SYST H2602: Propulsion Systems 1

Module Title:	Propulsion Systems 1
Language of Instruction:	English

Credits:	5

NFQ Level:	6

Module Delivered In	2 programme(s)

Teaching & Learning Strategies:	This module will be taught by Lectures, Tutorials & Practical/Trouble-shooting tasks.

Module Aim:	The student will understand the working principles of aircraft gas turbine, piston engines and propellers.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Explain the theoretical fundamentals of the gas turbine and piston engines.
LO2	Describe the principles of operation of an engines ancillary systems, eg oil and fuel.
LO3	Recognise the fundamental principles of a propeller.
LO4	Classify the relationship between an engine and an aircraft's on-board 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
Fundamentals Potential energy, kinetic energy, Newton's laws of motion, Brayton cycle; Otto Cycle, Diesel Cycle. The relationship between force, work, power, energy, velocity, acceleration; Constructional arrangement and operation of turbocharged, supercharged, turbojet, turbofan, turboshaft, turboprop.
Piston Engine Construction Crankcase, crankshaft, camshafts, sumps, accessory gearbox, cylinder and piston assemblies, connecting rods, inlet and exhaust manifolds, valve mechanisms, propeller reduction gearboxes.
Gas Turbine Construcion. Inlets, Compressors, Combustors, Turbines and Exhaust.
Propeller Fundamentals Blade element theory; High/low blade angle, reverse angle, angle of attack, rotational speed; Propeller slip; Aerodynamic, centrifugal, and thrust forces; Torque; Relative airflow on blade angle of attack; Vibration and resonance
Propeller Construction Construction methods and materials used in wooden, composite and metal propellers; Blade station, blade face, blade shank, blade back and hub assembly; Fixed pitch, controllable pitch, constant speeding propeller; Propeller/spinner installation
Propeller Pitch Control Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Overspeed protection. Reverse pitch protection and associated electronic systems.
Piston Engine Supercharging / Turbocharging. Principles and purpose of supercharging and its effects on engine parameters, construction and operation of supercharging / turbocharging systems, system terminology, control systems, system operation and system protection.
Bearings and Seals Constructional features and principles of operation
Lubricants and Fuels Properties and specifications; Fuel additives; Safety precautions.
Lubrication Systems System operation/lay-out and components
Fuel Systems Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.
Starting and Ignition Systems Operation of engine start systems and components; Ignition systems and components; Maintenance safety requirements.
Engine Indication Systems Exhaust gas temperature/ Interstage turbine temperature systems, engine speed, engine thrust Indication: engine pressure ratio (EPR), engine Turbine Discharge pressure or jet pipe pressure systems, Oil pressure and temperature, Fuel pressure, temperature and flow, Manifold pressure, Engine torque and Propeller speed, Exhaust gas analysis.
Turbo-prop Engines Gas coupled/free turbine and gear coupled turbines; Reduction gears; Integrated engine and propeller controls; Overspeed safety devices.
Auxiliary Power Units (APUs) Purpose, operation, protective systems
Fire Protection Systems Operation of detection and extinguishing systems
Engine Monitoring and Ground Operation Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring; Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer; Compressor washing/cleaning; Foreign Object Damage.
Propeller Synchronisation and Synchrophasing. Beat frequency, master, slave.
Sustainability Methods to reduce engine emissions and engine noise.

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*
Examination	Each student will take short answer question exams, administered during term time for which a maximum of 10% will be awarded	1,2	10.00	Week 4
Examination	Each student will take short answer question exams, administered during term time for which a maximum of 10% will be awarded	2,4	10.00	Week 10

No Project

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Each student will complete practical tasks during the module with a brief task report, administered during term time for which a maximum of 20% will be awarded.	3	20.00	Every Week

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	Each student will sit a formal written examination a the end of the module for which a maximum of 70% will be awarded.	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	3.00
Practicals	12 Weeks per Stage	2.00
Independent Learning	15 Weeks per Stage	4.33
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	3	Mandatory
CW_EEACS_D	Bachelor of Engineering in Aircraft Systems	3	Mandatory