COURSE INFORMATION

Course Code	AAM 548	Course Name	Turbulent Flows					
Type of Course	**Level of Course**	**Semester**	**Language**	**Theory**	**Application (Practice)**	**Laboratory**	**Local Credits**	**ECTS**
Elective	Graduate	-	English	3	0	0	3	6

Department	: Aerospace Engineering
Prerequisites/Requirements for Admission	: -
Mode of Delivery	: Face to Face
Course Coordinator	:
Course Lecturer(s)	: Asst. Prof. Dr. Mohamed Salem ELMNEFI
Course Assistant(s)	:
Course Description/Aim	: Introducing the turbulence phenomena and the solution of the governing equations of turbulent flow to the students. Study in detail the different types of turbulence models. Learn about ANSYS Fluent simulation software and learn how they are applied for solving various turbulent flow problems.
Course Contents	: The Nature of turbulent flows, motion equations, the statistical description of turbulent flows, scales of turbulent motion and spectral representation, İntroduction to modelling, Direct Numerical Simulations (DNS), Eddy-viscosity models, Reynolds stress and Related Models, Large Eddy Simulations (LES), and using ANSYS Fluent simulation software for solving turbulent problems.
Recommended Optional Program Components	: ANSYS Fluent simulation software.
Compulsory Attendance	: 70%

Course Learning Outcomes

#	Learning outcome	Teaching Methods/Techniques	Assessment method(s)
At the end of this course; students will be able to:			
1	Learn the nature of the turbulent flows.	Lecture	Standardized examinations, project application, homework
2	Understand the philosophy of turbulent modelling	Lecture	Standardized examinations, project application, homework
3	Understand the spectral representation phenomena	Lecture	Standardized examinations, project application, homework
4	Be able to apply eddy simulations.	Lecture	Standardized examinations, project application, homework
5	Be able to use simulation software to solve turbulent problems	Lecture	Standardized examinations, project application, homework

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Weekly Detailed Course Content

Week	Content	Recommended Resource(s)	Time (Hours)
1	Nature of Turbulent Flows	Textbook and Lecture Notes	3
2	Equations of Motion	Textbook and Lecture Notes	3
3	Statistical Description of Turbulent Flows	Textbook and Lecture Notes	3
4	Statistical Description of Turbulent Flows	Textbook and Lecture Notes	3
5	Scales of Turbulent Motion and Spectral Representation	Textbook and Lecture Notes	3
6	Scales of Turbulent Motion and Spectral Representation	Textbook and Lecture Notes	3
7	Introduction to Modeling / Midterm Exam	Textbook and Lecture Notes	3
8	Direct Numerical Simulations (DNS)	Textbook and Lecture Notes	2
9	Direct Numerical Simulations (DNS)	Textbook and Lecture Notes	3
10	Eddy-viscosity Models	Textbook and Lecture Notes	3
11	Reynolds Stress and Related Models	Textbook and Lecture Notes	3
12	Large Eddy Simulations (LES)	Textbook and Lecture Notes	3
13	ANSYS Fluent simulation software	Textbook and Lecture Notes	3
14	ANSYS Fluent simulation software	Textbook and Lecture Notes	3
15	Final Exam		3
16	Final Exam		3

Sources

Course Notes / Textbooks	Stephen B. Pope, “Turbulent Flows”, Cambridge University Press, 2000. David C. Wilcox “Turbulence Modeling for CFD”, DCW Industries, Inc, 2002. John Matsson “An Introduction to ANSYS Fluent 2020“, 2020.
Supplemental Readings	None

Evaluation System

Work Placement	Number	Percentage of Grade
Attendance		
Quizzes		
Homework	4	20
Presentation		
Laboratory/Practice		
Report(s)		
Graduate Thesis/Project		
Seminar		
Projects	1	30
Midterm exam(s)	1	20
Others		
Final exam	1	30
	Total	100
	Percentage of semester work	70
	Percentage of final exam	30
	Total	100

COURSE INFORMATION

Workload Calculation

Activity	Number	Time (hours)	Total Workload (hours)
Course Hours	14	3	42
On-line Activity Hours			
Individual study	14	4	56
Midterm exam(s)	1	3	3
Final exam	1	3	3
Homework	4	6	24
Presentation	1	3	3
Project	6	6	36
		Total	167
		ECTS Credit *(Total/30)*	6

Contribution of Learning Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
LO1	5	5	4	2	4	3	2	4	2
LO2	5	5	4	2	4	3	2	4	2
LO3	5	5	4	2	4	3	2	4	2
LO4	5	5	4	2	4	3	2	4	2

Contribution Level: 1: “Very low”, 2: “Low”, 3: “Medium”, 4: “High”, 5: “Very High”
LO: Learning Outcome of the Course
PO: Program Outcome