A) COURSE

Course Id:	Course
5686	Mechanical Design A

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	1	5	11	80 hrs Theory 16 hrs. Lab 96 hrs Total.

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	N.A	VI	VII	VIII	VI
Course Type (Required/Elective)		Obligatory	Obligatory	Obligatory	Obligatory
Prerequisite Course:		Design Methodology (5696) Kinematics of Machines (5522)	Mechanics of Materials II (5641) Kinematics of Machines (5522)	Mechanics of Materials II (5641)	Mechanics of Materials II (5641) Kinematics of Machines (5522)
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 knowledge of the most important machines elements. Based on the knowledge acquire in previous courses, the information provided in the course, and the design and analysis principles explained in the course, the student must be able to analyze and design these type of machine elements.

D) TOPICS (CONTENTS AND METHODOLOGY)

1. Introduction to the mechanical design		**2 Hours**
Specific Objective:	**Objective 1.** To know the different aspects of the mechanical engineering project at all its stages.	
1.1. Project definition. 1.2. Mechanical engineering project. 1.3. Project aspects. 1.4. Project decisions. 1.5. The nature of the creative thought.		
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. Strength of machine elements		**15 Hours**
Specific Objective:	**Objective 2.** To study the principles to carry out the stress and mechanical strength analysis of any mechanical element. To analyze the stresses effect according to their type and time variation.	
2.1. Stress concentration. 2.2. Coefficients computation. 2.3. Fatigue. 2.4. Strength fatigue. 2.5. Fatigue limit. 2.6. Cumulative fatigue damage. 2.7. Size effect. 2.8. Various effects. 2.9. Fatigue strength of fluctuating stresses.		
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. Mechanical springs		**15 Hours**
Specific Objective:	**Objective 3.** To study and calculate the types of mechanical springs used in engineering.	
3.1. Stresses in helical springs. 3.2. Deflection of helical springs. 3.3. Extension helical springs. 3.4. Compression helical springs. 3.5. Helical coil torsion springs. 3.6. Other springs. 3.7. Energy storage capacity.		
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. Threaded joints		**7 Hours**
Specific Objective:	**Objective 4.** To know the standards and norms used for threads. To analyze the mechanics of screws and threaded joints. To design and calculate different types of threaded joints.	
4.1. Thread Standards and definitions. 4.2. Power screws. 4.3. Joints. 4.4. Bolt strength. 4.5. Joints with preload and gasket joints. 4.6. Fatigue load. 4.7. 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.

5. Welded joints		**9 Hours**
Specific Objective:	**Objective 5.** To know the different types of welds and joints and to calculate and design welded joints based on their mechanical strength.	
5.1. Welding symbols. 5.2. Stresses in welded joints 5.3. Adhesive bonding. 5.4. Fatigue load. 5.4. 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.	

6. Lubrication and journal bearings		**8 Hours**
Specific Objective:	**Objective 6.** To identify and analyze the working principle of journal bearings and their effect on the machine performance.	
6.1. Petroff's equation 6.2. The relations of the variables. 6.3. Radial clearance. 6.4. Pressure-fed bearings. 6.5. Thermal balance. 6.6. 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.	

7. Rolling contact bearings		**9 Hours**
Specific Objective:	**Objective 7.** To study the different types of rolling contact bearings. To know the methodology to calculate and select rolling contact bearings.	
7.1. Bearing types. 7.2. Bearing friction. 7.3. Bearing life. 7.4. Equivalent bearing load. 7.5. Bearing selection. 7.6. Axial load bearings.		
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.	

8. Flexible mechanical elements	**15 Hours**

Specific Objective:	**Objective 8.** To study and analyze the different types of belt drives, chain drives and metallic wires, their properties and applications, and the criteria and methodologies to select, calculate and design these elements.
8.1. Flat belts. 8.2. Problems. 8.3. V belts. 8.4. Problems. 8.5. Roller chains. 8.6. Problems. 8.7. Wire rope. 8.8. 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 20	**20 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	1, 2
2nd partial evaluation.	Session 40	**20 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	3
3rd partial evaluation.	Session 60	**20 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	4, 5
4th partial evaluation.	Session 80	**20 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	6, 7
5th partial evaluation.	Session 100	**20 % Total Evaluation** Partial evaluation: Exam 90% , Assignments 10%	8

Ordinary final evaluation		**100%** (Average value of the partial evaluations)	
Others activities:			
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.