Course Specifications

Program on which this course is given:	**Diploma of Applications of Automatic Control of Mech. Power Systems**
Department offering the program:	**Mechanical Power Engineering Department - ACC control Lab**
Department offering the course:	**Mechanical Power Engineering Department - ACC control Lab**
Academic Level:	**Elective Course- 1st or 2nd Term of the Diploma of Graduate Studies**
Date	**1st or 2nd Term 2015/2016**
Semester (based on final exam timing)	√ Fall ☐ √ Spring

A- Basic Information

1. Title:	**Heat and Mass Transfer**						**Code:**	**MEP 590**
2. Units/Credit hrs per week:	**Lectures**	**3 Credit hours per week**	**Tutorial**	**--**	**Practical**	**--**	**Total**	**3**

B- Professional Information

1. Course description

Overall Aims:

This is one elective course of the 4 elective courses requirements of the Diploma. It is designed to review the essentials of Heat and Mass Transfer processes in many important applications of mechanical power systems. It is designed to enhance skills and give participants a broad based understanding of the most important concepts of Heat and Mass transfer and thermo-fluid processes in practical automatic control systems. The course includes large number of practical examples and problems for Heat and Mass Transfer systems and processes.

Course overall aims is to review various definitions, basics, and conservation equations of different types of applications of Heat and Mass Transfer processes.

-To study relation between heat transfer processes and thermodynamic processes.

-To examine different modes of heat transfer and their physical origin.

-To study, analyze, and examine Steady 1-D conduction, uniform & non-uniform thermal conductivity, heat sources, and extended surfaces.

-To study, analyze, and examine Transient 1-D conduction covering: lumped capacitance method and Heizler charts.

-To study, analyze, and examine Different free convection processes and problems involving horizontal cylinders, horizontal plates, spheres, vertical walls and vertical cylinders.

-To study, analyze, and examine Different forced convection problems involving flow across single cylinder, flow across single sphere, flow across tube banks & internal flow through tubes.

-To investigate and perform engineering analysis of multi-mode heat transfer problems and basic types and performance of various heat exchangers.

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding:

Having successfully completed this course, the post-graduate student should have knowledge and understanding of:

- Basics, various definitions & terminologies associated with Heat and Mass Transfer processes.

- Relation between heat transfer processes and thermodynamic processes.

- Different modes of heat transfer and their physical origin.

- Steady 1-D conduction, uniform and non-uniform thermal conductivity, heat sources, and extended surfaces.

- Transient 1-D conduction covering: lumped capacitance method and Heizler charts.

- Different heat transfer processes involving free convection processes and problems involving horizontal cylinders, horizontal plates, spheres, vertical walls and vertical cylinders.

- Different forced convection problems involving flow across single cylinder, flow across single sph flow across tube banks & internal flow through tubes.

- Multi-mode heat transfer problems and basic types and performance of heat exchangers.

b) Intellectual Skills:

Having successfully completed this course, the student should have the ability to do:

-Select and apply appropriate technical and optimum method in doing engineering design and analysis of automatic control problems.
-Searching for scientific information and adopting self-learning capabilities.
-Analyze and compare the component effects, performance, and efficiency of different types of Heat and Mass Transfer systems.
-Compare between various types of Heat and Mass Transfer processes, components, and systems.
-Select and apply appropriate Heat and Mass Transfer processes, components to design, model, analyze, and solve automatic control problems.
-Apply scientific and engineering analysis for Heat and Mass Transfer systems.

c) Professional and Practical Skills:

Having successfully completed this course, the student should have the ability to do:

-Identify several types of Heat and Mass Transfer control problems which are essential for design and operation of mechanical power systems and energy transfer processes.
-Perform professional design & modelling for different Heat & Mass Transfer control systems.
-Suggest possible alternative solutions for various types Heat and Mass Transfer components and parts.
-Diagnose efficiency and performance of different types of Heat and Mass Transfer systems.

d) General and Transferable Skills:

Having successfully completed this course, the student should have the ability to do:

-Perform engineering assembly of different Heat and Mass Transfer processes & components in one control system.
-Transfer knowledge, Work in group, & Communicate in written & oral forms, in English.
- Use IT& evolutionary technological tools& PC applications (Excel, Mat lab, Virtual labs, .etc).
- Prepare&write reports,Manipulate&sort data, Think logically, and continuous self-E-learning.
- Use computer software applications (Excel, EES, Mat lab, AutoCAD,…etc).
- Identify practical problems, compare between different technologies for HVAC systems.
-Organise & manage time & resources effectively; for short-term and longer-term commitments.

3. Contents

Topics:	Total hrs	Lectures hours	Tutorial/ Practical hrs
Introduction to Heat and Mass Transfer processes in many important applications of mechanical power systems. Important concepts of Heat and Mass transfer and thermo-fluid processes in practical automatic control systems. Various definitions, basics, and conservation equations of different types of applications of Heat and Mass Transfer processes. **Relation between heat transfer processes and thermodynamic processes.** **Different modes of heat transfer and their physical origin. Analysis and examination of steady 1-D conduction, uniform & non-uniform thermal conductivity, heat sources & extended surfaces. Analysis and examination of Transient 1-D conduction covering: lumped capacitance method and Heizler charts. Analysis and examination of Different free convection processes and problems involving horizontal cylinders, horizontal plates, spheres, vertical walls and vertical cylinders. Analysis and examination of Different forced convection problems involving flow across single cylinder, flow across single sphere, flow across tube banks & internal flow through tubes. Investigation & analysis of multi-mode heat transfer problems and basic types and performance of various heat exchangers.** **Practical examples for Heat and Mass Transfer systems and processes.**	**42 hrs**	**3hrs/week for 14 weeks before the final term exam**	---

4. Teaching and Learning Methods

Lectures (√)	Practical/ Training (√)	Seminar/ Workshop ( )	Class Activity (√)	Case Study (√)	Projects ( )	Laboratory ( )	E-learning (√)	Assignments /Homework (√)	Other: Submitting reports

5. Student Assessment Methods

Assessment Schedule	Week
-Assessment 1; Report # 1	Week # 1
-Assessment 2; Report # 2	Week # 2
-Assessment 3; Report # 3	Week # 4
-Assessment 4; Report # 4	Week # 6
-Assessment 5; Report # 5	Week # 8
-Assessment 6; Report # 6	Week # 10
-Assessment 7; Report # 7	Week # 12
-Assessment 8; Report # 8	Week # 13
-Assessment 9; – General course Report	Week # 14

- **Weighting of Assessments**

-All in-term works, sheets and reports	30%
-Final-term formal, written Examination	70%
-Project	--
-Class Test	--
-Presentation	--
-Total	100%

6. List of References:

1- Class notes, presentations &Special Reports prepared by Assistance Professor Dr. Amro Abdel-Raouf

2- Essential heat transfer data &fluid thermo physical properties are prepared and made available for all the students.

3- Essential Books (Text Books):

a) Holman, J.P., "Heat Transfer", McGraw Hill Inc., 2002.

b) Incropera, F.P. and De Witt, D.P., "Fundamentals of Heat and Mass Transfer", Third Edition, John Wiley & Sons, 1996.

4- Recommended Books:

Cancel, Y.A., "Heat Transfer- A Practical Approach", McGraw-Hill Higher Education, 2nd Edition, 2003.

7. Facilities Required for Teaching and Learning: Data Show & Laptop Computer

Course Coordinator:	**Associate Professor Dr. Mohsen S. Soliman & Assistance Professor Dr. Amro Abdel-Raouf**
Head of Department:	**Professor Ashraf S. Sabery**