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## *Course Specifications of: Internal Combustion Engines MEP 610*

**Program(s) on which the course is given:** Post Graduate **M. Eng.** 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:** Internal Combustion Engines

**Code:** MEP 610

**Credit Hours:** 3

**Lecture:** 3

**Tutorial:**

**Practical:**

**Total:** 3

### **B- Professional Information**

#### **1- Overall aims of course:**

This course introduces students to:

- 1 - Demonstrate knowledge of I.C.E performance as power, efficiency and specific fuel consumption.
- 2 - Solve problems in I.C.E applications and engine performance.
- 3 - Calculation and predict necessary design and operating parameters enhancing the performance, economy and environmental requirements of the engines.
- 4 - Know and understand the different oil resources, oil properties and oil systems.
- 5 - Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently

#### **2- Intended learning outcomes of course (ILOs)**

By completion of the course, the student should be able to:

##### **a- Knowledge and understanding**

- a1. Derive the governing equations for the engine performance, combustion and combustion chambers, engine friction and lubrication. (2.1.1)
- a2. Demonstrate environmental impact of mechanical power engineering professional practice. (2.1.2)
- a3. Name the scientific developments in the area of specialization. (2.1.3)
- a4. Define the basics and the ethics of scientific research. (2.1.4)
- a5. Illustrate the methodologies used in computational and experimental combustion research. (2.1.7)

##### **b- Intellectual skills**

- b1. Exploit different knowledge sources to solve combustion problems. (2.2.3)
- b2. Conduct a research study and/or write a scientific essay about a combustion research problem.(2.2.4)
- b3. Assess risks in professional practices in the area of combustion engineering.(2.2.5)
- b4. Assess and evaluate the characteristics and performance of the combustion system component (2.2.6)

**c- Professional and practical skills**

- c1. Write reports in accordance with the standard scientific guidelines. (2.3.2)
- c2. Have participated in the research, development, or application of engineering solutions that have had a positive impact on society in the area of combustion. (2.3.3)
- c3. Define optimal design for MEP projects under given constraints.(2.3.4)
- c4. Use the different instruments for measuring the combustion system properties safely and according to the specified accuracy. (2.3.7)

**d- General and transferable skills**

- d1. Communicate effectively.(2.4.1)
- d2. Set basis and standards to assess the performance of others.(2.4.5)
- d3. Work in a group and Lead a team in familiar professional contexts.(2.4.6)
- d4. Conduct self-learning and continuous education practices. (2.4.8)

**3- Contents**

Topic No.	Topic	No. of weeks	Total no. of hours
1	<b>Introduction to Internal Combustion Engines:</b> Heat engines, classification of I.C.E, working cycles, application, different parts, indicator diagram, four and two stroke engine cycles, comparison of S.I.E. and C.I.E	2	6
2	<b>Testing and performance:</b> Performance equations, measurement of speed; fuel and air consumption; smoke, exhaust emission; brake power; friction and indicated power. Performance of S.I. and C.I. Engines.	2	6
3	Modeling of different stages of internal combustion engines.	2	6
4	<b>Design of combustion chambers:</b> combustion chambers design principles, overhead or I-F head combustion chambers. Inductions swirls and open combustion chambers.	2	6
5	<b>Combustion in S.I.E. and C.I. Engines:</b> Ignition limits, normal combustion, abnormal combustion, pre-ignition, detonation, performance number, fundamentals of the combustion processes in diesel engines, diesel knock.	3	9
6	<b>Air pollution:</b> Pollutants from gasoline engines, diesel smoke and odors and control, effect of engine operation and maintenance on emission	1	3
7	<b>Engine lubrication:</b> Engines oils resources and types of chemical and physical properties of engine oils, tests for determining the engine oil properties, oiling systems.	2	6
8	<b>Exam</b>	1	3
	<b>Total</b>	15	45

**4- Course Matrix**

ILO's code number	Teaching/learning methods and strategies	Assessment methods and strategies
2.1.1	Formal lectures	Individual coursework assignments,



2.1.2 2.1.3 2.1.4, 2.1.7		quizzes, oral discussions and reports. Mid-year and /or final written examination is given.
2.2.3 2.2.4 2.2.5, 2.2.6	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.
2.3.2 2.3.3 2.3.4, 2.3.7	Experiments demonstrations, practical work	Coursework exercises and reports, project reports and presentations.
2.4.1 2.4.5 2.4.6, 2.4.8	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.	Project presentation

### 5- Assessment schedule

Assessment 1	Assignments	on weeks	1, 3, 6
Assessment 2	Quizzes	on weeks	2, 4, 9, and 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

**Course coordinator: Ass.Prof. Kairy Hussien , Ass.Prof. Ahmed Attia**

**Course instructor: Ass.Prof. Kairy Hussien , Ass.Prof. Ahmed Attia**

**Head of Department: Prof. Dr. Osama Ezzat Abdellatif**



Benha University



Mechanical Engineering Dept  
Course Specification- M. Eng. (2014-2015)



Faculty of Engineering

## Matrix of course content and ILO's

**Course Title: Internal Combustion Engines** **Code: MEP 610**

**Lecture: 3 Tutorial: Practical: Total: 3**

**Program on which the course is given: Post Graduate M. Eng. in Power Engineering.**

**Major or minor element of program: Elective**

**Department offering the program: Mechanical Engineering / Power**

**Department offering the course: Mechanical Engineering / Power**

**Academic year / level: 2014/2015. Date of specifications approval: 2012**

Course content	ILO's A	ILO's B	ILO's C	ILO's D
<b>Introduction to Internal Combustion Engines</b>	a2	b1		d2
<b>Testing and performance</b>	a1, a3	b1	c1	d4
<b>Modeling of different stages of internal combustion engines.</b>	a4	b2	c4	d3
<b>Design of combustion chambers</b>	a1,a5	b2		d2, d1, d3
<b>Combustion in S.I.E. and C.I. Engines</b>	a4, a2	b1		
<b>Air pollution</b>		b4	c2, c3	d1,d2
<b>Engine lubrication</b>	a5	b3	c1, c2	



## Matrix of course aims and ILO's

**Course Title:** Internal Combustion Engines

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**Lecture:** 3      **Tutorial:**                      **Practical:**

**Total:** 3

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Course aims	ILO's A	ILO's B	ILO's C	ILO's D
1- Demonstrate knowledge of I.C.E performance as power, efficiency and specific fuel consumption	a2, a3	b1, b2		d1,d4
2 -Solve problems in I.C.E applications and engine performance.	a1	b2	c1	d2, d3
3- Calculation and predict necessary design and operating parameters enhancing the performance, economy and environmental requirements of the engines.	a4	b3,b4	c2, c3	d2
4- Know and understand the different oil resources ,oil properties and oil systems.	a5	b2	c4	d1, d2
5- Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently	a3	b2	c3	d3