Course Specifications

Program(s) on which this course is given:	B.Sc. in Aerospace Engineering
Department offering the program:	Aerospace Department
Department offering the course:	Aerospace Department
Academic Level:	2014-2015 / 3rd year
Date	2015
Semester (based on final exam timing)	■ Fall ☐ Spring

A- Basic Information

1. Title:	**Heat Transfer and Combustion**			**Code:**		**AER 305**		
2. Units/Credit hours per week:	Lectures	**(3+1)**	Tutorial	1	Practical	**included**	Total	5

B- Professional Information

1. Course description:	**This course will introduce the basic concepts of heat transfer and combustion and their aerospace application.**
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	a1- The students will understand combustion principles and the design parameters influencing the achievement of combustion.
	a2- The students will know thermodynamics, Chemical Kinetics, Mass Transfer , Conservation Equations, Laminar Premixed Flames, Turbulent Premixed Flames, Diffusion Flames, Droplet Burning
	b) Intellectual Skills
	b1- The student will hypothesize and synthesize the modeling process.
	b2- The student will be able to analyze results and draw conclusions.
	c) Professional and Practical Skills
	c1- The student will be able to construct and use software codes.
	c2- The student will be able to present finding to fellow students through an oral presentation in a formal classroom setting **c3-** The student will have an over view of the physical process.
	d) General and Transferable Skills
	d1- The student will gain the capability to split complicated systems into model-able modules. **d2-** The student will gain the capability to choose a convenient model rigorous

	to employ.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Chemical reactions, Properties of some hydrocarbon fuels, Enthalpy of formation	1	1	0
Application of first law of thermodynamics on reacting systems, Combustion processes calculations, Chemical equilibrium, Equilibrium of single reaction, Equilibrium in multiple reactions	4	2	2
Mass transfer	5	3	2
Chemical kinetics, Simple global reaction mode	5	3	2
Detailed mechanisms of reactions, Reaction rate formulae	4	3	1
Laminar premixed flame: Definitions, Simple mathematical model and solution of the equations, Factors affecting flame speed and thickness. Ignition, Extinction, Flammability limits, Flame stability	5	3	2
Laminar non-premixed flame, Definitions, Simple mathematical model and solution, Factors affecting flame height	5	3	2
Droplet evaporation. Applications, Simple mathematical model and solution, Evaporation rate, Time of evaporation, Factors affecting evaporation time.	5	4	1
Fourier conduction equation and its application for steady state in simple and compound walls, cylindrical and spherical surfaces.	5	3	2
The critical radius of insulation, Extended surfaces (fins) and their efficiency charts.	3	2	1
Unsteady conduction for lumped and un-lumped systems. General conduction equation in two and three dimensions	1	1	0
Convection: Relations for free convection and forced convection for inner and outer surfaces,	8	5	3
The equivalent electric circuit and solution for temperatures and heat transfer by radiation.	4	3	2
Radiation from gases and emissivity	4	3	1
	∑ 60	39	21

4. Teaching and Learning Methods			
	Class Activity (1)	Case Study (1)	Projects (1)

	E-learning ( )	Assignment /Homework (1)	Other: (1)

5. Student Assessment Methods

• .Assessment Schedule		Week
Assessment 1	Quiz 1	3
Assessment 2	Report 1	4
Assessment 3	Quiz 2	5
Assessment 4	Report 2	7
Assessment 5	Midterm exam	8
Assessment 6	Report 3	9
Assessment 7	Quiz 3	10
Assessment 8	Report 4	12
Assessment 9	Project	13
Assessment 10	Report 5	15
Assessment 11	Final Exam	16

- **Weighting of Assessments**

-Mid-Term Examination	15 %
-Final-term Examination	50%
-Project	10%
-Class Test	15%
-Presentation	10%
-Total	100%

6. List of References

Holman, J. P., Heat Transfer, McGraw Hill Book Co., 1990.

Turns, S. T., An Introduction to Combustion, Concepts and Applications, McGraw Hill, Inc., 1996.

Geankoplis, C. J., Transport Processes and unit operations, Prentice Hall Int., 1993.

Van Wylen, Gordon J. and Sonntag, Richar E., Fundamentals of Classical Thermodynamics, John Wiley and Sons Inc., 1965.

Spalding, D. B., Combustion and Mass Transfer, Pergamon Press, 1979.

Bird, R. B.; Steward, W. E. and Lishtbast, E. N., Transport Phenomena, John Wiley and Sons Inc., 1960.

7. Facilities Required for Teaching and Learning

Course Coordinator:	**Prof. Dr. Farouk Owis**
Head of Department:	**Prof. Dr. Ayman Kassem**