ENGR H3601: Gas Turbine Engine

Module Title:	Gas Turbine Engine
Language of Instruction:	English

Credits:	5

NFQ Level:	7

Module Delivered In	No Programmes

Teaching & Learning Strategies:	This module will be taught by Lectures, Tutorials & Practical/Trouble-shooting tasks and by using aircraft gas turbine engines, components and manuals.

Module Aim:	The student will understand the working principles of gas turbine engines and engine control/cockpit indication systems as found on modern commercial aircraft used throughout the aircraft industry.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Explain the theoretical fundamentals of the gas turbine engine
LO2	Describe the principles of operation of a gas turbine's ancillary systems
LO3	Perform thermodynamic calculations relating to a gas turbine
LO4	Describe the relationship between a gas turbine 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; The relationship between force, work, power, energy, velocity, acceleration; Constructional arrangement and operation of turbojet, turbofan, turboshaft, turboprop.
Engine Performance Gross thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust, thrust horsepower, equivalent shaft horsepower, specific fuel consumption; Engine efficiencies; By-pass ratio and engine pressure ratio; Pressure, temperature and velocity of the gas flow; Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.
Inlet Compressor inlet ducts Effects of various inlet configurations; Ice protection.
Compressors Axial and centrifugal types; Constructional features and operating principles and applications; Fan balancing; Operation: Causes and effects of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ratio.
Combustion Section Constructional features and principles of operation.
Turbine Section Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes; Causes and effects of turbine blade stress and creep
Exhaust Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.
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.
Air Systems Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.
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; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication; Torque; Power.
Power Augmentation Systems Operation and applications; Water injection, water methanol; Afterburner systems
Turbo-prop Engines Gas coupled/free turbine and gear coupled turbines; Reduction gears; Integrated engine and propeller controls; Overspeed safety devices.
Turbo-shaft engines Arrangements, drive systems, reduction gearing, couplings, control systems.
Auxiliary Power Units (APUs) Purpose, operation, protective systems
Powerplant Installation Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.
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.
Engine Storage and Preservation Preservation and depreservation for the engine and accessories/systems.

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	20.00%
End of Module Formal Examination	70.00%

Continuous Assessment				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Multiple Choice Questions	Each student will take short answer question exams, administered during term time for which a maximum of 10% will be awarded	1,2	5.00	Week 4
Multiple Choice Questions	Each student will take short answer question exams, administered during term time for which a maximum of 10% will be awarded	2,4	5.00	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	70.00	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	Every Week	2.00
Independent Learning	Every Week	2.00
Practicals	Every Week	0.50
	Total Hours	4.50