Subject Description Form

Subject Code	AAE3003
Subject Title	Aircraft Propulsion Systems
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with knowledge of advanced aerodynamics and application in modern gas-turbine engines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Work professionally in aviation systems and understand aircraft regulations (including the understanding of state-of-the-art aerodynamics, propulsion systems, skills and hand-on experience to the design and analysis of propulsion systems).extend their knowledge of mechanical engineering to different situations of engineering context and professional practice in propulsions systems; and b. Function professionally in multidisciplinary teams (including the knowledge of aviation engineering to different situation of engineering context and professional practices in propulsions systems).
Subject Synopsis/ Indicative Syllabus	**Introduction to Propulsion -** fluid momentum, reaction force, rockets, propellers, turbojets, turboprop, turbofans. **Review of Thermodynamics -** mass, momentum and energy conservation laws; first and second laws; entropy equation; and perfect gas. • **Basic Concepts of Thermodynamics** – Thermal Properties. The First Law of Thermodynamics. p-v-T Relation. Ideal Gas Model. • **The Second Law of Thermodynamics** – The Kelvin-Planck and Clausius Statements. Reversible and Irreversible Processes. Carnot Cycle. The Clausius Inequality. Entropy. Isentropic Processes. Isentropic Efficiencies. • **Vapour and Gas Power Systems** – Rankine Cycle. Superheat and Reheat. Air Standard Otto and Diesel cycles. Air-Standard Brayton Cycle. **Steady-state, One-dimensional (1D), Compressible Flow -** Quasi-1D flow of perfect gas; isentropic and non-isentropic flow; stagnation concept. **Propulsion Basics -** thrust equations, thermal and propulsion efficiencies, fuel consumption rate and specific thrust, engine performance, aircraft range. **Cycle Analysis and Engine Performances -** ramjet, turbojet, turbofan, turboprop, and turbo-shaft engines. **Subsystems –** 1. Inlets, 2. Turbomachinery - basics of compressors and turbines, 3. combustors, and nozzles. **Modern Aircraft Engines -** High-by-pass engines.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures, homework assignments, test, and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for propulsion systems.
3. Technical/practical examples and problems are raised and discussed in class.
4. Experiments or CFD projects are designed to evaluate the propulsion system.

Teaching/Learning Methodology	Intended subject learning outcomes to be covered	
	a	b
1. Lectures	✓	✓
2. Homework assignments	✓	✓
3. Experiments/Projects	✓	✓
4. Tests	✓	✓
5. Exam	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed	
		a	b
1. Projects/Experiments	15%		✓
2. Homework assignments	10%	✓	
3. Tests	25%	✓	✓
4. Examination	50%	✓	✓
Total	100%		

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

The continuous assessment consists of homework assignments. 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.

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.
	▪ Lab/Project	6 Hrs.
	Other student study effort:	
	▪ Self-study	67 Hrs.
	Total student study effort	**106 Hrs.**
Reading List and References	1. Thermodynamics: An Engineering Approach, 8th Edition, 2014, by Yunus A. Cengel and Michael A. Boles. McGraw-Hill Education 2. Mechanics and Thermodynamics of Propulsion, 2nd Ed., 1992. Philip Hill & Carl Peterson. Pearson/Addison-Wesley Publishing Co. 3. Aircraft Engines and Gas Turbines, 2nd Edition, 1992. Jack Kerrebrock. MIT Press. 4. Elements of Propulsion: Gas Turbine and Rockets, 2nd Edition, 2006. Jack Mattingl., AIAA. 5. Elements of Gas Turbine Propulsion, (1st Edition) 1996. Jack Mattingly. McGraw-Hill. 6. Jet Engines: Fundamentals of Theory, Design and Operation, 2005. Klaus Huenecke. Zenith Press. 7. Aircraft Gas Turbine Engine Technology, 3rd ed., 1997. Irwin E. Treager. McGraw-Hill.	

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