

M2004 Aeronautics Fundamentals

CIP: 141901 Mechanical Engineering.

CL-L-U-CA: 3-0-8-3

Academic department that offers it:
Mechanical Engineering

Programs:
1 CDA10, 1 CAN17, 1 M 0117

Prerequisites:
None.

Equivalences:
M 95035

Course intention within the general study plan context:

Course objective:

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At the end of the course the student will be able to:

- Know the concepts of meteorology, air navigation, air traffic control and telecommunications, as well as the practical principles to carry out a flight.
- Explain the principles of aerodynamics and flight mechanics.

Course topics and subtopics:

1. Aerodynamics.
 - 1.1 Forces that act in an airplane in flight.
 - 1.1.1 Lifting
 - 1.1.2 Weight.
 - 1.1.3 Push.
 - 1.1.4 Drag or drag.
 - 1.1.5 Relationship between angle of attack and lift.
 - 1.1.6 Relation of thrust and drag in straight and level flight.
 - 1.1.7 Relationship between weight and lifting in straight and level flight.
 - 1.2 Factors that affect the lift and the resistance to the advance.
 - 1.2.1 Effect of the wing surface.
 - 1.2.2 Effect of the wing profile.
 - 1.2.3 Effect of wing design on the crash.

- 1.2.4 Effect of wind speed.
- 1.2.5 Effect of air density.
- 1.3 Tendency to the turn.
- 1.4 Stability and control of the aircraft.
 - 1.4.1 Longitudinal stability.
 - 1.4.2 Longitudinal control or pitch
 - 1.4.3 Lateral stability.
 - 1.4.4 Lateral control or warping.
 - 1.4.5 Directional stability.
 - 1.4.6 Directional control or yaw.
- 1.5 Loads and load factor.
- 1.6 Profile of the plane.
 - 1.6.1 Weight control.
 - 1.6.2 Effects of weight.
 - 1.6.3 Changes in weight.
 - 1.6.4 Stability, balance and center of gravity.
 - 1.6.5 Adverse swing effects.
 - 1.6.6 Weight and balance management.
 - 1.6.7 Principles of calculation of weight and balance.
 - 1.6.8 Aircraft actions.
- 2. Aircraft and engines.
 - 2.1 Types of aircraft.
 - 2.1.1 Classification.
 - 2.2 Main components of an airplane.
 - 2.2.1 Engine.
 - 2.2.2 Landing gear.
 - 2.2.3 Fuselage.
 - 2.2.4 Empennage.
 - 2.2.5 Wings.
 - 2.3 Types of engines.
 - 2.3.1 Reciprocal motors.
 - 2.3.2 Fixed pitch motors.
 - 2.3.3 Variable pitch motors.
 - 2.3.4 Turbines.
- 3. Air navigation.
 - 3.1 Profile of the aircraft.
 - 3.1.1 Factors that affect the profile of the aircraft.
 - 3.1.2 Profile for landing and takeoff.
 - 3.1.3 Profile for the ascent.
 - 3.1.4 Cruise profile.

3.2 Weight and balance.

3.2.1 Importance of weight and balance.

3.2.2 Terms.

3.2.3 Weight and balance principles.

3.2.4 Determination of the total weight and the center of gravity.

3.3 Navigation.

3.3.1 Consideration for course and course calculations.

3.3.2 Waypoints.

3.3.3 Course.

3.3.4 Flight plan.

3.3.5 Magnetic and true values.

3.3.6 Altitudes for IFR and VFR flights.

3.4 Advanced navigation.

3.4.1 VOR (VHF Omnidirectional Range).

3.4.2 ADF (Automatic Direction Finder).

3.4.3 DME (Distance Measuring Equipment).

3.4.4 GPS (Global Positioning System).

3.4.5 VFR (Visual Flight Rules).

4. Meteorology.

4.1 Basic theory of climate.

4.1.1 Composition of the atmosphere.

4.1.2 Atmospheric pressure.

4.1.3 Wind patterns.

4.2 Climate patterns.

4.2.1 Atmospheric stability.

4.2.2 Thermal inversion.

4.2.3 Humidity.

4.2.4 Clouds.

4.2.5 Cloud types.

4.2.6 Precipitation.

4.2.7 Snow.

4.2.8 Cold fronts.

4.3 Risky climate.

4.3.1 Thunderstorms.

4.3.2 Turbulence.

4.3.3 Tornadoes

4.3.4 Wind Shear.

4.3.5 Ice formation.

4.4 Interpretation of meteorological information.

4.4.1 METAR.

5. Air traffic control.

5.1 Radar.

5.2 Air space

5.2.1 Airspace without control.

5.2.2 Controlled airspace

5.2.3 Restricted airspace.

5.3 Airports.

6. Telecommunications.

7. Air regulation.

Specific learning objectives by topic:

1. Aerodynamics. Know the factors that make it possible to fly an airplane as well as the forces that produce the lift and the control surfaces that give movement to it.
2. Aircraft and engines. Know the different types of engines used in aviation as well as its components, parts, and systems.
3. Air navigation. Know the factors that affect air navigation, the different rules of air navigation and the systems and instruments involved in it.
4. Meteorology. Interpret a meteorological report, the factors that must be considered before and during a flight.
5. Air traffic control. Know the difference between a controlled and uncontrolled airspace, as well as the indications that exist in airports.
6. Telecommunications. Know the phraseology that is used to make a communication between the aircraft and the tower.
7. Air regulation. Know some of the rules that govern aviation in Mexico.

Suggested methodologies and learning techniques:

Learning activities conducted by the teacher:

1. Brief description of topics, reading of them and question sessions, discussion and answers on the topics studied, encouraging the active participation of students.
2. Proposal of series of questions and cases of application at the end of each topic to be answered by the students.
3. Coordination of visits to aeronautical companies and the airport of the region.

of independent learning:

1. Solution of practical tasks the basic principles of aerodynamics and principles of aeronautical engineering, as well as simulated flight practices.
2. Solution to a problem or project in teams.
3. Development and construction of an aircraft at scale.

Teaching and learning techniques:

Not Specified

Estimated timing per topic:

Subject 1: 10 hours

Subject 2: 9 hours

Subject 3: 9 hours

Subject 4: 9 hours

Subject 5: 2 hours

Subject 6: 4 hours

Subject 7: 2 hours

Exams: 3 hours

Total: 48 hours

Suggested evaluation policies:

For the evaluation of student learning, there are procedures and criteria that allow monitoring and evaluating the results of the learning process. The procedures and the weighting of each of them are the following:

50% --- 6 exams.

The understanding and application of concepts on principles of aerodynamics, air navigation, engines and air operations is evaluated.

20% --- Tasks and participation.

The capacity of investigation on new tendencies and theories that apply to the aeronautical industry is evaluated.

30% --- Final exam integrator.

The knowledge of the contents of the whole semester is evaluated.

Suggested Bibliography:

TEXT BOOKS:

* Fuentes, G. S., Tello, M., Landeros, E. y Flores, M. A., Fundamentos de aeronáutica, México : Trillas, 2011, spa, 9786071709998

BOOKS FOR CONSULTATION:

* Gleim, I. N., & Gleim, G. W., Instrument pilot : FAA knowledge test for the FAA computer-based pilot knowledge test, Gainesville, FL : Gleim Publications, 2013, eng,

* Private pilot manual., Englewood, CO : Jeppesen Sanderson, 1997, eng, 0884872386

* Gleim, I. N., & Gleim, G. W., Pilot handbook: A comprehensive text/reference for all pilots, Gainesville, FL : Gleim Publications, 2006, eng, 1581944489

Support material:

Academic credentials required to teach the course:

(141901)Master Degree in Mechanical Engineering ; (140201)Master Degree in Aerospace/Aeronautical Engineering ;

(143601)Master Degree in Manufacturing Engineering ; (141901)Doctoral Degree in Mechanical Engineering ; (140201)Doctoral Degree in Aerospace/Aeronautical Engineering ; (143601)Doctoral Degree in Manufacturing Engineering

CIP: 141901, 140201, 143601

Language of Instruction:

Spanish