

ELEC H3604: Electrical Propulsion

Language of Instruction: English Credits: 10 NFQ Lavel: 7 Module Delivered In 1 programme(s) Teaching & Lavring 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 cleats tests. The practical sessions will be used to support the theory. Module Alm: To provide students with an understanding of how propulsion systems can implement in the age of "more electric aircraft". Learning Outerments To provide students with an understanding of how propulsion systems can implement in the age of "more electric aircraft". Lue computer based engineering tools to evaluate electronically controlled electrical and electronic propulsion systems for aircraft. Lue computer based engineering tools to evaluate electronically controlled electrical and electronic propulsion systems. L01 Apply the fund=remental principles of electrical power generation, distribution, protection and utilization on board aircraft. Lue computer based engineering tools to evaluate electronically controlled electrical and electronic propulsion systems. L04 Develop knowedge and calculate performance of air breathing aerospace propulsion systems. Pre-requistermentations Trans principles duelets is kill that is recommended before enrolment in this module. No recommentations lister	Module Title:			Electrical Propulsion		
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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	