SYST H3602: Propulsion Systems 2

Module Title:	Propulsion Systems 2
Language of Instruction:	English

Credits:	10

NFQ Level:	7

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	The module will be taught with lectures and laboratory exercises and will be supported by on-line media that are available on the college VLE.

Module Aim:	The aim of this module is to provide the student with the knowledge required to analyse the performance of a diverse range of propulsion systems in the aerospace domain.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Perform calculations relating to the peformance of air breathing aerospace propulsion systems.
LO2	Calculate performance of different stages of propulsion systems.
LO3	Numerically evaluate performance of propellers
LO4	Categorise various electric propulsion architectures

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
Introduction to Thermodynamics Review of conservation equations: mass, momentum and energy, thermodynamics, compressible flow, Introduction: air-breathing and rocket propulsion, first Law of thermodynamics, specific heat capacity, ratio of specific heat capacities, closed systems, open system, steady state energy equation, enthalpy.
Thermodynamics Second Law of thermodynamics, entropy, T-S Diagrams.
Thermodynamic cycles Otto Cycle, Diesel Cycle, Brayton Cycle, Mean effective pressure, cycle efficiency, PV diagrams.
Compressors Centrifugal compressors, Axial compressor, work required, whirl speed, power.
Combustion Stoicometric combustion, thermochemistry, fuels, premixed, non-premixed flames, adiabatic flame temperature, experimental and numerical methods in combustion, flammability and stability limits.
Turbines Work, power, reaction.
Nozzles Critical pressure, critical temperature, nozzle velocity.
Froude Momentum Froude momentum theory, in-flow, thrust.
Torsion of shafts. 2nd Polar Moment, Torque, Power, Shear, Moment of Inertia, Radius of Gyration.
Balancing of Rotating Masses Static Balancing and Dynamic Balancing, both numerically and graphically.
Vibration Whirl speed, torsional vibration, Rayleigh method, Dunkerley's method.
Electric Motor Propulsion Construction Construction of rotating electric machines (outrunner, inrunner, rotor, stator, shaft, bearings, magnets, windings, electrical insulation, commutators, motor cooling, sensors).
Electric Motor Propulsion Power electronics (switching devices, DC–DC converters, single-phase and multiple-phase DC–AC inverters, single-phase and multiple-phase AC–DC rectifiers). Motor control systems (control functions, speed control, torque control, position measurement, generator mode for energy recuperation, protection functions). Wiring of electric power storage, power electronics and electric motor. High energy and voltages risks, and associated safety procedures.

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Written Report	Students will complete a written report where they will be required to perform some calculations.	1,2,3,4	10.00	Week 4
Examination	A class test which may be administered on the college VLE.	1,2	10.00	Week 4

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	A series of practical tasks relating to the performance of a propulsion system.	1,2	10.00	Every Week
Practical/Skills Evaluation	Will consist of a practical test in which students will be required to write software to analyse a propulsion system.	1,2,3	10.00	Week 12

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	A formal written exam where students will be required to peform calculations relating to propulsion sytems.	1,2,3,4	60.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	5.00
Practicals	12 Weeks per Stage	4.00
Independent Learning	15 Weeks per Stage	9.47
	Total Hours	250.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEACS_D	Bachelor of Engineering in Aircraft Systems	5	Mandatory