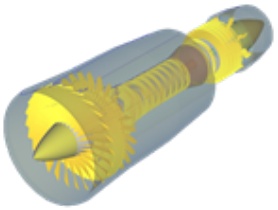

Course Outline

AERO 4402 - Aerospace Propulsion

Fall 2022

Department of Mechanical and Aerospace Engineering
Faculty of Engineering

0.5 credit
ONLINE SYNCHRONOUS
Lectures will be recorded and made available for students
1/week, 3hr/lecture

Professor / Contract Instructor

Name	**John Kidikian, PhD., Eng.**	
Telephone	514-945-8246	(emergencies only)
e-mail	John.Kidikian@carleton.ca	(will check during day – response during evening)
(send to both)	John.Kidikian@polymtl.ca	(will check during day – response during evening)

Course Schedule

Type	Time	Days	Where	Date Range
Class	6:05pm – 8:55pm	**Monday**	On-Line Brightspace (**Zoom** Invites)	Sep 07, 2022 - Dec 09, 2022

Academic Accommodations

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University.

If you need special arrangements to meet your academic obligations during the term, please follow the accommodation request process found at **https://students.carleton.ca/course-outline/**

SPECIAL NOTE: The on-line live lectures will be recorded for students to refer to during the semester.

Course Description and Objectives

The objective of this course is to give an in-depth view of the design and analysis of **gas turbine based engines for aerospace propulsion**, rocket propulsion topics are excluded. The main emphasis will be on air breathing units for civil aviation applications. Topics to be covered, but no limited to, will be:

- Engine performance cycle calculations
- Classification of gas turbine engine types
- Axial Compressor and Axial Turbine 1D mean-line design and analysis
- Design Point and Off-Design loss modelling theory
- Preliminary airfoil and disk design
- Computational Fluid Dynamics (CFD) analysis

This course will allow the participant to apply the various concepts of thermodynamics, fluid dynamics, and stress analysis to a gas turbine design. The participant will be tasked to solve engineering problems related to the design and analysis of a turbofan engine using a specialized engineering software called **MDIDS-GT**, the **M**ulti-**D**isciplinary **I**ntegrated **D**esign **S**ystem for **G**as **T**urbines, and 3D CFD using ANSYS TurboGrid and CFX.

Pre-requisites	Co-requisites
MAAE 2400 Thermodynamics & Heat Transfer MAAE 3300 Fluid Mechanics II	Enthusiasm Curiosity Active participation

Evaluation for Bachelor Students

Type	Number	Value	Date(s)
Group Project*	1	50%	To be submitted at end of semester
Individual Assignment CFD ANSYS TurboGrid and CFX	1	25%	To be submitted 2 weeks before the end of the semester
Final Exam	1	25%	TBD, Scheduled by Carleton University
Practice assignments will be given throughout the session to reinforce important concepts	2	0%	

* for the project teams, 3 to 5 max students

Evaluation for Special Students* (non-credit / professional hours)

Type	Number	Value	Date(s)
Option 1: Group Project**	1	100%	To be submitted at end of semester
Option 2: Group Project** + Individual Assignment CFD ANSYS TurboGrid and CFX	1+1	50% 50%	Project: To be submitted at end of semester Assignment: To be submitted 2 weeks before the end of the semester

* Special students shall decide which option they will pursue before the third week of the semester
** for the project teams, special students may participate with bachelor students

Important NOTE for final exams

For distance exam services, for students who are unable to come to campus to write in person because they are studying remotely, they can apply to write at a distance by **September 22** (https://carleton.ca/ses/distance-exams/).

Required Software

IMPORTANT for ANSYS:

- Download the free student trial version of ANSYS, verify that it includes TurboGrid and CFX
- **Or** access ANSYS by connecting to the University computer lab(s)

Contact Carleton University for more details for computer lab access

For MDIDS-GT, links are provided in Brightspace

Documentation

- Brightspace for AERO 4402 course lectures and recordings
- Google Sites for course modules: https://sites.google.com/site/mdidsgt/
- YouTube for software videos, type MDIDS-GT in search bar

NOTE: Only OER (Open Educational Resources) will be used for this course.

Reference material

- "Gas Turbine Theory", 7th Edition, Saravanamuttoo, Rogers, Cohen, Straznicky, Nix
  - (Pearson 2017)
  - Note: always look for the latest edition of this textbook, great to have in your library collection
- The library section devoted to gas turbines, there is lots there
- Google, a whole lot more here
- ASME digital collection, great to dig deeper and see the "latest" research
- NASA reports, classic and important

Lecture Schedule - Fall 2022 - Carleton University

week	month	day	Module	Project Assignment start	Additional Objectives
	Sept	7 (wed)	Fall Session Starts - **no scheduled lecture for AERO 4402**		
	Sept	7 (wed)			
1	Sept	12	00 - Introduction	**Part 1** - Google internet search	hello - expectations - objectives
	Sept	12	00 A - The gas turbine industry	access to labs or download ANSYS	create project groups
2	Sept	19	MDIDS introduction and overview	familiarize with MDIDS and ANSYS	Q&A
	Sept	19	ANSYS introduction and overview		execute ANSYS with demo file
3	Sept	26	03 - Engine Performance	**Part 2** - performance MDIDS-GT	Q&A
	Sept	26	03 - Engine Performance	**Part 2** - performance Hand-Calc	submit project **Part 1** for review
4	Oct	3	04 - Axial compressors	**Part 3** - compressor	Q&A
	Oct	3	04 - Axial compressors	CFD assignment	
5	Oct	10	Statutory holiday - **no scheduled lecture for AERO 4402**		
	Oct	10			
6	Oct	17	01 - Thrust & configurations		submit portions of your ANSYS
	Oct	17	01 - Thrust & configurations		submit project **Part 2** for review
7	Oct	24	University Break - **no scheduled lecture for AERO 4402**		
	Oct	24			
8	Oct	31	03 A - Turbofan design charts		Q&A
	Oct	31	02 - Fundamentals review		suggested - finish comp mean-line
9	Nov	7	06 - Axial turbines	**Part 3 & 4** - turbine	Q&A
	Nov	7	06 - Axial turbines		
10	Nov	14	07 - Stress analysis	**Part 5** - stress	Q&A
	Nov	14	07 - Stress analysis		suggested - finish turb mean-line
11	Nov	21	08 - Internal Air systems	All other project parts	Q&A
	Nov	21	09 A - Turbine Cooling		
12	Nov	28	10 & 10 A - Combustion & Hot streaks		Q&A
	Nov	28	04 A - Transonic axial compressors		suggested - finish all
13	Dec	5	15 - Certification		
	Dec	5	Q&A		
14	Dec	9 (Fri)	Q&A	Last day of Fall Session - **Classes follow a Monday schedule**	
	Dec	9 (Fri)	Q&A		
	Dec	9 (Fri)	final **Project Report** and **CFD assignment** are submitted		
	Dec	9 (Fri)			