A) COURSE

Course Id:	Course
5687	Mechanical Design B

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
4	1	4	9	64 hrs Theory 16 hrs. Lab 80 hrs Total.

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	N.A	VII	VIII	IX	VIII
Course Type (Required/Elective)		Obligatory	Obligatory	Obligatory	Obligatory
Prerequisite Course:		Mechanical Design A (5686)	Mechanical Design A (5686)	Mechanical Design A (5686)	Mechanical Design A (5686)
CACEI Classification:		CI	CI	CI	CI

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Give the student the background and knowledge in order to be able to design and evaluate design proposals, about machine elements that were not covered in previous courses, such as gears and couplings.

D) TOPICS (CONTENTS AND METHODOLOGY)

1. Shafts and axles design		**16 Hours**
Specific Objective:	**Objective 1.** The student will be able to conceptualize and design shaft and axles for any device or application. The design will take into account the stresses and strength, the strains and deformations and dynamic instabilities of the shafts and axles.	
1.1. Generalities. 1.2. Shafts dimensioning. 1.3. Materials and fabrication. 1.4. Shaft design for deflection. 1.5. Shaft design for dynamic stresses. 1.6. Critical speeds for shafts. 1.7. Flexible and articulated shafts.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

2. Shaft components and couplings		**8 Hours**
Specific Objective:	**Objective 2.** To know, calculate and select the different types of shaft components and cube-shaft assemblies. Additionally, to know, calculate and select the different type of shaft couplings and their properties.	
2.1. Keys. 2.2. Pins. 2.3. Splined shafts. 2.4. Setscrews. 2.5. Interference fit. 2.6. Positioning elements. 2.7. Rigid couplings. 2.8. Flexible couplings.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

3. Clutches and brakes		**10 Hours**
Specific Objective:	**Objective 3.** To know the different types and applications of existing clutches and brakes. To select and calculate brake and clutches based on their application.	
3.1. Positive-contact clutches. 3.2. Frictional-contact radial clutches and brakes. 3.3. Frictional-contact axial clutches. 3.5. Friction materials. 3.6. Energy considerations.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

4. General description of gears		**13 Hours**
Specific Objective:	**Objective 4.** To know and analyze the different types of gears and gear arrays used to transfer power.	
4.1. Types of gears. 4.2. Gears geometry. 4.3. Contact ratio. 4.4. Interference. 4.5. Gear trains. 4.6. Gears forces. 4.7. Gears efficiencies. 4.8. Gears materials. 4.9. Gears fabrication.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

5. Spur and helical gears		**8 Hours**
Specific Objective:	**Objective 5.** To know the characteristics and procedures to analyze and calculate spur and helical gears, which are the simples and most common used gears.	
5.1. Material selection. 5.2. Factors. 5.3. Gear design. 5.4. Practical considerations. 5.5. Problems.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

6. Bevel and worm gears		**9 Hours**
Specific Objective:	**Objective 6.** To know the characteristics and procedures to analyze and calculate bevel and worm gears.	
6.1. Gears geometry. 6.2. Gear design. 6.3. Couplings design. 6.4. Problems.		
Readings and other resources	Course notes, complementary bibliography, internet pages, videos, product catalogues and power point presentations.	
Teaching Methodologies	Presentation and explanation of topics in class, PPT presentations, student interactions.	
Learning Activities	Taking notes during class, problem solving, homework realization, and project development.	

E) TEACHING AND LEARNING METHODOLOGIES

a) Presentation and explanation of topics in class.
b) Power Point presentations (PPT)
c) Analysis and synthesis of concepts.
d) Problem solving.
e) Homework and discussion.
f) Team work.
g) Course project.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighting	Topics
1st partial evaluation.	Session 16	**25 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	1
2nd partial evaluation.	Session 32	**25 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	2,3
3rd partial evaluation.	Session 48	**25 % Total Evaluation**	4

		Partial evaluation: Exam 90% , Assignments 10%	
4th partial evaluation.	Session 64	**25 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	5, 6
Ordinary final evaluation		**100%** (Average value of the partial evaluations and course project)	
Others activities:	Mechanical Design B Laboratory and practices		
Second chance final exam	Week 17 of the semester in progress	100% Exam	100% topics
Third chance final exam	According to Secretary school setting	100% Exam	100% topics
Regularization Exam	According to Secretary school setting	100% Exam	100% topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main bibliography

Budynas Richard G. y Nisbett J. Keith. Diseño en Ingeniería Mecánica de Shigley. 9a. edición. Mc Graw Hill. 2012. ISBN 9786071507716.

Faires Virgil Moring. Diseño de Elementos de Máquinas. 1a edición. Uthea. 1998. ISBN: 9789681842079. Spotts

M. F., Shoup T. E. Elementos de Máquinas. 7a edición. Prentice Hall. 1999. ISBN: 9701702522.

Mott Robert L. Diseño de Elementos de Máquinas. 4a edición. Prentice Hall. 2006. ISBN: 9702608120.

Complementary bibliography

Juvinall Robert C. Diseño de Elementos de Máquinas. 2a edición. Limusa. 2013. ISBN: 9786070504365.

Hall Alfred, Holowenko A., Laughlin H. Machine Design. 1a edición. Schaum's Outline Series. McGraw-Hill. 1968. ISBN: 978-0070255951.

Black Paul H. y Adams O. Eugene. Machine Design. 3a edición. McGraw Hill, 1968. ISBN: 9780070055247.

Norton Robert L. Diseño de Maquinaria. 3a edición. Mc Graw Hill. 2005. ISBN: 9701046560.

Pahl G., Beitz W., Feldhusen J., Grote K. H. Engineering Design: A Systematic Approach. Third edition. Springer Verlag. 2007. ISBN: 978-1-84628-318-5.

Oberg Erik. Machinery's Handbook. 29a edition. Industrial Press. 2012. ISBN: 978-0831129002.

Avallone Eugene A., Baumeister Theodore III. Marks, Manual del Ingeniero Mecánico. 9a edición. 1999. Mc. Graw Hill. ISBN: 9701006623.

Informatics resources

Web-sites of manufactures and suppliers of machine elements.

Videos regarding the function of the different machine elements.

Software CAD: CATIA, SolidWorks, AutoCAD, Unigraphics.