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:	**Mandatory Course - 1st Term of the Diploma of Graduate Studies**
Date	**1st Term 2014/2015**
Semester (based on final exam timing)	√ Fall ☐ Spring

A- Basic Information

1. Title:	**Automatic Control – Theory and Applications in Mechanical Power Systems**						**Code:**	**MEP 561**
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 a mandatory course as one of the 6 mandatory core courses of the Diploma. It is designed to show the basic concepts and essentials of automatic control theory as it is applied on mechanical power systems and heat and mass transfer processes. The course include large numbers of practical examples and problems on various types of control systems to enhance students professional skills in the field of modeling & analyzing real automatic control systems. Course overall aims is to define automatic control theory and the associated terminology- introduce and study various types of Control Systems– Mechanical components, pneumatic, hydraulic, electric systems–Mathematical Modeling of control systems–Laplace and the inverse Laplace transformations-Element and System Transfer functions – Close and open loop systems –Instantaneous system response–system stability & equilibrium tests –Design of control systems –Practical applications of automatic control theory in different mechanical power and heat transfer and mass transfer processes and equipments.

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 and various definitions and terminologies associated with automatic control theory.
- Various types of automatic control loops in mechanical power and energy transfer systems.
-Essential requirements of accuracy, efficiency, safety, and stability of automatic control systems
-Conceptsofmathematicalmodelling of various mech. power systems & energy transfer processes
-The element and the whole system transfer functions, and Block diagram analysis method.
-Laplace Transform & inverse Laplace technique to solve the system's ordinary time-dependent differential equations.
- Instantaneous dynamic response of control system and its graphical presentation on an output-time scale for various types of different input testing functions.
-Main definitions and control characteristics of dynamic response of 1st and 2nd order automatic control systems.
- The analogy between various types of mechanical control systems and electric control systems.
–Practical applications of automatic control theory in different mechanical power and heat transfer and mass transfer processes and equipments.

b) Intellectual Skills:

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

-Select and apply appropriate mathematical and technical methods to model, analyze, and solve automatic control problems.
-Search for scientific and technical information and adopt control self-learning capabilities.

	- Analyze and compare the performance and time response of different types of ordinary time-dependent differential equations of control systems. **-Solve numerical and practical examples on automatic control systems.** **-Apply scientific and engineering analysis for different mechanical power control systems.** **-Apply and use Laplace Transform and inverse Laplace tables for mathematical modeling, block diagram reduction and for solving the system's ordinary time-dependent differential equations.**
	c) Professional and Practical Skills: **Having successfully completed this course, the student should have the ability to do:** **-Identify several types of automatic control problems which are essential for design and operation of mechanical power systems and energy transfer processes.** **-Perform professional design and modelling fordifferent automatic control systems.** **-Suggest possible alternative solutions for various types of automatic control systems.** **-Use & apply different tables and equations for Laplace and inverse Laplace Transformations.** **-Diagnose stability and dynamic response problems of automatic control of mechanical power systems and energy transfer equipments.** **- Formulate and analyze heat transfer and fluid flow practical problem related to control fields.**
	d) General and Transferable Skills: **Having successfully completed this course, the student should have the ability to do:** **-Perform engineering calculations, draw feed-back control circuits, block diagrams, graphical presentation of experimental data, and perform data-regression analysis.** **-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.** **- Identify practical problems, compare between different technologies for control 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 Basics and definitions and terminologies associated with automatic control theory. **-Various types of automatic control loops in mechanical power and energy transfer systems.** **-Essential requirements of accuracy, efficiency, safety, and stability of automatic control systems** **-Concepts of mathematical modelling of various mechanical power systems and energy transfer processes** **-The element and the whole system transfer functions, and Block diagram analysis method.** **-Laplace Transform & inverse Laplace technique to solve the system's ordinary time-dependent differential equations.** **-Instantaneous dynamic response of control system and its graphical presentation on an output-time scale for various types of different input testing functions.** **-Main definitions and control characteristics of dynamic response of 1st and 2nd order automatic control systems.** **- The analogy between various types of mechanical control systems and electric control systems.** **–Practical applications of automatic control theory in different mechanical power and heat and mass transfer equipments.**	**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 – Introduction to control theory	Week # 2
-Assessment 2; Report # 2 – Terminology of control theory	Week # 4
-Assessment 3; Report # 3 – Mathematical modeling	Week # 6
-Assessment 4; Report # 4 – Laplace Transformations	Week # 8
-Assessment 5; Report # 5 – System Analysis & Dynamic Response	Week # 10
-Assessment 6; Report # 6 – Applications of dynamic analysis	Week # 12
-Assessment 7; Report # 7–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- Several Class Notes prepared by Associate Professor Dr. Mohsen S. Soliman
2- Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall & PEARSON, 2010.
3-"Instrumentation and Control- Process Control Fundamentals", www.pacontrol.com

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

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