SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore – 35

Accredited by NBA – AICTE and Accredited by NACC – UGC with 'A++ Grade
Approved by AICTE , New Delhi and Affiliated to Anna University , Chennai.

DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 5 – AIRCRAFT INSTRUMENTS_1

UNIT 5 – AIRCRAFT INSTRUMENTS

- *Atmosphere*
- *Flight Instruments & Navigation Instruments*
- *Gyroscope & Accelerometer*
- *Air Speed Indicators*
- *Altimeter*

TEXT BOOK

- ***Anderson. J D, "Introduction to Flight", McGraw-Hill, 1995***

- ***Richard S. Shevel, "fundamentals of Flight", Prentice Hall, 2010***

GYROSCOPE

Function: *Measure angular velocity, or the rate at which an object rotates around an axis.*

In Aircraft: *Used to determine the aircraft's orientation and angular velocity (roll, pitch, and yaw rates).*

Example: *A gyroscope can detect if an aircraft is banking (angle at which aircraft's wings are tilted sideways during a turn, measured relative to the horizontal plane) or changing its heading.*

TYPES OF GYROSCOPES

Mechanical Gyroscopes*: Uses a spinning wheel or rotor to measure angular velocity.*

MEMS Gyroscopes: *Micro-Electro-Mechanical Systems (MEMS) gyroscopes are smaller and more energy-efficient.*

Ring Laser Gyroscopes (RLGs): *Use laser beams to measure angular velocity, offering high accuracy and reliability.*

APPLICATIONS

Navigation: *Determine the aircraft's position and orientation, especially when GPS signals are unavailable.*

Flight Control: *Maintain stability and respond to pilot inputs.*

Flight Data Recorders (Black Boxes): *Accelerometers record acceleration data, which can be analysed to determine the cause of an accident.*

ACCELEROMETERS

In an aircraft model, accelerometers measure linear acceleration (changes in velocity), while gyroscopes measure angular velocity (rate of change in orientation). These sensors are crucial for navigation and flight control systems, providing data for attitude and position determination.

ACCELEROMETERS

Function: *Measure linear acceleration, which is the rate of change of velocity in a straight line.*

In Aircraft: *Used to determine the aircraft's acceleration in the X, Y, and Z axes (pitch, roll, and yaw).*

Example: *A sudden change in acceleration might indicate a turn or a change in altitude.*

HOW THEY WORK TOGETHER ?

Inertial Navigation Systems (INS): *Accelerometers and gyroscopes are key components of INS, which uses the principle of integrating acceleration to determine velocity and position.*

Attitude and Heading Reference System (AHRS): *AHRS combines data from accelerometers and gyroscopes to provide precise attitude and heading information.*

Flight Control Systems: *These systems use the data from accelerometers and gyroscopes to maintain stability and respond to pilot inputs.*