Subject Description Form

Subject Code	AAE6104
Subject Title	Advanced High Speed Propulsion
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Fundamental knowledge in gas turbine technology and thermodynamics as well as compressible flow.
Objectives	To provide students with in-depth knowledge in advanced high speed propulsion.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand and analyze the requirements for high speed propulsion and the system differences with the low speed gas turbines. b. Understand and analyze the operations and the corresponding cycle analysis for various high speed propulsion engines. c. Apply the advanced knowledge in high speed propulsion through a research project.
Subject Synopsis/ Indicative Syllabus	1. High speed flight missions, classification of systems, mission analysis, types of high speed propulsion systems. 2. Combustion – constant area and constant pressure combustors, supersonic combustion, equilibrium chemistry, adiabatic flame temperature. 3. Nozzles – Quasi-one-dimensional isentropic flow, nozzle operation, conditions for maximum thrust, nozzle performance. 4. Inlets/Compression Systems – inlet types, inlet starting, analysis of different shock inlets and isentropic spike inlets. 5. Ramjets/Scramjets: Cycle analysis, 1-D internal flow analysis, performance calculation. 6. Turbine-Based Systems for High Speed Flight: Cycle analysis, water/fluid injection, afterburning, turboramjets, performance calculations. 7. Oblique Detonation Engines: Principles of operation, performance analysis. 8. Experimental methods for hypersonic propulsion testing: Impulse facilities, similitudes and experimental techniques for measurements.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, and design project.
2. Technical/scientific examples and problems are raised and discussed in class/tutorial sessions.
3. Advanced knowledge in rocket propulsion will be applied through a research project.

Teaching/Learning Methodology	**Intended subject learning outcomes**		
	a	b	c
1. Lecture	√	√	√
2. Tutorial	√	√	√
3. Homework assignments/tests	√	√	
4. Research project	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Homework assignment	20%	√	√	
2. Test	20%	√	√	
3. Research project	35%	√	√	√
4. Examination	25%	√	√	√
Total	100 %			

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

Overall Assessment:

0.25 x End of Subject Examination + 0.75 x Continuous Assessment

The continuous assessment consists of three components: homework assignments, tests and a design project. Homework assignments and tests 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. The research project requires extensive research in the most updated high speed propulsion technology and the applications of these advanced technology to possible implementation.

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:	
	▪ Lecture	33 Hrs.
	▪ Tutorials	6 Hrs.
	Other student study effort:	
	▪ Literature Review and Self-learning	26 Hrs.
	▪ Assignments	50 Hrs.
	Total student study effort:	115 Hrs.
Reading List and References	1. Curran, E. T. and Murthy, S.N.B., Scramjet Propulsion, latest edition 2. Murthy, S.N.B, Developments in High-Speed Propulsion, latest edition 3. Heiser, W.H. and Pratt, D. T., Hypersonic Airbreathing Propulsion, latest edition. 4. Segal, C., The Scramjet Engine, Cambridge University Press, latest edition 5. Sforza, P.M., Theory of Aerospace Propulsion, latest edition.	

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