



A) COURSE

Course Id:	Course
5690	Drawing in Mechanical Engineering

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
4	0	4	8	64 Hrs. total

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	N.A.	II	II	III	I
Course Type (Required/Elective)		Elective	Elective	Elective	Elective
Prerequisite Course:		Descriptive Geometry (1120)	Descriptive Geometry (1120)	Descriptive Geometry (1120)	NA
CACEI Classification:		CI	CI	CI	CI

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:

Ability to represent , interpret, develop and elaborate mechanical design drawings . Similarly, the student will have the ability to interpret previously proposed designs for further manufacture or redesign. Above, taking into account existing international standards on the subject.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- Fundamentals of mechanical drawing		4 hours
Specific Objective:	That students know and describe the basics of drawing and general mechanical engineering	



1.1 General 1.2 Standardization 1.3 Drawing Process and Methodology 1.4 name and characteristics of the types of drawing in mechanical engineering 1.4.1 drawing equipment 1.4.2 manufacturing drawing 1.4.3 Drawing Parts 1.4.4 drawing assembly 1.5 Presentation and labeling 1.5.1 Formats 1.5.2 Reporting tables 1.6 Scale 1.6.1 Designation 1.6.2 Specification scale 1.7 The line and its group 1.7.1 Types of line and its application 1.8 Representation of materials in the drawing 1.9 Abbreviations in the drawing and legends	
Readings and other resources	<u>library resources</u> [1] K.L. Narayana , P. Kannaiah , K, Venkata Reddy, "Machine drawing" , New Age International Publishers, 3rd.Ed. [2] J. M Duff, " Industrial technical illustration ," Cole Engineering Division . [3] A. Chevalier , "Industrial Drawing " Limusa . [4] Look Llosa , Jose Ramon , " exercises of technical drawing : representation systems " Universidad Politecnica de Valencia, Publishing Service . <u>electronic resources</u> http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20&ASME : https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category= MIT Design Handbook, engineering drawing and sketching : http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
Teaching methods	- The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class. - The student must develop a project in which the planes of manufacturing and assembly of a mechanical system are involved.
Learning activities	Professor will design activities that allow the evaluation of StudentOutcomes involved in the course .

2.- Projections and views		10 hours
Specific Objective::	The student analyze and generate projections and views showing a mechanical object designed .	



2.1 Projection systems in the drawing 2.1.1 Orthogonal projection 2.1.2 isometric projection 2.1.3 axonometric projection 2.2 Methods for obtaining views 2.2.1 Top view 2.2.2 Front view 2.2.3 Side views 2.3 Description and relative position of the views 2.4 Selection of the view according to the type of drawing and their characteristics Cortes 2.5 and section views Full section 2.5.1 Views 2.5.2 partial sectional views 2.5.3 Detail Views	
Readings and other resources	<u>library resources</u> [1] K.L. Narayana , P. Kannaiah , K, Venkata Reddy, "Machine drawing" , New Age International Publishers, 3rd.Ed. [2] J. M Duff, " Industrial technical illustration ," Cole Engineering Division . [3] A. Chevalier , "Industrial Drawing " Limusa . [4] Look Llosa , Jose Ramon , " exercises of technical drawing : representation systems " Universidad Politecnica de Valencia, Publishing Service . <u>electronic resources</u> http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20 & ASME : https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category= MIT Design Handbook, engineering drawing and sketching : http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
Teaching methods	- The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class. - The student must develop a project in which the planes of manufacturing and assembly of a mechanical system are involved.
Learning activities	Professor will design activities that allow the evaluation of StudentOutcomes involved in the course .

3.- Dimensioning and indications		12 hours
Specific Objective:	That students know and apply international standards and regulations sizing involved in mechanical drawing and their correct implementation.	



3.1 General principles of dimensioning 3.1.1 Regulations sizing 3.1.2 Guidelines sizing process 3.2 Provisions sizing 3.2.1 chained Dimensioning 3.2.2 Dimensioning Parallel 3.2.3 Dimensioning coordenado 3.2.4 Dimensioning of diameters, arcs and angles 3.3 . special instructions 3.3.1 chamfers and roundings 3.3.2 waisted and countersunk 3.3.3 Slotted 3.3.4 Knurled 3.3.5 Drilling	
Readings and other resources	<u>library resources</u> [1] K.L. Narayana , P. Kannaiah , K, Venkata Reddy, "Machine drawing" , New Age International Publishers, 3rd.Ed. [2] J. M Duff, " Industrial technical illustration ," Cole Engineering Division . [3] A. Chevalier , "Industrial Drawing " Limusa . [4] Look Llosa , Jose Ramon , " exercises of technical drawing : representation systems " Universidad Politecnica de Valencia, Publishing Service . <u>electronic resources</u> http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20 & ASME : https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category= MIT Design Handbook, engineering drawing and sketching : http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
Teaching methods	- The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class. - The student must develop a project in which the planes of manufacturing and assembly of a mechanical system are involved.
Learning activities	Professor will design activities that allow the evaluation of StudentOutcomes involved in the course .

4.- Limits , tolerances , adjustments and roughness		12 hours
Specific Objective:	The student will know , analyze , use and apply the limits , and dimensional and geometric tolerances according to the needs , design and implementation of components. This taking into account the capabilities of the manufacturing processes employed .	



<p>4.1 Tolerances and dimensional limits</p> <p>4.1.1 General and regulations</p> <p>4.1.2 Analysis of tolerances</p> <p>4.1.3 Tolerances recommended according to the application Free</p> <p>4.1.4 Dimensional tolerances</p> <p>4.1.5 Tolerances for adjustments</p> <p>4.2 Settings</p> <p>4.2.1 General Recommended settings according to the application</p> <p>4.2.2 Settings with game</p> <p>4.2.3 Setting transition</p> <p>4.2.4 Adjustment with interference</p> <p>4.3 geometric tolerances , shape and position</p> <p>4.3.1 General</p> <p>4.3.2 Representation of geometric parameters tolerated</p> <p>4.4 Surface roughness</p> <p>4.4.1 General Roughness</p> <p>4.4.2 required according to the application</p> <p>4.4.3 Roughness obtained mediante manufacturing processes</p> <p>4.4.4 Indication of roughness requirements</p>	
<p>Readings and other resources</p>	<p><u>library resources</u></p> <p>[1] K.L. Narayana , P. Kannaiah , K, Venkata Reddy, "Machine drawing" , New Age International Publishers, 3rd.Ed.</p> <p>[2] J. M Duff, " Industrial technical illustration ," Cole Engineering Division .</p> <p>[3] A. Chevalier , "Industrial Drawing " Limusa .</p> <p>[4] Look Llosa , Jose Ramon , " exercises of technical drawing : representation systems " Universidad Politecnica de Valencia, Publishing Service .</p> <p><u>electronic resources</u></p> <p>http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20 ASME :</p> <p>https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category= MIT Design Handbook, engineering drawing and sketching :</p> <p>http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/</p>
<p>Teaching methods</p>	<p>- The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class.</p> <p>- The student must develop a project in which the planes of manufacturing and assembly of a mechanical system are involved.</p>
<p>Learning activities</p>	<p>Professor will design activities that allow the evaluation of StudentOutcomes involved in the course .</p>

5.- Representation and machine elements designation		14 hours
<p>Specific Objective:</p>	<p>The student will know , identify and represent the elements of a mechanical system governing its geometry by international standards.</p>	



- 5.1 threaded elements
 - 5.1.1 Nomenclature
 - 5.1.2 Types of threads
 - 5.1.3 Types of threaded elements
 - 5.1.4 Conventional Representation of threads
 - 5.1.5 Representation of elements threaded assemblies
 - 5.1.6 Description of threaded elements
- 5.2 Gear
 - 5.2.1 gear elements
 - 5.2.2 Involute
 - 5.2.3 spur gear
 - 5.2.4 helical gear
 - 5.2.5 bevel gear
 - 5.2.6 Representation gear
- 5.3 Fasteners
 - 5.3.1 Rivets
 - 5.3.2 Flanges
 - 5.3.3 dovetail Union
 - 5.3.4 Welded joints
- 5.4 Links
 - 5.4.1 Universal joint
 - 5.4.2 Rigid couplings
 - 5.4.3 Flexible couplings
 - 5.4.4 eccentric Links
 - 5.4.5 Pulleys
 - 5.4.6 Bands and chains
- 5.5 Sliding elements
 - 5.5.1 Elements that make up the rod
 - 5.5.2 Types of bearings
 - 5.5.3 Bearings
 - 5.5.4 Ball Screw and guides
 - 5.5.5 Representation and designation of bearings
 - 5.5.6 Bushings
- 5.6 machine elements, and other types of auxiliary power transmission
 - 5.6.1 key and keyway
 - 5.6.2 Shim and keyway
 - 5.6.3 Striated interior and exterior
 - 5.6.4 Pins
 - 5.6.5 Springs
 - 5.6.6 Seals and gaskets
 - 5.6.7 Washers
 - 5.6.8 Collars
 - 5.6.9 Cleats
 - 5.6.10 Bolts
 - 5.6.11 Levas
 - 5.6.12 Cone Morse
- 5.7 electrical, hydraulic and pneumatic Symbology



Readings and other resources	<p>library resources</p> <p>[1] K.L. Narayana , P. Kannaiah , K, Venkata Reddy, "Machine drawing" , New Age International Publishers, 3rd.Ed.</p> <p>[2] J. M Duff, " Industrial technical illustration ," Cole Engineering Division .</p> <p>[3] A. Chevalier , "Industrial Drawing " Limusa .</p> <p>[4] Look Llosa , Jose Ramon , " exercises of technical drawing : representation systems " Universidad Politecnica de Valencia, Publishing Service .</p> <p>electronic resources</p> <p>http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20 ASME :</p> <p>https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category= MIT Design Handbook, engineering drawing and sketching :</p> <p>http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/</p>
Teaching methods	<ul style="list-style-type: none"> - The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class. - The student must develop a project in which the planes of manufacturing and assembly of a mechanical system are involved.
Learning activities	Professor will design activities that allow the evaluation of StudentOutcomes involved in the course .

6.- Mechanical properties and essays		8 hours
Specific Objective:	The student will interpret , select and identify the types of engineering drawings and has the ability to produce in its entire assembly drawings , manufacturing, assembly in the area of mechanical.	
6.1 Drawing equipment <ul style="list-style-type: none"> 6.1.1 Drawing together 6.1.2 Drawing subset comprising a team 6.1.3 Representation of power systems 6.2 manufacturing drawing <ul style="list-style-type: none"> 6.2.1 flat pattern drawing 6.2.2 Drawing for material removal processes 6.2.3 Drawing for special manufacturing processes 6.3 Drawing assembly <ul style="list-style-type: none"> 6.3.1 Assembly drawing and parts lists 6.3.2 drawing assembly subsets 6.3.3 explosion drawing 6.3.4 drawing assembly sequence 		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

E) TEACHING AND LEARNING METHODOLOGIES



The student must perform tasks in which drawings are made of mechanical elements where they implement each of the topics reviewed in class. The student must develop a project in which detail drawings , explosion, manufacturing and assembly of a mechanical system are involved.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st . Partial evaluation	session 16	25% Total evaluation Partial Evaluation: 90%Exam, 10% (tasks, investigations, exercises, considerations).	1 and 2
2nd Partial Evaluation	session 32	25% Total evaluation Partial Evaluation: 90%Exam, 10% (tasks, investigations, exercises, considerations).	3 and 4
3rd . Partial evaluation	Session 48	25% Total Evaluation Partial Evaluation: 90%Exam, 10% (tasks, investigations, exercises, considerations).	5
4th. Partial evaluation	session 64	25% Total evaluation Partial Evaluation: 90%Exam, 10% (tasks, investigations, exercises, considerations).	6
Final Ordinary evaluation		Average partial evaluations	
Other activity:	Proyecto optativo		
Extraordinary exam	Week 17 of the semester	100% Exam	100% agenda
According to exam	According to schedule school secretary	100% Exam	100% agenda

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Basic texts

- [1] K.L. Narayana, P. Kannaiah, K, Venkata Reddy, “*Machine drawing*”, New Age International Publishers, 3rd.Ed.
- [2] J.M Duff, “*Industrial technical illustration*”, Cole Engineering Division.
- [3] A. Chevalier, “*Dibujo industrial*”, Limusa.
- [4] Mira Llosa, José Ramón, “*Ejercicios de dibujo técnico: sistemas de representación*”, Universidad Politecnica de Valencia, Servicio de Publicaciones.



[5] André Chevalier, "*Guide du dessinateur industriel*", Hatchette technique, Édition 2004

Internet sites

Normativa

ISO:

http://www.iso.org/iso/home/store/catalogue_ics/catalogue_ics_browse.htm?ICS1=01&ICS2=100&ICS3=20&

Normativa ASME: <https://www.asme.org/gsearch.aspx?searchText=drawing&#page=1,category=>

MIT Design Handbook, engineering drawing and sketching: http://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/