Sana'a University
Faculty of Engineering
Mechanical Engineering Department
Mechanical Engineering Program

50. Course Specification of Fluid Power Systems

I. Course Identification and General Information:						
1.	Course Title:	Fluid Power Systems.				
2.	Course Code & Number:	ME325.				
3.	Credit Hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	2	-	3
4.	Study level/ semester at which this course is offered:	Fourth Year - Second Semester.				
5.	Pre –requisite (if any):	ME241 (Fluid Mechanics-I), ME242 (Fluid Mechanics – II) and ME324 (Automatic Control).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof. Dr. Eng. Hamoud A. Al-Nahari				
11.	Date of Approval:					

II. Course Description:

This course introduces the basic components and functions of Fluid Power Systems. Topics include standard symbols, pumps, valves, actuators, FRL, maintenance procedures. The control of Fluid Power Systems and maintenance procedures are introduced. Upon completion, students should be able to understand the operation of a fluid power system, including design, application, and troubleshooting.

III. Alignments of the Course Intended learning outcomes (CILOs)		Referenced PILOs
a1	Define the basic concepts of fluid power systems components.	A3
a2	Explain the operation of systems used to control the fluid power systems.	A4

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b1	Analyze different situations related to fluid power systems.	B2
b2	Explore appropriate solutions to design and trouble-shooting of fluid power systems.	
c1	Employ practical hydraulic and pneumatic components and circuits.	C1
c2	Perform different approaches related to measurements of pneumatic and hydraulic systems.	C2
c3	Choose hardware associated with fluid power systems applications.	
d1	Cooperate in work successfully as a part of a team and prepare the presentations and reports with all facilities.	D1, D5
d2	Review results and defend his ideas.	D4

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Define the basic concepts of fluid power systems components.	• Lectures. • Tutorials. • Interactive class discussion.	• Written tests and quizzes. • Oral discussion. • Presentations.
a2. Explain the operation of systems used to control the fluid power systems.		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Analyze different situations related to fluid power systems.	• Lectures. • Tutorials. • Interactive Class Discussion.	• Written Tests and Quizzes. • Oral Discussion. • Presentations.
b2. Explore appropriate solutions to design and trouble-shooting of fluid power systems.		

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Employ practical hydraulic and pneumatic components and circuits.	• Lectures. • Exercise and Homework. • Laboratory Projects. • Simulation Tools.	• Written Tests and Quizzes. • Laboratory Reports Evaluation. • Presentations Evaluation. • Project Reports.
c2. Perform different approaches related to measurements of pneumatic and hydraulic systems.		
c3. Choose hardware associated with fluid power systems applications.		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Cooperate in work successfully as a part of a team and prepare the presentations and reports with all facilities.	• Lectures. • Presentations. • Laboratory. • Projects Presentation.	• Written Tests. • Laboratory Reports Evaluation. • Presentation Evaluation.
d2. Review results and defend his ideas.		

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Basic Concepts of Hydraulics.	a1	▪ Introduction & Definitions of Important Terms Like Hydraulics, Pressure, Force, Vacuum etc. ▪ Pascal's Law and its Application to Hydraulics. ▪ Advantages and Disadvantages of Hydraulic System. ▪ Hydraulic Oil: Purpose of Hydraulic Oil, Ideal Characteristics of Hydraulic Oil, Maintenance of Hydraulic Oil.	1	2
2.	Hydraulic Pumps and Motors.	a1, a2, b1, b2	▪ Pump Specifications. ▪ Construction & Working of: Gear Pump, Vane Pump, Radial Piston Pump. ▪ Pump Maintenance & Trouble Shooting. ▪ Hydraulic Motor Specifications. ▪ Construction & Working of: Gear Motor, Vane Motor, Radial Piston Motor. ▪ Hydrostatic Transmissions.	2	4
3.	Hydraulic Actuators.	a1, a2, b1, b2, c1, d1, d2	▪ Linear. ▪ Rotary.	1	2
4.	Hydraulic Valves.	a1, a2, b1, b2, c1, d1, d2	▪ Directional Control Valves. ▪ Pressure Control Valves. ▪ Flow Control Valves.	2	4

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5.	Hydraulic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	▪ Simulation using Automation Studio Software. ▪ Regenerative Cylinder Circuit. ▪ Pump-Unloading Circuit. ▪ Hydraulic Cylinder Sequencing Circuit. ▪ Cylinder Synchronizing Circuit. ▪ Fail-Safe Circuit. ▪ Speed Control of Hydraulic Cylinder and Motor.	1	2
6.	Mid-Term Exam.	a1, a2, b1, b2, c1, c2, c3	The First 5 Chapters.	1	2
7.	Hydraulic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	▪ Simulation using Automation Studio Software. ▪ Regenerative Cylinder Circuit. ▪ Pump-Unloading Circuit. ▪ Hydraulic Cylinder Sequencing Circuit. ▪ Cylinder Synchronizing Circuit. ▪ Fail-Safe Circuit. Speed Control of Hydraulic Cylinder and Motor.	1	2
8.	Auxiliary Hydraulic Devices.	a1, a2, b1, b2, c1, d1, d2	▪ Reservoir. ▪ Accumulator. ▪ Pressure Intensifier. ▪ Sealing Devices. ▪ Heat Exchangers. ▪ Pressure Gages. ▪ Flow meters.	1	2
9.	Introduction to Pneumatics.	a1, a2, b1, b2, c1, d1, d2	▪ Principles of Pneumatics. ▪ Comparison with Hydraulic System. ▪ Physical Law of Pneumatics. ▪ Gas Law and Various Processes.	1	2

			▪ Air Compressors: Single Acting and Double Acting. ▪ Components of Pneumatics System. ▪ Air Receiver and Pressure Control. ▪ Stages of Air Treatment: Intercooler, Lubricator, Filter and Air dryer.		
10.	Pneumatic components.	a1, a2, b1, b2, c1, d1, d2	▪ Actuator and Output Device. ▪ Valves and Control Valves: Directional Control valve, Pressure Control Valve and Solenoid Valve. ▪ Sensor: Type and Characteristics of Sensors.	1	2
11.	Pneumatic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	▪ Basic Pneumatic Circuits. ▪ Pneumatic Vacuum System. ▪ Gas Loaded Accumulators.	1	2
12.	Controls of Hydraulic and Pneumatic Circuits.	a1, a2, b1, b2, c1, d1, d2	▪ Electrical Controls. ▪ Logic Control. ▪ Advanced Electrical Controls.	2	4
13.	Final Exam.	a1, a2, b1, b2, c1, c2, c3	▪ All the Chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes
1.	Introduction to Hydraulic Trainer.	2	4	a1, a2, b1, b2, c1, c2, c3, d1, d2
2.	Sequential Control of a 2 Double Acting Cylinders.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
3.	Regenerative and Parallel Circuits.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2

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4.	Hydraulic Motor Circuits.	2	4	a1, a2,b1, b2, c1, c2, c3, d1, d2
5.	Safety Circuits.	1	2	a1, a2, b1, b2, c1, c2, c3,d1, d2
6.	Pneumatic Control of a Double-Acting Cylinder.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
7.	Electro Pneumatics Control Technology.	2	4	a1, a2, b1, b2, c1, c2, c3, d1, d2
8.	Electro Pneumatics Sequential control of a 2 Double Acting Cylinders.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
9.	Pneumatic Sequential Control of a 3 Double Acting Cylinder.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
10.	Electro Pneumatic Sequential Control of a 3 Double Acting Cylinder.	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
11.	Review	1	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures Supported with Discussions, Videos and Seminars.
- Laboratory Work.
- Interactive Class Discussion.
- Simulations Using Computer Software.
- Presentations.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Homework 1	a1, a2, b1, b2, d1, d2	2nd	1.5
2.	Homework 2	a1, a2, b1, b2, d1, d2	3rd	1.5
3.	Homework3	a1, a2, b1, b2, d1, d2	4th	1.5
4.	Homework 4	a1, a2, b1, b2, d1, d2	5th	1.5

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5.	Homework5	a1, a2, b1, b2, d1, d2	6th	1.5
6.	Homework6	a1, a2, b1, b2, d1, d2	7th	1.5
7.	Homework7	a1, a2, b1, b2, d1, d2	8th	1.5
8.	Homework 8	a1, a2, b1, b2, d1, d2	9th	1.5
9.	Homework9	a1, a2, b1, b2, d1, d2	10th	1.5
10.	Homework 10	a1, a2, b1, b2, d1, d2	11th	1.5
Total				**15**

VII. Schedule of Assessment Tasks for Students during the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Homework for every chapter.	Weekly	15	10 %	a1, a2, b1, b2, d1, d2
2.	Project (Single/Groups).	13	15	10 %	a1, a2, b1, b2, c1, c2, c3, d1, d2
3.	Quiz 1.	8	7.5	5 %	a1, a2, b1, b2, d2
4.	Quiz 2.	12	7.5	5 %	a1, a2, b1, b2, d2
5.	Practical.	12-14	30	20%	a1, a2, b1, b2, c1, c2, c3, d2
6.	Mid-Term Exam.	8	15	10 %	a1, a2, b1, b2, d2
7.	Final Exam (theoretical).	16	60	40 %	a1, a2, b1, b2, d2
	Total:		**150**	**100 %**	

VIII.Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- Anthony Esposito, 2014, "Fluid Power with Applications", Prentice Hall.
2- Andrew Parr, 1998,"Hydraulics and Pneumatics", Elsevier (Third Edition).

2- Essential References.

1. Dudleyt, A. Pease and John J. Pippenger, 1987, " Basic Fluid Power ", Prentice Hall.
2. Andrew Parr, 1999, " Hydraulics and Pneumatics ", Jaico Publishing House.
3. Johnson, James L. Introduction to Fluid Power. ISBN 107668-2365-2.
4. Michael J. , Pinches and John G. Ashby, 1989, " Power Hydraulics ", Prentice Hall.

3- Electronic Materials and Web Sites *etc.*

1. Interactive animation of Hydraulic systems: http://home.wxs.nl/~brink494/frm_e.htm

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	2. Glossary of Pumps animation. http://www.animatedsoftware.com/pumpglos/pumpglos.ht 3. The Fluid Power Journal: http://www.fluidpowerjournal.com/-

I. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat**

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	President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi **Name of Reviewer from the Department: Assoc. Prof. Dr. Abdul-Malik Momin**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

50. Template for Course Plan of Fluid Power Systems

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Asst. Prof. Dr. Eng. Hamoud A. Al-Nahari	Office Hours					
Location& Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail	h_nahary@hotmail.com						

II. Course Identification and General Information:

1.	Course Title:	Fluid Power Systems.				
2.	Course Number & Code:	ME325.				
3.	Credit Hours:	C.H				Total Cr. Hrs.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	2	-	3
4.	Study level/year at which this course is offered:	Fourth level - Second Semester.				
5.	Pre –requisite (if any):	ME241 (Fluid Mechanics-I), ME242 (Fluid Mechanics – II) and ME324 (Automatic Control).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	System of Study:	Semesters.				
10.	Mode of delivery:	Lectures and Lab. Work.				
11.	Location of teaching the course:	Mechanical Engineering Department.				

III. Course Description:

This course introduces the basic components and functions of Fluid Power Systems. Topics include standard symbols, pumps, valves, actuators, FRL, maintenance procedures. The control of Fluid Power Systems and maintenance procedures are introduced. Upon completion, students should be able to understand the operation of a fluid power system, including design, application, and troubleshooting.

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IV. Intended learning outcomes (ILOs) of the course:

Brief summary of the knowledge or skill the course is intended to develop**:**

1. Describe and define the basic concepts of fluid power systems components.
2. Explain the operation of systems used to control the fluid power systems.
3. Analyze different situations related to fluid power systems.
4. Explore appropriate solutions to design and trouble-shooting of fluid power systems.
5. Employ practical hydraulic and pneumatic components and circuits.
6. Perform different approaches related to measurements of pneumatic and hydraulic systems.
7. Use hardware associated with fluid power systems applications.
8. Cooperate in work successfully as a part of a team and prepare the presentations and reports with all facilities.
9. Discuss results and defend his ideas.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Week Due	Contact Hours
1.	Basic Concepts of Hydraulics.	a1	• Introduction & Definitions of Important Terms Like Hydraulics, Pressure, Force, Vacuum etc. • Pascal's Law and its Application to Hydraulics. • Advantages and Disadvantages of Hydraulic System. • Hydraulic Oil: Purpose of Hydraulic Oil, Ideal Characteristics of Hydraulic Oil, Maintenance of Hydraulic Oil.	1st	2
2.	Hydraulic Pumps and Motors.	a1, a2, b1, b2	• Pump Specifications. • Construction & Working of: Gear Pump, Vane Pump, Radial Piston Pump. • Pump Maintenance & Trouble Shooting. • Hydraulic Motor Specifications. • Construction & Working of: Gear Motor, Vane Motor, Radial Piston Motor. • Hydrostatic Transmissions.	2nd, 3rd	4
3.	Hydraulic Actuators.	a1, a2, b1, b2, c1, d1, d2	• Linear. • Rotary.	4th	2
4.	Hydraulic Valves.	a1, a2, b1, b2, c1, d1, d2	• Directional Control Valves. • Pressure Control Valves. • Flow Control Valves.	5 th, 6 th	4

5.	Hydraulic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	• Simulation using Automation Studio Software. • Regenerative Cylinder Circuit. • Pump-Unloading Circuit. • Hydraulic Cylinder Sequencing Circuit. • Cylinder Synchronizing Circuit. • Fail-Safe Circuit. • Speed Control of Hydraulic Cylinder and Motor.	7 th	2
6.	Mid-Term Exam.	a1, a2, b1, b2, c1, c2, c3	• The First 5 Chapters.	8 th	2
7.	Hydraulic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	• Simulation using Automation Studio Software. • Regenerative Cylinder Circuit. • Pump-Unloading Circuit. • Hydraulic Cylinder Sequencing Circuit. • Cylinder Synchronizing Circuit. • Fail-Safe Circuit. • Speed Control of Hydraulic Cylinder and Motor.	9 th	2
8.	Auxiliary Hydraulic Devices.	a1, a2, b1, b2, c1, d1, d2	• Reservoir. • Accumulator. • Pressure Intensifier. • Sealing Devices. • Heat Exchangers. • Pressure Gages. • Flow meters.	10 th	2
9.	Introduction to Pneumatics.	a1, a2, b1, b2, c1, d1, d2	• Principles of Pneumatics. • Comparison with Hydraulic System. • Physical Law of Pneumatics.	11 th	2

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			• Gas Law and Various Processes. • Air Compressors: Single Acting and Double Acting. • Components of Pneumatics System. • Air Receiver and Pressure Control. • Stages of Air Treatment: Intercooler, Lubricator, Filter and Air dryer.		
10.	Pneumatic components.	a1, a2, b1, b2, c1, d1, d2	• Actuator and Output Device. • Valves and Control Valves: Directional Control valve, Pressure Control Valve and Solenoid Valve. • Sensor: Type and Characteristics of Sensors.	12 th	2
11.	Pneumatic Circuits and Simulation.	a1, a2, b1, b2, c1, d1, d2	• Basic Pneumatic Circuits. • Pneumatic Vacuum System. • Gas Loaded Accumulators.	13 th	2
12.	Controls of Hydraulic and Pneumatic Circuits.	a1, a2, b1, b2, c1, d1, d2	• Electrical Controls. • Logic Control. • Advanced Electrical Controls.	14 th, 15th	4
13.	Final Exam.	a1, a2, b1, b2, c1, c2, c3	• All the Chapters.	16 th	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Week Due	Contact Hours	Learning Outcomes

1.	Introduction to Hydraulic Trainer.	1st ,2nd	4	a1, a2, b1, b2, c1, c2, c3, d1, d2
2.	Sequential Control of a 2 Double Acting Cylinders.	3rd	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
3.	Regenerative and Parallel Circuits.	4th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
4.	Hydraulic Motor Circuits.	5th , 6 th	4	a1, a2,b1, b2, c1, c2, c3, d1, d2
5.	Safety Circuits.	7 th	2	a1, a2, b1, b2, c1, c2, c3,d1, d2
6.	Pneumatic Control of a Double-Acting Cylinder.	8th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
7.	Electro Pneumatics Control Technology.	9th , 10 th	4	a1, a2, b1, b2, c1, c2, c3, d1, d2
8.	Electro Pneumatics Sequential control of a 2 Double Acting Cylinders.	11 th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
9.	Pneumatic Sequential Control of a 3 Double Acting Cylinder.	12 th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
10.	Electro Pneumatic Sequential Control of a 3 Double Acting Cylinder.	13th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
11.	Review	14th	2	a1, a2, b1, b2, c1, c2, c3, d1, d2
Number of Weeks /and Units Per Semester		**14**	**28**	

VI. Teaching strategies of the course:

- Lectures Supported with Discussions, Videos and Seminars.
- Laboratory Work.
- Interactive Class Discussion.
- Simulations Using Computer Software.
- Presentations.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark

1.	Homework 1	a1, a2, b1, b2, d1, d2	2nd	1.5
2.	Homework 2	a1, a2, b1, b2, d1, d2	3rd	1.5
3.	Homework3	a1, a2, b1, b2, d1, d2	4th	1.5
4.	Homework 4	a1, a2, b1, b2, d1, d2	5th	1.5
5.	Homework5	a1, a2, b1, b2, d1, d2	6th	1.5
6.	Homework6	a1, a2, b1, b2, d1, d2	7th	1.5
7.	Homework7	a1, a2, b1, b2, d1, d2	8th	1.5
8.	Homework 8	a1, a2, b1, b2, d1, d2	9th	1.5
9.	Homework9	a1, a2, b1, b2, d1, d2	10th	1.5
10.	Homework 10	a1, a2, b1, b2, d1, d2	11th	1.5
Total				**15**

VIII. Schedule of Assessment Tasks for Students during the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Homework for every chapter.	Weekly	15	10 %	a1, a2, b1, b2, d1, d2
2.	Project (Single/Groups).	13	15	10 %	a1, a2, b1, b2, c1, c2, c3, d1, d2
3.	Quiz 1.	8	7.5	5 %	a1, a2, b1, b2, d2
4.	Quiz 2.	12	7.5	5 %	a1, a2, b1, b2, d2
5.	Practical.	12-14	30	20%	a1, a2, b1, b2, c1, c2, c3, d2
6.	Mid-Term Exam.	8	15	10 %	a1, a2, b1, b2, d2
7.	Final Exam (theoretical).	16	60	40 %	a1, a2, b1, b2, d2
Total			**150**	**100 %**	

IX. Learning Resources:

- *Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
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1- Anthony Esposito, 2014, "Fluid Power with Applications", Prentice Hall.
2- Andrew Parr, 1998,"Hydraulics and Pneumatics", Elsevier (Third Edition).

2- Essential References.

1. Dudleyt, A. Pease and John J. Pippenger, 1987, " Basic Fluid Power ", Prentice Hall.
2. Andrew Parr, 1999, " Hydraulics and Pneumatics ", Jaico Publishing House.
3. Johnson, James L. Introduction to Fluid Power. ISBN 107668-2365-2.
4. Michael J. , Pinches and John G. Ashby, 1989, " Power Hydraulics ", Prentice Hall.

3- Electronic Materials and Web Sites *etc*.

1. Interactive animation of Hydraulic systems: http://home.wxs.nl/~brink494/frm_e.htm
2. Glossary of Pumps animation. http://www.animatedsoftware.com/pumpglos/pumpglos.ht
3. The Fluid Power Journal: http://www.fluidpowerjournal.com/-

II. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**:

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	Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

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