Model No.12
Course Specifications (2014-2015)
Heat Transfer and Furnaces

University: Benha University

Faculty: Faculty of Engineering at Shoubra

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

1- Course Data

Course Code: MEP293 **Course Title**: Heat Transfer and Furnaces **Study Year**: Second Year

Specialization: Mechanical Production Engineering

Teaching Hours: Lecture: 2 Tutorial/ Practical: 2

2- Course Aim

This course is designed to introduce a basic study of the phenomena of heat transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes. At the end of the course students will be able to:

1. To develop an understanding of the physics of heat transfer by conduction, convection and radiation.
2. Solve one-dimensional steady state conduction problems by applying the heat balance equation and using thermal resistances through linear, cylindrical and spherical geometries.
3. Determine the heat transfer occurring through a series of fins and their performance.
4. To develop the skills required for the solution of engineering problems involving unsteady heat transfer.
5. Solve two-dimensional steady state conduction roblems.
6. Analyze convection problems and determine convection coefficients in external flow conditions.
7. To be aware of industrial furnaces, furnaces Heat balance and design.

3- Intended Learning Outcomes of Course

a. Knowledge and Understanding Skills:

On completing this course, students acquiring and understanding of:

a.1) The heat transfer mechanisms; conduction, convection and radiation. (A1, A5)

a.2) The steady state one dimensional conduction heat transfer in rectangular and radial systems. (A5, A14)

a.3) The unsteady state conduction heat Transfer in rectangular and radial systems. (A1, A5, A14)

a.4) The convection heat-transfer mechanisms; forced, free and combined. (A1, A5, A14)

a.5) Industrial furnaces, furnaces Heat balance and design. (A4, A5, A14)

b. Intellectual Skills:

At the end of this course, the students will be able to:

b.1) Compare between conduction, convection and radiation heat transfer mechanisms. (B1, B2, B4)

b.2) Solve the problem of the temperature distribution and heat conducted through the walls. (B2, B3, B5)

b.3) Assess and evaluate the heat transfer from fins. (B2, B13)

b.4) Solve numerically the two-dimensional conduction heat transfer. (B1, B2, B3, B5, B13)
b.5) Compare between forced, free and combined convection heat transfer mechanisms. (B13, B17

c. Practical and Professional Skills:

On completing this course, the students are expected to be able to:
c.1) Apply the relation between the heat-transfer and the first law of thermodynamics. (C1)
c.2) Apply numerical modeling methods to two-dimensional conduction heat transfer. (C7)

d. General and Transferable Skills:

At the end of this course, the students will be able to:
d.1) The rate of lost and waste heat energy. (D7)
d.2) The practical limits of fins efficiency and performance. (D7)

4- Course Contents

Week no.	Topics
1	Introduction to heat transfer
2	Heat transfer mechanisms
3	Steady state one dimensional conduction heat transfer in rectangular coordinates
4	Steady state one dimensional conduction heat transfer in cylindrical coordinates
5	Heat transfer from fins
6	Transient conduction heat transfer
7	Steady state two dimensional conduction heat transfer in rectangular coordinates
8	Introduction to convection heat transfer
9	Laminar forced convection over flat plate
10	Introduction to radiation heat transfer
11	Introduction to industrial furnaces
12	Industrial furnaces heat balance and design

5- Teaching and Learning Methods

5.1 Lectures
5.2 Tutorial problem session
5.3 Class activity
5.4 Assignments/homework

6- Teaching and Learning Methods Disables

Nothing

7- Student Assessment

a- Student Assessment Methods

1	Six assignments to assess knowledge and intellectual skills.
2	Two quizzes to assess knowledge, intellectual and professional skills.
3	Midterm exam to assess knowledge, intellectual, professional and general skills.
4	Oral exam to assess knowledge and intellectual skills
5	Final exam to assess knowledge, intellectual, professional and general skills.

b- Assessment Schedule

NO.	Assessment	Week
1	Assignments	2, 5, 7, 9, 11, 13
2	Quiz	4, 11
3	Midterm exam	8
4	Oral exam	14
5	Final exam	15

c- Weighting of Assessments

Assessment	Weight (%)
Midterm Examination	15
Final Term Examination	60
Oral Examination	20
Practical Examination	00
Semester Work	05
Other Types of Assessment	00
Total	100

8- List of References a-

a - Course Notes

- Course notes prepared by instructor.

b- Recommended Books

1- Introduction to Heat Transfer by Frank P. Incropera and David P. Dewitt, John Wiley & Sons; 7th edition (March 21, 2011).

2- Heat Transfer by J. P. Holman; Mcgraw-Hill series in mechanical engineering, 10th edition (January 13, 2009).

3- Heat Transfer: A Practical Approach by Yunus A. Cengel, Mcgraw-Hill (Tx); 2nd edition (November 1, 2002).

Course Coordinator: Prof. Dr. Reda Ibrahim El-Ghanam & Dr. Eng. Mohamed Reda Salem

Head of Department: Prof. Dr. Osama Ezzat Abdelatif

Model No.11A
Course Specifications: Heat Transfer and Furnaces

University: Benha University

Faculty: Faculty of Engineering at Shoubra

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

Matrix of Knowledge and Skills of the course

no.	Topics	Week no.	Knowledge and Understanding Skills	Intellectual Skills	Practical and Professional Skills	General and Transferable Skills
1	Introduction to heat transfer	1	a.1, a.2	b.1 b.1,	c.1	d.1
2	Heat transfer mechanisms	2	a.1, a.2	b.2	c.1	d.1
3	Steady state one dimensional conduction heat transfer in rectangular coordinates	3	a.2	b.2	c.1	d.1
4	Steady state one dimensional conduction heat transfer in cylindrical coordinates	4	a.2 a.1,	b.2	c.1	d.1 d.1,
5	Heat transfer from fins	5	a.2	b.3	c.1	d.2
6	Transient conduction Heat transfer	6	a.3	b.2 b.2,	c.1 c.1,	d.1
7	Steady state two dimensional conduction heat transfer in rectangular coordinates	7	a.2	b.4	c.4	d.1
9	Introduction to convection heat transfer	9	a.4	b.5	c.1	d.1
10	Laminar forced convection over flat plate	10	a.4	b.5	c.1	d.1
11	Introduction to radiation heat transfer	11	a.1	b.1	c.1	d.1
12	Introduction to industrial furnaces	12	a.1	b.2	c.1	d.1
13	Industrial furnaces heat balance and design	13	a.5	b.2	c.1	d.1

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Matrix of Course Aims and ILO's

Course Title: Heat Transfer and Furnaces

Course Code: MEP293

Teaching Hours: Lecture: 2 Tutorial/ Practical: 2 Total: 4

Major or minor element of program: Major

Program on which the course is given: B.Sc. Mechanical Production Engineering

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

Academic year / level: 2014 / 2015 Second Year / Second Semester

Date of specifications approval: 2014

Course aims	a	b	c	d
1- To develop an understanding of the physics of heat transfer by conduction, convection and radiation.	a1 a4	b1 b5	c1	d1
2- Solve one-dimensional steady state conduction problems by applying the heat balance equation and using thermal resistances through linear, cylindrical and spherical geometries.	a2 a5	b2	c1	d1
3- Determine the heat transfer occurring through a series of fins and their performance.	a1 a2	b2 b3	c1	d1 d2
4- To develop the skills required for the solution of engineering problems involving unsteady heat transfer.	a3	b2	c2	
5- Solve two-dimensional steady state conduction problems.		b2 b4	c1 c2	
6- Analyze convection problems and determine convection coefficients in external flow conditions.	a1 a2 a4	b5		d1
7- To be aware of industrial furnaces, furnaces Heat balance and design.	a5	b2	c1	d1

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