## A) COURSE

| Course Id: | Course |
|---|---|
| 5697 | Fabrication Process I |

| Class Hours per Week | Lab hours per week | Complementary practices | Credits | Total hour course |
|---|---|---|---|---|
| 3 | 2 | 3 | 8 | 48 Hrs. teory<br>32 hrs. lab.<br>80 hrs. total |

## B) GENERAL COURSE INFORMATION:

| | EE (IEA) | ME (IM) | MME (IMA) | EME (IME) | MTE (IMT) |
|---|---|---|---|---|---|
| **Level:** | N.A. | V | VI | N.A. | N.A. |
| **Course Type (Required/Elective)** | | Elective | Elective | | |
| **Prerequisite Course:** | | **ENGINEERING MATERIALS II (5666)** | **ENGINEERING MATERIALS II (5666)** | | |
| **CACEI Classification:** | | CI | CI | | |

## C) COURSE OBJECTIVE

| **At the end of the course, the student will be capable of:** |
|---|
| To analyze and apply different casting processes and parameters involved in the process, with the overall objective of which is in the ability to design pieces by this process. Likewise castability will acquire knowledge , adapt the part to each of the process steps and be able to view the source of the defects that it can generate and process improvements to make |

## D) TOPICS (CONTENTS AND METHODOLOGY)

| 1.- Basics Concepts | | **3 HRS** |
|---|---|---|
| Specific Objective: | The student describes the basics of solidification of a metal melt and the influence that different parameters have on the crystal structure. Further comprise the influence of the addition of foreign elements or atoms | |
| 1.1 Solidification of molten metal<br>1.2 Growth of crystals.<br>1.3 Morphology of solidification.<br>1.4 Solidification controlled<br>1.5 Segregation | | |
| **Readings and others resources** | Books, Articles, Complementary bibliography , Internet.<br>Reading articles and research ( Foundry ) . | |
| **Teaching Methods** | Class presentation , Analysis of the concepts presented , exercises , Collaborative Work | |

| | |
|---|---|
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these .Development laboratory practices applying theoretical concepts. Practice reports , group and individual problem solving |

| **2.- Castability** | | **3 HRS** |
|---|---|---|
| Specific Objective: | The student analyze and describe the property castability , so the student knows the methods of measurement | |
| 2.1 Creep (Capacity molten metal to melt ) .<br>2.2 Capacity form filling.<br>2.3 Deficit volume.<br>2.4 Feed capacity.<br>2.5 Tendency to crack formation | | |
| **Readings and others resources** | Books, Articles, Regulations, additional bibliography, internet.<br>Reading articles and research ( Fluidity ) | |
| **Teaching Methods** | • Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these. Development laboratory practices applying theoretical concepts. Practice reports, group and individual problem solving. | |

| 3.- **General rules for the design of castings.** | | **2 HRS** |
|---|---|---|
| Specific Objective: | That students know and apply the rules for the design of the pieces to be cast, efficiently and ensure minimum error in their manufacture. | |
| 3.1 Important rules forming.<br>3.2 Failures casting caused by poor design | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary Bibliography Internet.<br>Reading articles and research | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics , assignments and discussion of these | |

| 4.- **Materials for molds and casting systems** | | **3 HRS** |
|---|---|---|
| Specific Objective: | The student will know, understand and apply the different materials used for the manufacture of molds and materials properties, as well as errors or failures in the casting process caused by improper mold. In addition to applying the stages and equipment found in a foundry company as well as the importance of each within the production process. | |
| 4.1 Structure of mold material.<br>4.2 Properties of the materials for the mold.<br>4.3 Department of mold manufacturing.<br>4.4 Preparation and recovery of molds and sand.<br>4.5 Failures caused by casting the mold material. | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography , Internet. | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these. | |

| 5.- **Manufacture of cores and casting methods** | | **2 HRS** |
|---|---|---|
| Specific Objective: | The students to recognize the components of a mold for the manufacture of parts; also mastered the special methods for manufacturing | |

| | |
|---|---|
| 5.1 Cores oil.<br>5.2 Core glass<br>5.3 Cores "Cold -set"<br>5.4 Cores"Cold -box"<br>5.5 Cores"Hot -box" .<br>5.6 Cores " croning " .<br>5.7 Soluble salt cores | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these |

| 6.- Casting methods | | **3 HRS** |
|---|---|---|
| Specific Objective: | The student classify , analyze and determine the most viable method for manufacture cast in one piece | |
| 6.1 Sand casting.<br>6.2 Foundry lost mold.<br>6.3 Foundry perennial mold (Groin).<br>6.4 Special Methods | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these | |

| 7.- Foundry iron alloys (structure and properties) | | **9 HRS** |
|---|---|---|
| Specific Objective: | The student will know, describe and apply iron alloys for the foundry area . In addition to integrating the parameters of influence and form or method of its control. | |
| 7.1 Stable Solidification of iron - carbon fusions<br>7.2 metastable solidification of iron - carbon fusions .<br>7.3 Influence of the cooling rate<br>7.4 Forms of graphitization<br>7.5 Influence of the chemical composition<br>7.6 Influence of the number of embryos<br>7.7 Grey cast iron lamenar<br>7.8 Grey cast iron nodular<br>7.9 Grey cast iron vermicular<br>7.10 Ductile cast iron White<br>7.11 Smelting and special cast iron<br>7.12 Steel cast | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these | |

| 8.- Nonferrous alloys casting | | **4 HRS** |
|---|---|---|
| Specific Objective: | The student will know, describe and apply iron alloys for the foundry area . In addition to integrating the parameters of influence and shape or control method. | |
| 8.1 Aluminium alloys for casting.<br>8.2 Copper alloys for casting.<br>8.3 Tin alloys for casting.<br>8.4 casting magnesium alloys.<br>8.5 Metals bearing. | | |

| | |
|---|---|
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these |

| 9.- Changing the properties of the castings through heat and surface treatments. | | **3 HRS** |
|---|---|---|
| Specific Objective: | The student will know, understand and calculate the variables involved in a thermal or surface treatment. | |
| 9.1 Heat treatments.<br>9.2 Thermochemical treatments.<br>9.3 Surface treatments | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these | |

| 10.- Processes for bonding | | **11 HRS** |
|---|---|---|
| Specific Objective: | The student will know , analyze and apply permanent bonding processes that can be applied to metals | |
| 10.1 Welding<br>10.2 Welding Techniques<br>10.3 Types of board<br>10.4 Methods and procedures for verification of welding<br>10.5 Welding Machines<br>10.6 Mechanical joints | | |
| **Readings and others resources** | Books, Articles, Regulations, Complementary bibliography, Internet. | |
| **Teaching Methods** | Class presentation, collaborative work, problem-based learning. | |
| **Learning Activities** | Teamwork dynamics, assignments and discussion of these | |

**E) TEACHING AND LEARNING METHODOLOGIES**

a) Conventional Exposure of each subject by the teacher, using materials such as board.
b) Analysis of the concepts presented.
c) Resolution of exercises.
d) Allocation of tasks and discussion of these, to encourage collaborative work among students.
e) Application of tests.

**F) EVALUATION CRITERIA:**

| Evaluation: | Schedule | Suggested Form of Evaluation and weighing | Topics |
|---|---|---|---|
| First partial evaluation | Session 16 | **33 % Total Evaluation**<br>Parcial evaluation:<br>Exams 80% , Assignments 20% | 1,2,3,4 y 5 |
| Second partial evaluation | Session 32 | **33 % Total Evaluation**<br>Parcial evaluation<br>Exams 80% , Assignments 20% | 6 y 7 |

| | | | |
|---|---|---|---|
| Third parcial evaluation | Session 48 | **33 % Total Evaluation**<br>Parcial evaluation<br>Exams 80% , Assignments 20% | 8, 9 y 10 |
| Ordinary final evaluation | | 1<br>**100%** (Average partial assessments) | |
| Others activities: | Laboratory includes: Casting: 32 hrs .<br>With activities specified in the corresponding Manual | | |
| Second chance final exam | Week 17 of the semester in progress | 100% Exam | 100% Notes |
| Third chance final exam | According to Secretary school setting | 100% Exam | 100% Notes |
| Regularization Exam | According to Secretary school setting | 100% Exam | 100% Notes |

**G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES**

**Basic Books**

Modern manufacturing processes
Mikell P. Groover
Editorial Pearson Education, 1997

Manufacture process
John A. Schey
Editorial Mc. Graw -Hill, 3rd edition 2002

Principle of Manufacturing Engineering
Chiles, Black, Lissaman.
Editorial CECSA, 1st edition 1999

Castings,
J. Campbell,
Heineworth Butterworth, 2nd edition 2003

**Supplementary Books**

Fundamentals of Modern Manufacturing
( Materials , processes and systems )
Mikell P. Groover
Prentice Hall

SI version manufacturing processes
Myron L. Begeman
Ed. CECSA 13th reprint 1998

Basic manufacturing processes
H. C. Kasanas , Glenn E. Baker
Ed Mc . Graw -Hill

Manufacturing , Engineering and Technology
Serope Kalpakjian , Steven R. Schmid
Ed. Pearson , 2002 .

Mechanical Engineer's Handbook
Dubbel W. Beitz , K. H. Küttner
ed . Springer - Verlag

Materials and Manufacturing Processes for Engineers
Laurence E. Doyle , Carl A. Keyser, Lames L. Leach
Ed . Prentice Hall

Metal Technology
A. Kucher
Mir Publishers Moscow

## Internet sites

http://www.kenametal.com

http://www.serviacero.com/especiales

http://www.aws.org