

ME-105 BASIC AERODYNAMICS

COURSE TITLE	BASIC AERODYNAMICS	COURSE CODE	AME-105
Semester:	I	Course group:	Core
Teaching scheme in periods:	4:1:0	Credits:	3
Methodology:	Lecture+ Tutorial	Total Contact periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites

Enthusiasm to learn the course and requires the basic knowledge of Applied Science and Mathematics at Secondary school level.

COURSEOUTCOMES

On successful completion of the course, the students will be able to:

COURSEOUTCOMES	
CO1	Explain the various types of aircraft configurations, and basic principles of flight
CO2	To study the basics of flight and mechanics of flight
CO3	Discuss the aircraft structures and its design
CO4	Describe the basics of aircraft propulsion and stability
CO5	To know about various aircraft systems
CO6	To study about Space vehicle

CO-POMatrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	2	2		1	1			1,2,4,5
CO2	3	2						1,2
CO3	3	2				2		1,2,6
CO4	3					1		1,6
CO5	3	2				1		1,2,6
CO6	3	2				1	1	1,2,6,7

UNIT-1**HISTORY AND AIRCRAFT CONFIGURATIONS:****L: 20 T:05**

Early development of Airplanes, biplanes and monoplanes, Developments in materials, structures and propulsion over the years, types of flight vehicles, classifications-Components of an airplane and their functions.

UNIT-2**BASICS OF FLIGHT:****L: 20 T:05**

Structures of the Atmosphere - Temperature, pressure and altitude relationships, Evolution of Aerodynamics forces and moments-centre of pressure-aerodynamic centre pressure coefficients, Aerofoils and its nomenclature, speed of sound, Mach number, concepts of aircraft stability and control.

UNIT-3**BASICS OF AIRCRAFT STRUCTURES AND DESIGN:****L: 20 T:05**

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials- V-n diagram and load factor. Phases of conceptual design of an aircraft.

UNIT-4

BASICS OF PROPULSION:

L: 20 T: 05

Introduction to aircraft powerplant-classification- principle of operation, Characteristics of piston, turboprop, turbofan and turboshaft engines, use of propeller and jets for thrust production- Comparative merits and demerits, Principle of operation of rocket, types of rocket and typical applications

UNIT-5

AIRCRAFT CONTROL, COMMUNICATION & NAVIGATION SYSTEMS -L: 20 T: 05

Conventional control, powered control- Basic instruments for flying- Typical systems for control actuation & Modern control systems. Need for communication system on aircraft, working principle of communication system. Basics of navigation system, Principle of operation of radar.

UNIT-6

SPACE VEHICLES:

L: 20 T: 05

Missile and its types, space vehicles and its types, reusable space vehicles, space shuttle, satellites, types of satellites and their functions.

REFERENCE BOOKS:

1. Introduction to flight: J.D. Anderson- McGraw-Hill
2. Flight without Formulae: Kermode, AC- McGraw-Hill

ONLINE RESOURCES:

NPTEL

NPTEL

NPTEL

Upon completion of this unit, the student shall be able to:

UNIT-1: History and Aircraft Configurations

- 1.1 Explain the early development of aircraft.
- 1.2 Differentiate between biplane and monoplane configurations.
- 1.3 Describe the developments in aircraft materials, structures, and propulsion systems.
- 1.4 Classify various types of flight vehicles.

- 1.5 Identify the major components of an aircraft and state their functions.
 - 1.6 Explain different aircraft configurations and their applications.
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UNIT–2: Basics of Flight

- 2.1 Describe the structure of the atmosphere.
 - 2.2 Explain temperature, pressure, and altitude relationships.
 - 2.3 Define aerodynamic forces and moments acting on an aircraft.
 - 2.4 Explain the concepts of centre of pressure and aerodynamic centre.
 - 2.5 Define pressure coefficient.
 - 2.6 Describe aerofoils and their nomenclature.
 - 2.7 Define speed of sound and Mach number.
 - 2.8 Explain the concepts of aircraft stability and control.
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UNIT–3: Basics of Aircraft Structures and Design

- 3.1 Classify different types of aircraft construction.
 - 3.2 Explain monocoque, semi-monocoque, and geodesic constructions.
 - 3.3 Describe wing and fuselage structures.
 - 3.4 Identify metallic and non-metallic materials used in aircraft construction.
 - 3.5 Explain the uses of aluminium alloys, titanium, stainless steel, and composite materials.
 - 3.6 Define V-n diagram and load factor.
 - 3.7 Describe the phases involved in conceptual aircraft design.
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UNIT–4: Basics of Propulsion

- 4.1 Classify aircraft power plants.
 - 4.2 Explain the principle of operation of piston engines.
 - 4.3 Explain the working of turboprop, turbofan, and turboshaft engines.
 - 4.4 Describe thrust production using propellers and jet engines.
 - 4.5 Compare the merits and demerits of different propulsion systems.
 - 4.6 Explain the principle of rocket propulsion.
 - 4.7 Classify different types of rockets and their applications.
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UNIT–5: Aircraft Control, Communication & Navigation Systems

- 5.1 Explain conventional and powered control systems.
- 5.2 Identify basic flight instruments used in aircraft.

- 5.3 Describe control actuation systems.
 - 5.4 Explain modern aircraft control systems.
 - 5.5 State the need for communication systems in aircraft.
 - 5.6 Explain the working principle of aircraft communication systems.
 - 5.7 Describe the basics of aircraft navigation systems.
 - 5.8 Explain the principle of operation of radar systems.
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UNIT-6: Space Vehicles

- 6.1 Define missile and classify its types.
- 6.2 Explain various types of space vehicles.
- 6.3 Describe reusable space vehicles and their advantages.
- 6.4 Explain the features of space shuttles.
- 6.5 Classify satellites based on their functions.
- 6.6 Explain the applications of satellites in communication, weather forecasting, and navigation.