AMITY UNIVERSITY
UTTAR PRADESH

Course Title: AERODYNAMICS - II **Credit Units: 05**

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	1	2	-	5

Course Code: AERO304

Course Level : UG

Course Objectives

The objective of this course is to make the students understand the transformation of circles into aerofoils, Aerodynamic characteristics of thin aerofoil in incompressible flow. The study of incompressible flow over finite wings and derivation of linearised velocity potential equation in compressible flow.

Pre-requisites: Aerodynamics – I

Course Contents/Syllabus:

	Weightage (%)
Module I : Conformal Transformation	**25**
Descriptors/Topics : Complex potential function, Blasius theorem, principles of conformal transformation, Kutta - Juokowaski transformation of a circle into flat plate, airfoils and ellipses.	
Module II : Incompressible Flow over Airfoils	**25**
Descriptors/Topics : Glauert's thin airfoil theory, symmetrical airfoil, cambered airfoil, flapped airfoil, determination of mean camber line shapes for uniform and linear distribution of circulation. Description of flow about multi-element airfoils.	
Module III : Incompressible Flow over Finite Wings	**25**
Descriptors/Topics : Downwash and induced drag, Biot-Savart's law and Helmholtz's theorem, Prandtl's classical lifting line theory, fundamental equations. Elliptic lift distribution, general lift distribution, effect of aspect ratio, Lifting Surface theory, Formation Flying, Ground effect. Flow field of delta wing. Sample calculation of lift and drag on delta plan forms.	
Module IV : Compressible Subsonic Flows over Airfoils	**25**

Descriptors/Topics : The derivation of velocity potential equation. Linearized velocity potential equation. Prandtl-Glauert compressibility correction. Critical Mach number, Whitcomb's area rule, Super critical airfoil.	

Student Learning Outcomes:

- Describe and analyze compressible and incompressible flow properties over aerofoils and finite wings.
- Calculate aerodynamic properties and analyze flow pattern over various bodies.
- Demonstrate flow pattern using visualization techniques.
- Design and test aerofoils in the wind tunnel to estimate aerodynamic characteristics.

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

Lab/ Practicals details, if applicable:.

List of Experiments:

- Measurement of C_L, C_D, C_M over a 2-D wing from pressure distribution
- Measurement of drag of an airfoil; from Jone's Wake Survey method.
- Tuft and Oil Flow Visualization over airfoils and wings.
- Experiment on Delta-Wing Aerodynamics.
- Measurement of Turbulence.
- Experiments on Boundary layers.
- Experiments on Flow around obstacles.
- Experiments on Vortex flow in water channel.
- Experiments on Karman's Vortex Street.
- Experiments on Aerodynamics of Road Vehicles.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
80	**20**	**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 (%)	10	10	5	5	35	35

Text & References:

- John D. Anderson, Jr., "Fundamentals of Aerodynamics", 2nd Ed. McGraw Hill, 1991.
- Bertin and Smith, "Aerodynamics for Engineers", Prentice Hall, 1989.
- Shevel RS, "Fundamentals of Flight", Prentice Hall,2nd ed
- Houghton and Brock, "Aerodynamics for Engineering students", 2nd Ed., Edward-Arnold UK.
- Liepmann and Rosheko, "Elements of Gas Dynamics", John Wiley, 1957.

Any other Study Material:

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