Subject Description Form

Subject Code	AAE6105
Subject Title	Advanced Aerodynamics
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N/A
Objectives	1. To provide students with knowledge in compressible aerodynamics. 2. To develop students' capability in aerodynamic analysis of canonical geometries, airfoils and wings with the consideration of compressibility.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Obtain fundamental knowledge in the area of aerodynamics primarily in inviscid compressible flow. b. Gain comprehensive understanding of compressible flows over canonical geometries, airfoils and wings. c. Get familiar with flow physics involved in practical applications including boundary-layer flow, flow separation and shock-wave/boundary-layer interactions. d. Be exposed to state-of-the-art research advances.
Subject Synopsis/ Indicative Syllabus	**One-Dimensional and Quasi-One-Dimensional Flows** – Normal Shock Relations; One-Dimensional Flow with Heat Addition; One-Dimensional Flow with Friction; Area-Velocity Relation; Nozzles and Diffusers. **Oblique Shock and Expansion Waves** – Oblique Shock Relations; Shock Polar; Pressure-Deflection Diagrams; Shock Interactions; Conical Flow; Prandtl-Meyer Expansion Waves. **Linearized Flow** – Velocity Potential Equation; Linearized Subsonic Flow; Compressibility Corrections; Linearized Supersonic Flow. **Transonic and Hypersonic Flows** – Full Velocity Potential Equation; Newtonian Theory; Mach Number Independence; Hypersonic Small-Disturbance Equations; Statistical Thermodynamics; Kinetic Theory; High-Temperature Gas Dynamics. **Boundary-Layer Flow** – Boundary-Layer Equations; Self-Similar Solutions; Von Kármán Momentum Integral; Boundary-Layer Transition; Linear Stability Theory; Turbulent Boundary Layer; Turbulence Modeling; Hypersonic Viscous Interactions; Shock-Wave/Boundary-Layer Interactions.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments and case study report and presentation.
2. Technical/scientific examples and problems are raised and discussed in class/tutorial sessions.
3. Case study report and presentation will be applied to provide students a guided study with the basic research elements, including literature review, research methodology, experimental/numerical data analysis and presentation skill.

Teaching/Learning Methodology	Intended subject learning outcomes			
	a	b	c	d
1. Lecture	√	√	√	√
2. Tutorial	√	√	√	
3. Homework assignment	√	√	√	
4. Case study report and presentation	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignment	20%	√	√	√	
2. Test	20%	√	√	√	√
3. Case study report and presentation	20%	√	√	√	√
4. Examination	40%	√	√	√	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

1. The assessment is comprised of 60% continuous assessment and 40% examination.
2. The continuous assessment consists of homework assignment, tests and case study report and presentation. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, enhancing the integration of the knowledge learnt and training students' research skills.
3. The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lectures	33 Hrs.
	▪ Tutorials	6 Hrs.
	Other student study effort:	
	▪ Self-study	33 Hrs.
	▪ Homework Assignments	25 Hrs.
	▪ Case study report and presentation	25 Hrs.
	Total student study effort:	122 Hrs.
Reading List and References	1. Anderson J. D., Fundamentals of Aerodynamics. McGraw-Hill, latest edition. 2. Anderson J. D., Modern Compressible Flow: With Historical Perspective. McGraw-Hill, latest edition. 3. Bertin J. J. and Cummings R. M., Aerodynamics for Engineers. Pearson, latest edition.	

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