# 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 2015/2016** |
| **Semester (based on final exam timing)** | √ Fall ☐ Spring |

## A- Basic Information

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1. Title:** | **Using Hydraulic Circuits in Automatic Control Of Mechanical Power Systems** | | | | | | | **Code:** | **MEP 562** |
| **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 Hydraulic Circuits as it is applied in automatic control of mechanical power systems. The course uses the Virtual Lab method by a practical on-line interactive PC program. This control Virtual Lab is an E-self-learning type software. The course includes a large number of examples for hydraulic parts and circuits, 3-D animations, e-learning labs, quizzes..etc. This Virtual Lab program along with the course notes & sheets provide a typical example for modern self-learning education techniques for studying and analyzing various aspects related to applications of Hydraulic Circuits in automatic control of mechanical power systems.**

**Course overall aims is to introduce & study basic definitions of Hydrostatics (i.e., Pressure, work, transportation and magnification of force and moment). Hydraulic Power Transportation-Basic Components of Hydraulic Systems-Types of Positive Displacement Pumps(Gear, Vane, and piston pumps)-Types of Hydraulic Actuators (Cylinders, Engines, Semi-rotating Engines)-Pressure control Valves – Directional Control Valves- Flow Control Valves-Non-return Valves–Conditioning of Hydraulic Oils (filters, Heat Exchangers, Tanks)- Oil Piping – Auxiliaries (Accumulators, Manifolds, Flow Meters, Pressure Gauges, Switches)-Hydraulic Symbols – Reading Hydraulic Schematics–Basic Hydraulic Circuits(Direction & Speed Control, 2 cylinders Control, Pumps Curves, Step-displacement diagram, Numbering of Hydraulic Elements).**

**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 Hydraulic control circuits/systems.**
**-Requirements of general interactive virtual lab program to study and analyze control systems.**
**-Basics of on-line interactive virtual lab to study and analyze Hydraulic control circuits/systems.**
**-Basic and essential components of Hydraulic circuits as types of automatic control systems for producing mechanical type outputs.**
**-Various types of positive displacement Pumps, hydraulic actuators, pressure control valves, directional control valves, flow control valves, check or non-return valves, fluid oil conditioning methods, oil conductors, and hydraulic circuit auxiliaries.**
**-Essential hydraulic symbols used for presentation of all types of hydraulic circuits & systems.**
**-Concepts of reading hydraulic circuits schematics for proper analysis of the hydraulic system function, performance and the type of the circuit output.**

**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 using Hydraulic systems.<br>Searching for scientific information and adopting automatic control self-E-learning capabilities.<br>-Analyze and compare the component effects, performance, and efficiency of different types of automatic control Hydraulic circuits/systems.<br>-Apply the concept of software simulation of diagnostics & operation of various types of practical Hydraulic circuits/systems.<br>-Compare between various types of Hydraulic symbols, components, & complete circuits/systems.<br>-Select & apply appropriate Hydraulic symbols, components to design, model, analyze, and solve automatic Hydraulic control problems.<br>-Apply scientific and engineering analysis for Hydraulic circuits/systems |
| | **c) Professional and Practical Skills:**<br>Having successfully completed this course, the student should have the ability to do:<br>-Identify several types of automatic Hydraulic control problems which are essential for design and operation of mechanical power systems and energy transfer processes.<br>-Perform professional design and modelling for different automatic Hydraulic control systems.<br>-Suggest possible alternative solutions for various types of Hydraulic components and parts.<br>-Diagnose efficiency and performance of different types of Hydraulic control circuits/systems.<br>- Analyze different types of Hydraulic symbols, schematics, and control circuits. |
| | **d) General and Transferable Skills:**<br>Having successfully completed this course, the student should have the ability to do:<br>-Perform engineering assembly of different types of Hydraulic parts, schematics, & control circuits.<br>-Transfer knowledge, Work in group, & Communicate in written & oral forms, in English.<br>- Use IT & evolutionary technological tools & PC applications (Excel, Mat lab, Virtual labs, .etc).<br>- Prepare & write reports, Manipulate & sort data, Think logically, and continuous self-E-learning.<br>- Identify practical problems, compare between different technologies for Hydraulic systems.<br>-Organise & manage time & resources effectively; for short-term and longer-term commitments. |

**3. Contents**

| Topics: | Total hrs | Lectures hours | Tutorial/ Practical hrs |
|---|---|---|---|
| -Introduction, Basics and definitions of Hydrostatics(i.e.,work, Pressure, transportation and magnification of force and moment)-<br>-Hydrodynamics (Continuity,Bernoulli's eqn.,Energy, typesof fluid flow)<br>-Methods of Power transportation<br>-Basic components of Hydraulic Systems-Types of Positive Displacement Pumps (Gear, Vane, and piston pumps)- Types of Hydraulic Actuators (Cylinders, Engines, Semi-rotating Engines)-Pressure Valves–Directional Valves–Flow Valves-Non-return Valves – Conditioning of Hydraulic Oils (filters, Heat Exchangers, Tanks)- Oil Piping–Auxiliaries (Accumulators, Manifolds, Flow Meters, Pressure Gauges, Switches).<br>-Hydraulic Symbols– Reading Hydraulic Schematics – Basic Hydraulic Circuits (Direction Control, Speed Control, 2-cylinders Control, Pumps Curves, Step-displacement diagram, Numbering of Hydraulic Elements).<br>-Practical applications of automatic control Hydraulic systems/systems 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; Sheet # 1 – Overview and Fluid Power Physics | Week # 2 |
| -Assessment 2; Sheet # 2 – Pumps and Actuators | Week # 4 |
| -Assessment 3; Sheet # 3 – Pressure Control Valves | Week # 6 |
| -Assessment 4; Sheet # 4 –Directional Control Valves & Flow Control Valves | Week # 8 |
| -Assessment 5; Sheet # 5 – Fluid Conditioning & – Check Valves | Week # 10 |
| -Assessment 6; Sheet # 6 – Accessory Components & Fluid Conductors | Week # 12 |
| -Assessment 7; Sheet # 7 – Understanding Schematics & Basic system Design | Week # 13 |
| -Assessment 8; Report # 8– 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 and Special Reports prepared by Associate Professor Dr. Mohsen S. Soliman.
2- Virtual Lab program by "Interactive Industrial Training, Inc.", *fluidpowerzone.com, a Newport vertical community 1987 north 1120 west Provo, UT 84604*

**7. Facilities Required for Teaching and Learning: Data Show & Laptop Computer to run the Virtual Lab.**

| | |
|---|---|
| Course Coordinator: | Associate Professor Dr. Mohsen S. Soliman |
| Head of Department: | Professor Ashraf S. Sabery |