



**Course Title: EXPERIMENTAL AERODYNAMICS**

**Credit units: 03**

**Course Code: AERO402**

**Course Level: UG**

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	-	-	-	3

**Course Objectives**

The objective of this course is to make student understand about various types of wind tunnels, flow visualization techniques, measuring equipments and data Acquisition system.

**Pre-requisites:** Aerodynamics - I & II

**Course Contents/Syllabus:**

	Weightage (%)
<b>Module I : Wind Tunnel</b>	
<b>Descriptors/Topics</b> Necessity of Wind Tunnels; Basic Principle; Types of Wind Tunnels; Components of Subsonic Tunnel, Supersonic Tunnel, Hypersonic Tunnel and Shock Tunnel; Special Purpose Wind Tunnel; Design Consideration of Subsonic Tunnel and Supersonic Tunnel; Calibration Methods of Different Wind Tunnels; Design of Wind Tunnel Models; Simulation Parameters; Accessories for Wind Tunnels.	15
<b>Module II : Flow Visualization</b>	
<b>Descriptors/Topics :</b> Different Types of Flow Visualization Techniques for Subsonic, Supersonic and Hypersonic Tunnels; Basics of Schlieren, Shadowgraph and Interferometers; Laser Based Flow Visualization Technique.	15
<b>Module III : Pressure and Velocity Measurement</b>	
<b>Descriptors/Topics :</b> Pitot Static Probe; Cup Anemometer; Basic Principle of Hot Wire Anemometer; Constant Current and Constant Temperature Anemometer; Laser Doppler Velocimeter; Backward and Forward Scattering; Merits and Demerits of Different Methods; Major Components of Hot Wire and Laser Doppler Anemometers; Mechanical System for Pressure Measurement; Water and Mercury Manometers; Principle of Pressure Transducer;	20

Different Types of Pressure Transducers; Mechanical Pressure Scanner, Electronic Pressure Scanner; Pressure Sensitive Paint; Calibration of Pressure Measuring Units.	
<b>Module IV : Force and Moment Measurement</b>	
<b>Descriptors/Topics :</b> Definition of Forces and Moments on Aerospace Vehicles; Basic Principle of Mechanical Balance and Strain Gage Balance; Interaction between Different Components of Forces and Moments; Major Components for Force and Moment Measuring Systems.	<b>15</b>
<b>Module V : Unsteady Measurement</b>	
<b>Descriptors/Topics :</b> Introduction to Unsteady Pressure, Velocity and Temperature; Introduction to Turbulent Velocities and Turbulent Stresses; Measurement of Unsteady Velocities Using Hot Wire Anemometers; Measurement of Turbulent Stresses; Single and Multiple Hot Wire Probes; Basic Principles of Unsteady Pressure Transducers; Calibration of Steady and Unsteady Pressure Transducers.	<b>20</b>
<b>Module VI: Data Acquisition System</b>	
<b>Descriptors/Topics :</b> Analog and Digital Signals; Mean and Fluctuating Signals; ADC Cards; Amplifiers; Signal Conditioners; P C Based Data Acquisition System; Data Acquisition Software; Error Analysis.	<b>15</b>

### Student Learning Outcomes:

- Describe and recognize various types of wind tunnels, measuring equipments and their applications.
- Demonstrate and analyze fluid behavior over the body.
- Design and develop low speed wind tunnels.
- Explain various techniques of pressure and velocity measurement.
- Determination of pressure coefficient, Reynold no, pressure variation in wind tunnel.
- Calculate Aerodynamic characteristic using force and moment measuring systems.
- Select data acquisition system for the aerodynamic characteristic measurements.

**Pedagogy for Course Delivery:** Session Plan / course-material uploading, Class-room teaching associated with assignments, quiz, viva-voce and evaluation.

### Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
<b>100</b>	<b>NA</b>	<b>100</b>

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**Theory Assessment (L&T):**

<b>Continuous Assessment/Internal Assessment - 30</b>					<b>End Term Examination</b>
<b>Components (Drop down)</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>70</b>
<b>Weightage (%)</b>	5	10	8	7	70

**Text & References:**

- High Speed Wind Tunnel Testing – Roe, W. H. and Pope, A.
- Low Speed Wind Tunnel Testing – Pope, A. and Goin, L. **MSR**

**Any other Study Material:**

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