



Course Title: Wind Tunnel Techniques

Credit Units: 4

Course Code: To be decided

Course Level: PG

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	1		-	4

Course Objectives:

1. The objective of this course is to familiarize students with various measuring instruments, their construction and working principle.
2. Student will be able to use the equipment to evaluate various flow parameters aerodynamics forces. They will also be able to calibrate the instruments.

Pre-requisites: Introduction to Aerodynamics

Course Contents/Syllabus:

	Weightage (%)
Module I : Wind Tunnel	20
Descriptors/Topics : 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.	
Module II : Flow Visualisation techniques	15
Descriptors/Topics : Different Types of Flow Visualization Techniques for Subsonic, Supersonic and Hypersonic Tunnels; Basics of Schlieren, Shadowgraph and Interferometers; Laser Based Flow Visualization Technique.	
Module III : Pressure and Velocity Measurement	30
Descriptors/Topics : 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; Different Types of Pressure Transducers; Mechanical Pressure Scanner, Electronic Pressure Scanner; Pressure Sensitive Paint; Calibration of Pressure Measuring Units. Digitization and procurement of data for online evaluation.	
Module IV : Force and Moment Measurement	15
Descriptors/Topics : 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.	
Module V : Unsteady Measurement	20
Descriptors/Topics : 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. Some common data acquisition techniques and available hardwares	

Student Learning Outcomes:

- Define the types & application of wind tunnels
- Demonstrate different flow visualization techniques
- Recognize different pressure & velocity measurement techniques
- Discuss force & moment measurement techniques
- Identify different techniques for unsteadiness measurement

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

Lab/ Practicals details, if applicable:.

List of Experiments:

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	-	100

Theory Assessment (L&T):

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

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination	
Components (Drop down)	PR	LR	V	A	EXP	V
Weightage (%)						

Text & References:

- A. Pope, A. and K. L. Goin, "High Speed Wind Tunnel Testing"
- J. B. Barlow, W. H. Rae and A. Pope, "Low Speed Wind Tunnel Testing", Wiley Interscience Publication, 1999.

Any other Study Material: