumes and pressures.

Readings and other resources	Se recomienda leer los temas de la bibliografía sugerida, y resolver problemas indicados por el maestro.
Teaching Methodologies	Se impartirá mediante sesiones expositivas por el maestro, sesiones de solución de problemas y conducción de análisis de casos.
Learning Activities	Los trabajos de investigación, resolución de ejercicios y problemas, lecturas. Prácticas de obtención y análisis de datos. Manejo de tablas y gráficas.

6.- THERMODYNAMIC CYCLES		**18 horas**
Objetivo Especifico:	Students will analyze and apply the principles governing thermodynamic cycles, both power and energy consumers have the ability to build and analyze and solve problems.	
6 .1. - Thermodynamic cycles. 6 .2. - The Carnot Cycle. 6 .3. - Volume displaced thermal efficiency and mean effective pressure. 6 .4. - Reversed and reversible cycles cycles. 6 .5. - The reversed Carnot cycle. 6.6.- The Ericsson Cycle and Stirling Cycle (Regenerative Effect). 6.7. - Three Cycles Analysis Process. 6. 8. - Analysis cycle 4 or more processes		
Readings and other resources	Read the suggested topics of literature, and solve problems indicated by the teacher.	
Teaching Methodologies	It will be taught by expository sessions by the teacher, problem solving sessions and conducting case analysis.	
Learning Activities	Solving exercises and problems, readings and research tasks. Collection practices and data analysis. Management of charts and graphs.	

E) TEACHING AND LEARNING METHODOLOGIES

a) Conventional exposure of each subject by the teacher, using materials such as board.
b) Reading scientific articles and outreach.
c) Research by students.
d) Exhibition of Projects by students.
e) Using this software to the forefront.
f) Company visits

PRACTICES:

For the experiments, they are considered a total of 16 one-hour sessions. Practices to be performed are listed below:

1. Standards and safety equipment.
2. thermal expansion of substances.
3. Use and handling of instruments to measure temperature.
4. Use and handling of instruments for measuring pressure.
5. First Law of Thermodynamics.
6. Specific heat.
7. Work without flow.
8. Second Law of Thermodynamics.
9. Ideal gas law.
10. Latent heat of fusion and evaporation.
11. Phase changes.

12. Pressure dependence of water vapor with temperature.
13. Ranking Ideal Invested Simple Cycle.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st. Partial Evaluation	16 Sessions	Exam 90%, Tasks 10% (Relative value: 20%)	1
2nd Partial Evaluation	16 Sessions	Exam 90%, Tasks 10% (Relative value: 20%)	2
3rd. Partial Evaluation	16 Sessions	Exam 90%, Tasks 10% (Relative value: 20%)	3
4th. Partial Evaluation	16 Sessions	Exam 90%, Tasks 10% (Relative value: 20%)	4
Final Ordinary Evaluation		100% (Average of the Partial Evaluations)	5 Y 6
Other activities:			
Extraordinary Exam	Week 17 of the semester in course	Exam 100%	Topics 100%
Title Exam	According to the program of the School Secretary.	Exam 100%	Topics 100%
Regularization Exam	According to the program of the School Secretary.	Exam 100%	Topics 100%

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

1. FAIRES V.M., Thermodynamics, Macmillan, 6a. ed.
2. FAIRES V.M., Problems on thermodynamics , Macmillan, 6th. ed. (Tomo de texto y Tomo de Problemas).
3. ENGEL , YUNUS A. & BOLES, MICHAEL A., Termodinámica, Mc. Graw Hill, 4ª. Edición, 2000.
4. MORAN, MICHAEL J. & SHAPIRO, HOWARD N., Fundamentos de Termodinámica Técnica, Editorial Reverté, 2ª. Edición, 2004.
5. JONES, J.B.& HAWKINGS, G.A., Engineering thermodynamics, an introductory text book, John Wiley & sons, Inc, 2nd edition, New York, 1986.
6. JONES J.B. y DUGAN R.E., Ingeniería termodinámica, Prentice Hall, 1997.
7. KENNETH WARK, Termodinámica, McGraw-Hill, 4a. Edición.
8. LEVENSPIEL O., Fundamentos de termodinámica, Prentice Hall, 1997.

Complementary Books

1. BURGHARDT, M. DAVID, Ingeniería Termodinámica, Harper & Row Latinoamericana. 2a. Edición, 1984.
2. CARROLL M. L. & MALEEV V. L., Heat power fundamentals, Pitman.
3. Loredo Moreleón Luis A. , Apuntes de Ingenieria Termica I, Facultad de Ingenieria, UASLP, 2002.
4. ZEMANSKY VAN & NESS, Basic engineering thermodynamics, Mc Graw-Hill N. Y. 1976.

Internet Links