COURSE INFORMATION

Course Code	AAM 562	Course Name	Applied Spectroscopy for Complex Material Analysis					
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	: Python programming
Mode of Delivery	: Face to Face
Course Coordinator	: Assoc. Prof. Mecit Yaman
Course Lecturer(s)	: Assoc. Prof. Mecit Yaman
Course Assistant(s)	: -
Course Description/Aim	: This course demonstrates the use of spectroscopic methods for the micro and molecular analysis solid, liquid and gases. Advanced chemometric techniques such as neural networks and neuromorphic computation are used for data analysis.
Course Contents	: Measurement basics: Electronic components and circuits digital electronics and computers, signals and noise, Spectroscopic methods, optical components, molecular spectroscopy, infrared spectroscopy and applications, FTIR spectroscopy, chemometrics, pattern analysis and classification, machine learning and neuromorphic computation.
Recommended Optional Program Components	:
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	Describe the application fields of molecular spectroscopy.	Theoretical Lecture, Lab practice	Exams/Homeworks/Project
2	Use FTIR spectrometer in the transmission and gas cell mode.	Theoretical Lecture, Lab practice	Exams/Homeworks/Project
3	Select appropriate chemometrics techniques and use for data analysis	Theoretical Lecture, Computational practice	Exams/Homeworks/Project
4	Employ modern neural networks for spectroscopic data analysis	Theoretical Lecture, Computational practice	Exams/Homeworks/Project

COURSE INFORMATION

Weekly Detailed Course Content

Week	Content	Recommended Resource(s)	Time (Hours)
1	Measurement basics: Electronic components	Textbook/ Course website	3
2	Signal and noise, basic statistics	Textbook/ Course website	3
3	Spectroscopy and optical instruments	Textbook/ Course website	3
4	FTIR spectroscopy	Textbook/ Course website	3
5	FTIR spectroscopy applications	Textbook/ Course website	3
6	Aerospace applications of spectroscopy	Textbook/ Course website	3
7	Pattern recognition and classification	Textbook/ Course website	3
8	Plume dynamics and gas phase spectroscopy/Midterm Exam	Textbook/ Course website	3
9	Electronic nose systems	Textbook/ Course website	3
10	Machine learning methods for spectroscopy I	Textbook/ Course website	3
11	Machine learning methods for spectroscopy II	Textbook/ Course website	3
12	Neuromorphic computation for spectroscopy I	Textbook/ Course website	3
13	Neuromorphic computation for spectroscopy II	Textbook/ Course website	3
14	Review	Textbook/ Course website	3
15	Final Exam		
16	Final Exam		

Sources

Course Notes / Textbooks	Principals of Instrumental Analysis, Holler, Skoog, Crouch, Seventh edition, Thomson Brooks Cole. 2018. Chemometrics, Matthias Otto, Third edition, 2017, Wiley-VCH.
Supplemental Readings	See course website https://sites.google.com/view/spectroscopy-course/home

Evaluation System

Work Placement	Number	Percentage of Grade (%)
Attendance	10	5
Quizzes	5	5
Homework	2	10
Presentation	1	5
Laboratory/Practice	3	15
Report(s)	1	5
Graduate Thesis/Project		
Seminar		
Projects	1	10
Midterm exam(s)	1	15
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	16	1	16
Individual study	16	3	48
Lab practice	3	8	24
Midterm exam(s)	1	5	5
Final exam	1	5	5
Homework	3	6	18
Presentation	1	3	3
Project	1	20	20
		Total	181
		ECTS Credit *(Total/30)*	6

Contribution of Learning Outcomes to Program Outcomes

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

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