

Mechanics of Machines

1. Course number and name: 020CMAES4 Mechanics of Machines
 2. Credits and contact hours: 6 credits ; 52,5 hours
 3. Instructor's or course coordinator's name: Toufic WEHBE
 4. Text book :
 - a. other supplemental materials:
Written courses / PowerPoint / Video / Handout / Moodle sharing
- [1] Techniques de l'Ingénieur
[2] Mécanique du solide, applications industrielles. P. Agati; Y. Brémont; G. Delville
[3] Liaisons et mécanismes, P. Agati; M. Rosetto
[4] Éléments de machines, Gilbert Drouin, Michel Gou, Pierre Thiry, Robert Vinet
[5] Systèmes mécaniques, théorie et dimensionnement, M. Aublin et Al
5. Specific course information
 - a. brief description of the content of the course (catalog description)

Mechanical machines – mechanisms – power transmission – movement transformation – mechanical parts – design drawing - mechanical parts connections – existing standardized kinematic connections in mechanical engineering – modeling with kinematic connections – input output expression- rod and crank - cams – shafts – ball bearings- roller bearings – bearings mounting –belts – braking – disc brakes – aeronautical multidisc brakes - straight toothed gears - gearboxes – synchronizer - planetary gear train – differential.

- b. prerequisites or co-requisites:
Prerequisites: 020RDMES4 Mechanics of Materials, 020TH2NI3 or 020TH2CI4
Thermodynamics 2
Co-requisites: None

- c. Required/Elective/Selected Elective: Required
6. Specific goals for the course
 - a. specific outcomes of instruction
 - Apply the methodology of decrypting design drawings of mechanisms
 - Identify the links between parts and build a kinematic model of the powertrain
 - Apply the principles of mechanical motion and power transformation
 - Calculate the dimensions of key parts of a machine (shafts, ball and roller bearings, brakes, belts, cylindrical gears)
 - Design the gears for a gearbox with parallel axes
 - Describe the principle of the planetary gear train

b. KPIs addressed by the course.

KPI	a2	k2			
Covered	x	x			
Assessed	x	x			
Give Feedback		x			

7. Brief list of topics to be covered and approximate lecture hours :

1 – 9

Kinematic modeling (mechanical parts, drawings decrypting, contact between solid parts, standardized kinematic connections in mechanical design, kinematic modeling exercises).

10 – 16

Mechanical motion and power transformation (transmission devices, operating principles and input/output expressions, connected rods and crank, cams, Maltese cross, indexers. Mechanical power transmission / statics and exercises).

17 – 20

Design of shafts (shaft families, applications, design with material resistance criteria, exercises).

21-24

Design of bearings (bearing families, mounting rules, applications, design for reliability, exercises on ball and roller bearings).

25-30

Design of belts (belt families, applications, transmitted torque, design and selecting of belts, exercises).

31 - 33

Design of brakes (brake families, mounting, applications, braking torque, thermal aspects, and exercises: design for technical and thermal reliability).

34 – 42

Introduction to gearboxes and gears (engine power and torque curves, clutch, gear trains and gearboxes. Transmission by gears (tooth families and materials, applications, lubrication, wear). Introduction to design of straight and helical teeth gears. Exercises: wind turbine gearbox. Introduction to planetary gear trains principle.