MET 219: Hydraulics and Pneumatics Technology

(Elective)

Course Description: **MET 219: Hydraulics and Pneumatics Technology. LT: 2 LB: 3 CR: 3.**
This course is directed to study the design, principal of operation and calculation of fluid power systems (hydraulics and pneumatics). In addition, a special attention will be paid to cover the construction, troubleshooting and maintenance of fluid power systems and their industrial applications. Also, the course will cover a good theoretical base of fluid power systems which enables the further study analysis of the static and dynamic performance of different elements of fluid power systems. Together with the theoretical study, the course includes the different case studies of typical industrial circuits. Laboratory sessions involving the use of computers for simulation and analysis of different systems and individual elements performance.

Prerequisite: **MET 211, MET 212**

Textbooks: **Yanbu Industrial College workbooks:**

1. **MET 219:** Hydraulics and Pneumatics Technology: Information Sheets.
2. **MET 219:** Hydraulics and Pneumatics Technology: Laboratory Manual

References:

1. James E. Johnson, "Hydraulics for Engineering Technology", Prentice Hall, 1996.
2. H. L. Stewart, "Pneumatics and Hydraulics", Macmillan Publishing Company, 1987.

Objectives: To enable the students to:

1. Develop a fundamental background in fluid power systems.
2. Understanding the classifications and operation of individual elements of fluid power control systems.
3. Identify and operate fluid power equipments
4. Study and identify the possible troubleshoots to repair and maintain it.

Course Outline:

[I] Modules:

Module	Topic	Duration
1.	Basics of fluid power system (Hydraulics and pneumatics)	1 week
2.	Power transforming elements	2 weeks
3.	Fluid power control Valves (pressure and flow control valves)	2 weeks
4.	Fluid power actuators	2 weeks
5.	Fluid power accessories.	2 weeks
6.	Hydraulics circuits assembly and design	2 weeks
7.	Pneumatics circuits assembly and design	2 weeks

8.	Troubleshooting and maintenance methods	2 weeks

[II] Laboratory Work/Projects:

Exercise	Topic	Duration
1.	Introduction to Hydraulics and Pneumatics Systems.	1 week
2.	Introduction and Operation of the Hydraulics and Pneumatics Benches.	1 week
3.	Operation of a Relief Valve in a Hydraulic Circuit.	1 week
4.	Operation of a Single Acting Cylinder in a Pneumatic Circuit.	1 week
5.	Operation of Directional Control Valves in a Hydraulic Circuit.	1 week
6.	Operation and Application of a Variable Return Orifice Check Valve in a Hydraulic Circuit.	1 week
7.	Speed Control of a Double Acting Cylinder in a Hydraulic Circuit with a 4/2 Way Directional Control Valve.	1 week
8.	Speed Control of a Double Acting Cylinder in a Pneumatic Circuit with a 4/2 Way Directional Control Valve.	1 week
9.	Operation and Position Control of Pilot Controlled Check Valves in a Hydraulic Circuit.	1 week
10.	Semi Automatic Operation of a Double Acting Cylinder in a Pneumatic Circuit.	1 week
11.	Operation of a Meter-in and Meter-out Hydraulic Circuits with a Flow Control Valve.	1 week
12.	Operation of a Hydraulic Motor in a Circuit.	1 week
13.	Operation of a Sequence Valve in a Hydraulic Circuit.	1 week

Evaluation Methods:

1. Major exams and a final exam.
2. Home works and quizzes.
3. Lab work, mid and final lab exams.

Course Learning Outcome:

The expected learning outcome is that the students will be able to:

1. Understand the basic principal of fluid power systems and their advantages and disadvantages.
2. Understand the change in operational conditions on the system's behavior (i.e., temperature, density, viscosity, .etc).
3. Recognize the principal of operation and different types of the mechanical power transformation elements (pumps).
4. Define and use the fluid power control elements (control valve, pressure and flow control valves).
5. Recognize the principal of operation and different types of the fluid power transformation elements (motors and actuators).

6. Understand the industrial application of hydraulic and pneumatic power systems.
7. Model and simulate the fluid power systems.
8. Troubleshoot and effectively carry the necessary maintenance.

Prepared by:

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