ELEC H3604: Electrical Propulsion

Module Title:	Electrical Propulsion
Language of Instruction:	English

Credits:	10

NFQ Level:	7

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	Teaching will be conducted through lectures, practicals and problem-based learning. The Institute VLE will be used to evaluate the student's understanding of the basic concepts during each section, including using class tests. The practical sessions will be used to support the theory.

Module Aim:	To provide students with an understanding of how propulsion systems can implement in the age of "more electric aircraft".

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Apply the fundamental principles of electrical power generation, distribution, protection and utilization on board aircraft.
LO2	Use computer based engineering tools to evaluate electronically controlled electrical and electronic propulsion systems for aircraft.
LO3	Perform calculations relating to the peformance of air breathing aerospace propulsion systems.
LO4	Develop knowledge and calculate performance of different stages of propulsion systems.

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
Avionic Fundamentals Review AC theory, transformers, relays, contactors, RLC Circuits, power factor, power factor correction, J-notation, polar form, transistors as a switch, pulse code modulation.
Electrical Power Batteries (installation and operation, new battery technology, UAV batteries), DC power generation, AC power generation, emergency power generation, voltage regulation, frequency regulation, power distribution and utilization, circuit protection, external / ground power.
Electrical Motor Propulsion Power electronics (switching devices, DC–DC converters, single-phase and multiple-phase DC–AC inverters, single-phase and multiplephase 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.
Electric Motor Propulsion Construction of rotating electric machines (outrunner, inrunner, rotor, stator, shaft, bearings, magnets, windings, electrical insulation, commutators, motor cooling, sensors). Induction, reluctance, brushless dc, series, shunt motors.
Introduction to Thermodynamics Review of conservation equations: mass, momentum and energy, thermodynamics, compressible flow, Introduction: air-breathing, first Law of thermodynamics, specific heat capacity, ratio of specific heat capacities, closed systems, open system, steady state energy equation, enthalpy.
Propulsion Thermodynamics Second Law of thermodynamics, entropy, T-S Diagrams, Otto Cycle, Diesel Cycle, Brayton Cycle, Mean effective pressure, cycle efficiency, PV diagrams.
Combustion Combustion: stoichiometry, thermochemistry, Fuels, premixed, non-premixed flames, adiabatic flame temperature, experimental and numerical methods in combustion, flammability and stability limits.
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.

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	n/a	1,3,4	10.00	Week 8
Examination	n/a	1,3,4	10.00	Week 5

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Completion of assigned practical tasks.	1,2,3,4	20.00	Every Week

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	A formal envigilated exam at the end of the semester.	1,3,4	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 Time	15 Weeks per Stage	9.47
	Total Hours	250.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	5	Mandatory