Course unit title:	Gas Turbines		
Course unit code:	ME 403		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	8 (Spring)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. George Karagiorgis		
Learning outcomes of the course unit:	1. Comprehend the basic processes in gas turbines (atmospheric air characteristics, compression, combustion and expansion). Identify the basic components of gas turbine, and configuration of rotor/stator of compressor, configuration and types of combustion chambers and rotor and/stator of turbine and electrical generator type 2. Carry out performance analysis of gas turbines (compressor and turbine isentropic efficiencies), using simple analysis of an open-circuit gas turbine 3. Describe the different types of gas turbines (closed circuit, open circuit). For different types, describe various flow processes phenomena 4. Learn the flow processes in the gas turbine components with emphasis in the compression process taking place in the compressors, the combustion process, in combustion chamber, along with the expansion process in the turbine 5. Identify the heat/mass transfer and turbulent flow phenomena associated with combustion and the related qualitative pressure drops in the combustion chamber 6. Use thermodynamic principles for calculating stagnation pressures and temperatures. Compare isentropic and polytropic efficiencies of compressors and turbines 7. Use energy balance and calculate the thermal efficiency of gas turbine. Account pressure drops in the various components of gas turbine and consider effects of the combustion products. 8. Study improvement of performance via modifications and quantify the associated effects on performance. Learn and synthesise modifications related with heat exchangers, reheat cycles and intercooling during compression		
Mode of delivery:	Face-to-face		
Prerequisites:	ME200, ME202	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	- **Fundamental Concepts**: ➢ Basic processes in gas turbines (atmospheric air characteristics, compression, combustion and expansion. ➢ Basic components of gas turbine, and configuration of rotor/stator of compressor, configuration and types of combustion chambers and rotor and/stator of turbine and electrical generator type. ➢ Performance analysis of gas turbines (compressor and turbine isentropic efficiencies), using simple analysis of an open-circuit gas turbine. - **Types/Arrangements of Engine Components:** ➢ Different types of gas turbines (closed circuit, open circuit). For different types, various flow processes phenomena ➢ Flow processes in the gas turbine components with emphasis in the compression process taking place in the compressors, the combustion process, in combustion chamber, along with the expansion process in the turbine ➢ Heat/mass transfer and turbulent flow phenomena associated with combustion and the related qualitative pressure drops in the combustion chamber of gas turbines - **Performance Characteristics:** ➢ Thermodynamic principles for calculating stagnation pressures and temperatures.		

	Compare isentropic and polytropic efficiencies of compressors and turbines. ➢ Energy balance and calculation of the thermal efficiency of gas turbine. Pressure drops in the various components of gas turbine and effects of the combustion products. ➢ Improvement of performance via modifications and quantify the associated effects on performance. Synthesis of modifications related with heat exchangers, reheat cycles and intercooling during compression - **Theory of stationary Gas Turbines (power plants), Gas Turbines for Aircraft Propulsion:** ➢ Concept of operating power plants utilising gas turbines and interrelate with peak energy demands and national energy management and distribution. ➢ Developments in gas turbine technology including natural gas and solar/thermal power plants combinations with solar fields utilising parabolic trough and power tower technologies. ➢ Different types of gas turbines used for aviation propulsion including turbo-jet, turbo-prop etc. Development and control aspects of gas turbines for aviation and aspects of performance , maintenance and noise level - **Design Assignment:** Individual or small group assignment performed following the gas turbine design stages and engineering design principles, for an open-cycle gas turbine and associated components for low rated power output for industrial applications.
Recommended and/or required reading:	Thermodynamics cycles and principles of fluid mechanics
Textbooks	• Gas Turbine Theory, H. I. H. Saravanamuttoo, G. F. C. Rogers, Henry Cohen Prentice Hall, 5th edition, 2001. • Gas Turbine Engineering Handbook by Meherwan P. Boyce Butterworth-Heinemann, 2nd edition, 2001. • Fundamentals of Gas Turbines, 2nd edition, William W. Bathie, 1996. • Combined Cycle Gas & Steam Turbine Power Plants, Rolf Kehlhofer, Rolf Bachmann, Henrik Nielsen, 2nd edition, 1999. • Gas Turbine Theory, Gohen Rogers, Third Edition, Longman, 1992. • Eastop, T. D. and McConkey, A. Applied thermodynamics for engineering technologists. Fifth Edition. Pearson Education Publications. Essex, England, 1993.
Planned learning activities and teaching methods:	The course is delivered to the students by means of lectures, conducted with the help of computer presentations. Lecture notes and presentations are available through the web for students to use in combination with the textbooks.
Assessment methods and criteria:	• Assignments 20% • Tests 20% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No