Introduction to Spectroscopy and Laser Diagnostics for Gases - Course Syllabus

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Course Number: ME 348

Course Title: Introduction to Spectroscopy and Laser Diagnostics for Gases

Academic Semester:	Spring	**Academic Year:**	2015/ 2016
Semester Start Date:	Jan, 24, 2016	**Semester End Date:**	May, 19, 2016

Class Schedule: Tue/Thu 10:30 to 12:00

Classroom Number:

Instructor(s) Name(s): Aamir Farooq
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Teaching Assistant name:
Email:

Office Location: Building 5, Room 4217
Office Hours:

COURSE DESCRIPTION FROM PROGRAM GUIDE

Fundamentals of microwave, infrared, Raman, and electronic spectroscopy. Laser-based diagnostic techniques for measurements of species concentration, temperature, pressure, velocity, and other flow field properties. Topics: rotational, vibrational, and electronic transition frequencies; spectral lineshapes and line-broadening mechanisms; nuclear spin effects; electronic spectra of atoms and molecules; absorption; emission; laser induced fluorescence (LIF); Rayleigh and Raman scattering methods; Mie theory; laser Doppler velocimetry (LDV) and particle image velocimetry (PIV); applications and case studies.

COMPREHENSIVE COURSE DESCRIPTION

What is spectroscopy? Interaction of radiation (light) with matter (in our case, gases)

Motivation: Spectroscopy is of increasing utility to engineers in a variety of fields both in research and industry

Example Applications: Remote sensing, combustion and gasdynamic diagnostics, process control, energy systems, environmental monitoring, biomedical

Common Measurements: Species concentrations, temperature (T), pressure (P), density (ρ), velocity (u), mass flux (ρu)

GOALS AND OBJECTIVES

Week #	Topic
1	Introduction and Basic Concepts
2	Diatomic Molecular Spectra
3	Diatomic Molecular Spectra
4	Polyatomic Molecular Spectra
5	Effects of Nuclear Spin
6	Rayleigh and Raman Spectra
7	Review and Midterm Exam
8	Quantitative Emission and Absorption
9	Spectral Line-shapes
10	Electronic Spectra of Atoms
11	Electronic Spectra of Molecules
12	Laser Induced Fluorescence
13	Other Diagnostic Techniques and Equipment
14	Case Studies

REQUIRED KNOWLEDGE

Physical Gasdynamics or Statistical Mechanics

REFERENCE TEXTS

Introduction to Spectroscopy and Laser Diagnostics for Gases

(This course reader can be ordered at the KAUST Library and should cost about US$ 45)

Reference book: Fundamentals of Molecular Spectroscopy, 4th Edition by Banwell and McCash

METHOD OF EVALUATION

Percentages %	Graded content
20% **10%** **25%** **45%**	**Homework** **Class participation** **Midterm(s)** **Final** • **Collaborative discussion on homework is encouraged, but each student must do his/her own work. There will be about 5 or 6 homework sets during the semester.** • **Class participation**

COURSE REQUIREMENTS

Assignments

Assignments will involve solving problems related to the concepts covered in the class.

Course Policies

- Students are expected to attend all classes and be actively involved in class discussions.
- There will be a total of 6 or 7 assignments during the semester.
- Late assignments will be penalized by taking away 10% for each late day.
- Handouts, assignments, and course announcements will be available via Blackboard

Additional Information

NOTE
The instructor reserves the right to make changes to this syllabus as necessary.