

AIRCRAFT SYSTEMS (Elective-I)

Course Code: 15ME2205

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Course Outcomes: At the end of the course, the student will be able to

CO1: explain the basics of aircraft industry and aircrafts.

CO2: differentiate between different types of aircrafts and discuss basic principles of flight.

CO3: explain drag, pitching moments and aerofoil nomenclature.

CO4: discuss mechanics of flight, aircraft performance and manoeuvres.

CO5: explain stability control of aeroplane and aircraft systems.

UNIT- I

(10-Lectures)

Aircraft industry overview: evolution and history of flight, types of aerospace industry, key players in aerospace industry, aerospace manufacturing, industry supply chain, prime contractors, tier 1 suppliers, key challenges in industry supply chain, OEM supply chain strategies, mergers and acquisitions, aerospace industry trends, advances in engineering/CAD/CAM/CAE tools and materials technology, global and Indian aircraft scenario

Introduction to aircrafts: basic components of an aircraft, structural members, aircraft axis system, aircraft motions, control surfaces and high lift devices.

UNIT- II

(10-Lectures)

Types of aircrafts: lighter than air/heavier than air aircrafts, conventional design configurations based on power plant location, wing vertical location, intake location, tail unit arrangements, landing gear arrangements. unconventional configurations-biplane, variable sweep, canard layout, twin boom layouts, span loaders, blended body wing layout, stol and stovl aircraft, stealth aircraft, advantages and disadvantages of these configurations

Basic principles of flight: significance of speed of sound, air speed and ground speed, properties of atmosphere, Bernoulli's equation, forces on the airplane, airflow over wing section, pressure distribution over a wing section, generation of lift

UNIT- III (10-Lectures)

Drag, pitching moments: types of drag, lift curve, drag curve, lift/drag ratio curve, factors affecting lift and drag, center of pressure and its effects

Aerofoil nomenclature: types of aerofoil, wing section-aerodynamic center, aspect ratio, effects of lift, drag, speed, air density on drag, mach waves, mach angles, sonic and supersonic flight and its effects

UNIT- IV

Mechanics of flight aircraft performance: taking-off, climbing, cruise, landing, power curves

Manoeuvres: Pull out dives, the load factor, loads during a turn, correct and incorrect angles of bank, control and steep banks, inverted manoeuvres, manoeuvrability.

Aircraft performance and manoeuvres: power curves, maximum and minimum speeds of horizontal flight, effects of changes of engine power, effects of altitude on power curves, forces acting on an aeroplane during a turn, loads during a turn, correct and incorrect angles of bank, aerobatics, inverted manoeuvres, manoeuvrability.

UNIT- V (10-Lectures)

Stability and control: meaning of stability and control, degree of stability- lateral, longitudinal and directional stability, dihedral and anhedral angles, control of an aeroplane

Introduction to aircraft systems: types of aircraft systems

Mechanical systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit,

Electrical systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System

TEXT BOOKS:

1. A.C Kermode, "*Flight without Formulae*" ,10thedition, Pearson Education
2. A.C Kermode, "*Mechanics of Flight*", 5thedition, Pearson Education
3. Shevell, "*Fundamentals Of Flight*", 2ndedition, Pearson Education
4. Dave Anderson, "*Introduction to Flight*" 6thedition, McGraw Hill
5. Ian Moir and Allan Seabridge, "*Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration*" 3rdedition, Wiley

WEB RESOURCES:

1. <http://www.aero.org/>
2. http://www.rl.af.mil/rrs/resources/griffiss_aeroclub/aircraft.html
3. http://www.ctas.arc.nasa.gov/project_description/pas.html