Machine Mechanics

Academic Year: (2023 / 2024) **Review date: 12-05-2023**

Department assigned to the subject: Mechanical Engineering Department

Coordinating teacher: RAMIREZ BERASATEGUI, MARIA BEATRIZ

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Physics I

OBJECTIVES

By the end of this subject, students will be able to have:

1. The knowledge and understanding of the fundamentals of kinematic and dynamic of the rigid body and machines theory and mechanisms.
2. The ability to apply their knowledge and understanding to identify, formulate and solve problems of kinematics and dynamics of the rigid solid and mechanisms and simple machines using established methods.
3. The ability to design and perform experiments on machine theory and mechanisms, analyse the data and draw conclusions.
4. The technical and laboratory skills in machine theory and mechanisms.
5. The ability to select and use appropriate equipment, tools and methods to solve problems of kinematics and dynamics of rhe rigid body, mechanisms and simple machines.
6. The ability to combine theory and practice to solve problems of kinematics and dynamics of rigid body, mechanisms and simple machines
7. The understanding of methods and techniques applicable in machine theory and mechanisms and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Mechanics. Static. Kinematics of the point. Systems of Units
   - 1.1. Mechanics
   - 1.2. Basics
   - 1.3. The particle and rigid body
   - 1.4. Static
   - 1.5. Point Kinematics
   - 1.6. Speed Concept
   - 1.7. Acceleration Concept
   - 1.8. System Units

2. Kinematics of rigid bodies
   - 2.1. Orthonormal basis of a scalar dependent
   - 2.2. Movement of the Rigid Solid
   - 2.3. Instantaneous axis of rotation
   - 2.4. Intrinsic component of acceleration
   - 2.5. Acceleration of Rigid Solid
   - 2.6. Movement Absolute, Relative and Drag
   - 2.7. Speed relative motion
   - 2.8. Acceleration in relative motion
   - 2.9. Euler Angles

3. Dynamics of rigid
   - 3.1. Newton's Laws
   - 3.2. No Inertial Reference Systems
   - 3.3. Inertia Forces
   - 3.4. Momentum
   - 3.5. Angular momentum
   - 3.6. Theorem of angular momentum
   - 3.7. Motion of a rigid body with a fixed point

3.8. Gyroscopic motion
3.9. Motion of a rigid body with a fixed axis
3.10. Equation of Motion
3.11. Calculation of reactions
3.12. Balancing of shafts

4. Mechanisms Plans
4.1. Introduction
4.2. Component parts of a mechanism
4.3. Mobility mechanisms
4.4. Four-bar linkage
4.5. Determining the relative CIR

5. Kinematics of Planar Mechanisms
5.1. Determination of rates members of a mechanism
5.2. Determination of members of an acceleration mechanism
5.3. Value of accelerations and velocities of points of kinematic pairs
5.4. Polar diagram of velocities
5.5. Polar diagram of accelerations

6. Dynamics of Planar Mechanisms
6.1. Introduction
6.2. Kineto-static analysis of planar mechanisms
6.3. Static Analysis
6.4 Theorem of virtual works
6.5. Analysis of Inertia Forces 7.5. Full Dynamic Analysis

7. Energy and Power
7.1. Work and power
7.2. Kinetic energy. Theorem of the prime movers
7.3. Potential energy
7.4. Energy Conservation
7.5. Friction Forces
4.6. Mechanical Performance

LEARNING ACTIVITIES AND METHODOLOGY

Master class, classroom exercises and / or laboratories and work.

ASSESSMENT SYSTEM

The subject will be evaluated according to the following criteria:
1- Continuous evaluation (up to 5 points)

Continuous evaluation of the first part of the subject (EC1): Up to 1,5 points
Continuous evaluation of the second part of the subject (EC2): Up to 1,5 points
Laboratories (P): Up to 1 point
2- Ordinary final call
Ordinary Final Exam, with two parts: Up to 5 points
Final exam of the first part of the subject (EF1): Up to 2,5 points
Final exam of the second part of the subject (EF2): Up to 2,5 points
Total: Up to 10 points
If the student passes any of the parts of the continuous evaluation, he (she) is released to attend the corresponding part of the final exam.
So that (All the grades are over 10):
If the student passes the two continuous evaluations (EC1> 5 and EC2> 5), the final grade is calculated:
FINAL GRADE = 0,1xP+0,1xEGR+ 0,4xEC1+ 0,4xEC2
¿ If the student passes one of the two continuous evaluations but fails the other, the final grade is calculated as follows:
If EC1> 5 and EC2 <5 then FINAL GRADE = 0,1xP+ 0,45xEC1+ 0,15xEC2 + 0,3x EF2
If EC1 <5 and EC2 > 5 then FINAL GRADE = 0,1x P+ 0,45xEC2+ 0,15xEC1 + 0,3xEF1
If the student does not pass either of the two continuous evaluations (EC1 <5 and EC2 <5), the final grade is calculated as follows:
FINAL GRADE = 0,1x P+ 0,15xEC1+ 0,15xEC2 +0,3xEF1 + 0,3xEF2
To pass it is necessaryPara aprobar la asignatura es necesario obtener un mínimo de 4 puntos sobre 10 en cada una de las

partes del examen final: (EF1 >4 y EF2 >4)
To pass it is necessary to obtain a minimum of 4 points out of 10 in the each part of the final exam

3- Extraordinary final call
The highest grade of the two cases will be computed.
Case A: Extraordinary Final Exam, with two parts, computes the 100% of the grade for the extraordinary call
Case B: Extraordinary Final Exam, with two parts computes the 50% of the grade for the extraordinary call. The continuous evaluation is considered in the same way as in the ordinary call.
To pass it is necessary to obtain a minimum of 4 points out of 10 in the each part of the final exam

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50