Subject Description Form

Subject Code	AAE4111
Subject Title	Compressible Aerodynamics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AAE3008 Fundamental Thermal-fluid Science
Objectives	1. To provide students with knowledge in compressible aerodynamics; and 2. To develop students' capability in aerodynamic analysis of canonical geometries, nozzles, 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; and b. Gain comprehensive understanding of compressible flows over canonical geometries, nozzle, airfoils and wings; and c. Get familiar with flow physics involved in practical applications including transonic swept wings, shock tubes, super wings, and convergent-divergent nozzles.
Subject Synopsis/ Indicative Syllabus	**Linearised Flow** – Full Velocity Potential Equation; Linearised Subsonic Flow; Compressibility Corrections; Linearised Supersonic Flow. **Transonic Flows** –Velocity Potential Equations for Sub-transonic and Super-transonic Flows; Prandtl-Glauert Rule; Critical Mach number; Drag Divergence; Supercritical Airfoil; Swept Wings; Area Rule. **One-Dimensional** – Normal Shock Relations; One-Dimensional Flow with Heat Addition; One-Dimensional Flow with Friction; **Quasi-One-Dimensional Flows** –Area-Velocity Relation; Convergent/Divergent Nozzles and Diffusers. **Oblique Shock and Expansion Waves** – Oblique Shock Relations; Shock Polar; Pressure-Deflection Diagrams; Shock Interactions; Conical Flow; Prandtl-Meyer Expansion Waves; Supersonic Airfoils. **Unsteady Supersonic Flows** – Shock Tube Equations; Detonation

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for compressible aerodynamics.

Technical/scientific examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	Intended subject learning outcomes to be covered		
	a	b	c
1. Lectures	✓	✓	✓
2. Tutorials	✓	✓	✓
3. Homework assignments	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Homework assignments	20%	✓	✓	✓
2. Tests	20%	✓	✓	✓
3. Experiments/Projects	20%	✓	✓	✓
4. Examinations	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 (homework assignments, tests and experiment reports/project report) and 40% examination.
2. The continuous assessment consists of homework assignments, tests and experiments/projects. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.
3. The examination is used to assess the knowledge acquired by the students for understanding and analysing 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	50 Hrs.
	Total student study effort:	**122 Hrs.**
Reading List and References	1. Anderson J. D., Fundamentals of Aerodynamics. McGraw-Hill, 6th edition, 2016. ISBN 13: 978-1259129919 2. Anderson J. D., Modern Compressible Flow: With Historical Perspective. McGraw-Hill, 3rd edition, 2012. ISBN 13: 978-0072424430 3. Bertin J. J. and Cummings R. M., Aerodynamics for Engineers. Pearson, 6th edition, 2013. ISBN 13: 978-0132832885	

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