Course Specifications of:
Selected Topics in Combustion *(MEP 704)*

Program(s) on which the course is given: Ph.D. in Mechanical Power Engineering
Compulsory or Elective element of program: Elective
Department offering the program: Mechanical Engineering / power
Academic year / Level: year/2014/2015
Date of specification approval: 2012

A. Basic Information

Title: Selected Topics in Combustion **Code: MEP 704**
Credit Hours: 3 **Lecture: 3**
Tutorial: - **Practical: -** **Total: 3**

B- Professional Information

1- Overall aims of course:
For students understanding this course will be able to:

1. Use of the appropriate technological means to serve the professional practice in the field of combustion engineering.
2. Develop new methods, tools and techniques in professional practice in the field of combustion engineering
3. Employ of the available resources with high motivation to develop and create new resources in the field of combustion engineering.
4. Apply the analytical approach with critical survey in the field of combustion engineering.
5. Integrate the specialized knowledge with relevant knowledge with ability to deduce and develop the mutual relationships in file of combustion engineering

2- Intended learning outcomes of course (ILOs)
By completion of the course, the student should be able to:

2.1 Knowledge and understanding

a1. Acquire and Identify theories and principles of modern technology in the field of combustion engineering. (2.1.1)
a2. Summarize the advanced knowledge on methodology in computational and experimental research in the field of combustion engineering. (2.1.2)
a3. Have a significant knowledge in the basic and methodologies at the forefront of combustion engineering Society. (2.1.4)
a4. Illustrate the modern concepts and methodologies used in computational and experimental in the field of combustions engineering research. (2.1.7)
a5. Have the ability to respect interdisciplinary, and identify the roles and expertise of others professionals. (2.1.8)

2.2 Intellectual skills

b1. Analyze and evaluate information in the field of combustion engineering and make full use of such information to solve problems. (2.2.1)
b2. Solve specific problems on the basis of limited information.(2.2.2)
b3. Assess and analyses risks in professional practices in the area of combustion engineering. (2.2.5)
b4. Have creativity and make good decisions in different combustion engineering aspects. (2.2.7)
b5. Evaluate the relative enhancement in the combustion system or process performance due to the innovative part or procedure application. (2.2.8)

2.3 Professional and practical skills

c1. Perform basic professional and modern skills in the area of combustion engineering according to the relevant codes of practice. (2.3.1)
c2. Use the different instruments for measuring the combustion system properties safely and according to the specified accuracy. (2.3.7)
c3. Develop innovative solutions, demonstrating flexibility and resourcefulness in the combustion engineering field. (2.3.8)
c4. Ability to identify research opportunities and use of the appropriate technological means to serve combustion.(2.3.9)

2.4 General and transferable skills

d1. Use information technology in order to serve the development of professional combustion practice. (2.4.2)
d2. Analyzing and synthesizing information or data from a variety of sources and demonstrate effective IT capabilities to serve the development in combustion field. (2.4.4)
d3. Capability to demonstrate of ethical, legal, social and civic responsibility as a researcher and member of the combustion and ability to lead the team work. (2.4.6)
d4. Ability to demonstrate a high level of competence the management of time and scientific meetings. (2.4.7)

3- Contents

No. of weeks	Topic	No. of hours
1 2	**Thermodynamics of combustion:** Combustion process and the first law, energy balance of chemical reaction, adiabatic flame temperature, equilibrium composition of gaseous mixtures, calculation of equilibrium composition and temperature	6
3 4	**Fundamentals of chemical kinetics:** Rate of reaction, reaction order, complex reaction, chain reaction, theories of reaction kinetics	6

5	**Laminar flame propagation:** Premixed flames, the structure of laminar flame, theories of laminar flame propagation	3
6	**Determination of burning velocity:** Definition of burning velocity, methods of measuring velocity, comparison of burning velocity, factors affecting burning velocities.	3
7	**Flame stability:** Flame stabilization, characteristic stability diagram, mechanism of flame stabilization, flame stretch theory, quenching distance.	3
8	**Mid term**	3
9	**Diffusion flames:** Gaseous diffusion flames , theory of diffusion flames, theory of turbulent diffusion flames, confined diffusion jet flames	3
10 11	**Computational combustion:** study the new technique of combustion by use computational program.	6
12	**Boiler:** classification of boiler, boiler calculations	3
13	**Boiler design:** design of each type of boiler.	3
14	Oral Exam.	3
15	Final Exam	3
	Total	45

4- Course Matrix

ILO's code number	Teaching/learning methods and strategies	Assessment methods and strategies
2.1.1 2.1.2 2.1.4 2.1.7 2.1.8	Formal lectures	Individual coursework assignments, quizzes, oral discussions and reports. Mid-term and /or final written examination is given.
2.2.1 2.2.2 2.2.5, 2.2.7 2.2.8	Analysis and problem-solving skills are developed through tutorial/problem sheets and small group exercises.	Analysis and problem-solving skills are assessed through oral and written examinations.
2.3.1, 2.3.7 2.3.8, 2.3.9	Simulate published papers	Coursework exercises and reports, project reports and presentations.
2.4.2 2.4.4 2.4.6 2.4.7	Those skills are not explicitly taught; however, along the course of study the student will acquire those skills to be able to perform his obligations. Attendance of seminars, workshops or conferences will help the student in developing those skills. Presentation by students (either group or individual) will train students for those skills.	Project presentation

5-Assessment schedule

Assessment 1	Assignments	on weeks	1, 3, 6
Assessment 2	Quizzes	on weeks	2, 4, 9, 13
Assessment 3	Mid-term exam	on weeks	8
Assessment 3	Oral exam	on week	14
Assessment 4	Final exam	on week	15

6- Weighting of assessments

20% (60 marks) Home assignments, Quizzes, and reports
20% (60 marks) Mid-term examination and Oral examination
60% (180 marks) Final-term examination
100% (300 marks) Total

7- List of References

7.1 Text books

-Course notes Prepared by the instructor

- Kazimierz L.;Pawel W. "Internal Combustion Engines" Janeza Trdine 9, 51000 Rijeka, Croatia,2012
- Kalus M.;Hemult T. " Handbook of Diesel Engine" Springer-Verlag Berlin Heidelberg 2010
- Heywood John B., "Internal Combustion Fundamentals" McGraw-Hill,1988
- R.K.Rajput "Internal Combustion Engines" Laxmi Publications LTD,New Delhi,2005
-Richard stone, "Introduction to Internal Combustion Engines", Machmillan Press Ltd., 1992

7.2 websites

* www.4shared.com
* www.sciencedirect.com
* Yahoo mail group

8- Facilities required for teaching and learning

Lecture room equipped with overhead projector
Presentation board, computer and data show
Laboratory

Prepared by: Ass.Prof. Khairy Hussein

Head of Department: Prof. Dr. Osama Ezzet

Matrix of course content and ILO's

Course Title: **Selected Topics in Combustion** **Code**: **MEP704**
Lecture: 3. **Tutorial**: ---- **Practical**: ---- **Total:** 3
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Course content	ILO's A	ILO's B	ILO's C	ILO's D
Thermodynamics of combustion: Combustion process and the first law, energy balance of chemical reaction, adiabatic flame temperature, equilibrium composition of gaseous mixtures, calculation of equilibrium composition and temperature	a1	b2	c1	
Fundamentals of chemical kinetics: Rate of reaction, reaction order, complex reaction, chain reaction, theories of reaction kinetics	a2	b3	c2	
Laminar flame propagation: Premixed flames, the structure of laminar flame, theories of laminar flame propagation	a3	b4	c2	d1,d2
Determination of burning velocity: Definition of burning velocity, methods of measuring velocity, comparison of burning velocity, factors affecting burning velocities.	a2,a5	b1	c3	
Flame stability: Flame stabilization, characteristic stability diagram, mechanism of flame stabilization, flame stretch theory, quenching distance.	a1	b3,b5	c1	d4
Diffusion flames: Gaseous diffusion flames , theory of diffusion flames, theory of turbulent diffusion flames, confined diffusion jet flames	a3		c2,c4	
Computational combustion: study the new technique of combustion by use computational program.	a1,a4	b2		d3
Boiler: classification of boiler, boiler calculations	a2	b3	c2	d1
Boiler design: design of each type of boiler.	a3	b4		d4

Matrix of course aims and ILO's

Course Title: **Selected Topics in Combustion** **Code**: **MEP704**
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Course aims	ILO's A	ILO's B	ILO's C	ILO's D
1-Use of the appropriate technological means to serve the professional practice in the field of combustion engineering.	a1	b1	c1	d3
2-Develop new methods, tools and techniques in professional practice in the field of combustion engineering.	a2	b2 , b3		d4
3-Employ of the available resources with high motivation to develop and create new resources in the field of combustion engineering.	a3	b3	c1	d1
4-Apply the analytical approach with critical survey in the field of combustion engineering.	a3	b3	c1	d1
5-Integrate the specialized knowledge with relevant knowledge with ability to deduce and develop the mutual relationships in file of combustion engineering.	a2	b2	c3	d2