<table>
<tr><td>Course Title</td><td colspan="5">Gas Turbines</td></tr>
<tr><td>Course Code</td><td colspan="5">ME 403</td></tr>
<tr><td>Course Type</td><td colspan="5">Compulsory</td></tr>
<tr><td>Level</td><td colspan="5">BSc (Level 1)</td></tr>
<tr><td>Year / Semester</td><td colspan="5">4th Year / 8th Semester</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Dr. George Karagiorgis</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>3</td><td>Laboratories/week</td><td></td></tr>
<tr><td>Course Purpose</td><td colspan="5">The course purpose is for the students to develop a sound understanding of the theory and operation of the gas turbine. Students will gain the ability to evaluate various gas turbine cycles and investigate variables that influence the cycle performance. They will learn designing a stationery gas turbine power plant in terms of components matching, and designing an adequate gas turbine for an aircraft propulsion system in terms of thermodynamic quantities. Upon completion of this course, the students will be able to develop skills on analysing Gas Turbines cycles etc.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">By the end of the course, students must be able to:
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</td></tr>
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	modifications related with heat exchangers, reheat cycles and intercooling during compression		
Prerequisites	**ME200, ME202**	Corequisites	**None**
Course Content	- **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.		

Teaching Methodology	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 e-learning platform for students to use in combination with the textbooks. Furthermore theoretical principles are explained by means of demonstration examples and solution of specific problems..
Bibliography	1. Gas Turbine Theory, H. I. H. Saravanamuttoo, G. F. C. Rogers, Henry Cohen Prentice Hall, 5th edition, 2001. 2. Gas Turbine Engineering Handbook by Meherwan P. Boyce Butterworth-Heinemann, 2nd edition, 2001. 3. Fundamentals of Gas Turbines, 2nd edition, William W. Bathie, 1996. 4. Combined Cycle Gas & Steam Turbine Power Plants, Rolf Kehlhofer, Rolf Bachmann, Henrik Nielsen, 2nd edition, 1999. 5. Gas Turbine Theory, Gohen Rogers, Third Edition, Longman, 1992. 6. Eastop, T. D. and McConkey, A. Applied thermodynamics for engineering technologists. Fifth Edition. Pearson Education Publications. Essex, England, 1993.
Assessment	• Assignments 20% • Tests 20% • Final Exam 60%
Language	English