AMITY UNIVERSITY
UTTAR PRADESH

Course Title: Viscous Flow **Credit Units: 03**

Course Code: to be decided

Course Level: PG

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

Course Objectives: To study the fundamentals of viscous flows as applied to boundary layer and various types of flows.

Pre-requisites: Introduction to Aerodynamics

Course Contents/Syllabus:

	Weightage (%)
Module I : Introduction	**20**
Descriptors/Topics : Types of Fluids; Dependence of Boundary Layer at Different ReynoldsNumber, Blassius Solution and Its Series; Asymptotic Solutions; Theory of Similarity; Separation of Boundary Layer; Similar Solutions; Reduction of the Navier- Stokes Equation to the Boundary Layer Equations.	
Module II : Solution of Boundary Layer Equations	**25**
Descriptors/Topics : Exact Solutions; Flow Past a Wedge; Flow Past a Cylinder; Flow in the Wake of Flat Plate at Zero Incidence; Momentum Integral and Energy Integral Equations; Approximate Solutions; Application of Momentum Equation to the Flat Plate; Karman- Pouhlsen Method; Approximate Methods for 2D Flows; Comparison of Exact and Approximate Methods for Flat Plate at Zero Incidence, Two- dimensional Stagnation Flow and Flow Past a Circular Cylinder.	
Module III : Thermal Boundary Layer	**20**
Descriptors/Topics : The Problem of Starting a Supersonic Flow in Diffusers; Supersonic Inlet – Internal, External and Mixed Compression, Total Pressure Recovery, Mass Flow Characteristics and Inlet Performance; Starting of Supersonic Inlets; Shock Wave Patterns in Ducts and Shock Train Behaviour.	
Module IV : Conical and Wedge Flow	**15**

Descriptors/Topics : Physical Aspect of Conical Flow; Taylor and Maccoll Formulation; Numerical Procedure; Three- dimensional Flow over Cones and Blunt Nosed Bodies at Angle of Attack.	
Module V : Transonic Flow	**20**
Descriptors/Topics : Physical and Theoretical Aspects of Transonic Flows; Solution of small Perturbation; Velocity Potential Equations (Murman and Cole Method); Solution of Full Velocity Potential Equations; Solution of Euler Equations.	

Student Learning Outcomes:

- Define Boundary layer separation and Navier-Stokes equation
- Apply and analyze various equation to viscous flow past cylinder/flat plate.
- Explain supersonic flow in duct /inlet and mass flow characteristics.
- Analyze flow over cones/blunt bodies and transonic flow.
- Explain velocity potential equation and its application in flow field.

Pedagogy for Course Delivery: Session plane/ course material uploading, class room teaching associated with assignments, viva-voice and evaluation.

Lab/ Practicals details, if applicable:.

List of Experiments: NA

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:

- John D. Anderson,"Modern Compressible Flow", McGraw Hill.
- Ferri," Elements of Aerodynamics of Supersonic Flows"
- H. Liepmann and A. Roshko,"Elements of Gas Dynamics"

Any other Study Material:

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