UNIVERSITI TEKNOLOGI MALAYSIA

UTM SPACE

(salinan pelajar / pensyarah)

Department	:	Mechanical Engineering Department UTM SPACE UTM K.L	**Page** : 1/ 5
Course & Code		Fluid Power (DDJ 3312)	**Semester** : 6
Pre – requisite	:	Fluid Mechanic I (DDJ 2103)	**Academic Year** : 3
Total / Contact Hours		2 hours x 14 weeks	
Total / Tutorial		1 hours x 14 weeks	
		Lectures : 2 hrs Tutorial : 1 hr Lab : Nil	

Objectives

In this course student will :

1. recognize the features of pneumatic and hydraulic equipment.
2. explain the technical requirement and commercial aspects to a proposed system.
3. apply the use of fluid power technology for a given industries.
4. analyses the performance characteristics of pneumatic and hydraulic equipment..

Sypnosis

The introduction of the Fluid Power System, Hydraulic Power Source. Conductor's and the Actuator Control System, Actuator, The design of the Hydraulic and pneumatic system. The design of the Electro-hydraulic and Electro-pneumatic system.

Learning Outcome(Overall for the course)

After completing this course, students should be able to :

1. To select suitable pumps for the hydraulics system.
2. To analyse the fluid power system.
3. To draw a simple and complicated hydraulic and pneumatics circuit.
4. To draw a simple and complicated electro-hydraulic and electro-pneumatics circuit.
5. To design a fluid power system according to the operation requirement.

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Topic	Learning Outcomes *(For the topics)*
1. The Introduction of the Fluid Power System. Introduction. Prospect in Fluid Power Industries. Advantages of the Fluid Power System. Fluid Power Applications. Fluid Power Components	**Hours : 1** **NOSS-MLVK : - N/A** Student will be able to: i. Explain what is fluid power is. ii. Differentiate between hydraulics & pneumatics, iii. Understand the difference between fluid power systems and fluid transport systems. iv. Appreciate the history of the fluid power industry. v. Discuss the advantages and disadvantages of fluid power. vi. Describe key applications of fluid power . vii. Specify the basic components of fluid power systems.
2. Hydraulic Power Source 2.1 Introduction to pumps. 2.2 Classification of hydraulics pumps. 2.3 Gear Pumps. 2.4 Vane Pumps. 2.5 Piston Pumps. 2.6 Various types of Positive Displacement pumps 2.7 Positive Displacement pumps performance. 2.8 Pumps selection. 2.9 Pumps noise. 2.10 Pumps Circuit. 2.11 Pumps prime mover. 2.12 Examples of the Hydraulics Pump Circuit Design.	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Distinguish between positive displacement and dynamic pumps. ii. Describe the pumping action pumps. iii. Explain the operation of gear, vane and oiston pump. iv. Determine the flow rate delivered by positive displacement pump. v. Explain the symbols for hydraulic pumps. vi. Define Shaft Power. vii. Define Fluid power viii. Define volumetric efficiency. ix. Define overall efficiency.
3. Conductor's and the Actuator Control System 3.1 Introduction to the various types of pipes, tubes and hydraulics hoses. 3.2 Conductors sizing. 3.3 Derivation of the Design Formulas. 3.4 Actuator Control System. 3.5 Hydraulics oil reservoir	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Explain the definitions of pipes and tubes. ii. Describe the materials used for pipes and tubes. iii. Describe the methods used to form pipes and tubes. iv. Describe the methods used to join pipes and tubes. v. Describe the various types of fittings used in pneumatics and hydraulics. vi. Explain the purpose of flexible hoses and how to fit them correctly. vii. Explain the importance of clamping pipes and tubes.

Department	:	Mechanical Engineering Department UTM SPACE UTM K.L	**Page** : 3/ 5
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4. Acctuator 4.1 Linear Actuator 4.2 Cylinder Loading/strut 4.3 Semi Rotational Actuators 4.4 Hydraulics Motor	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Revise the basic units and quantities. ii. Explain the working principles of a range of hydraulic and pneumatic cylinders. iii. Describe the construction of cylinders. iv. Describe the seals used in cylinders. v. Describe the ways that cylinders are mounted. vi. Explain the symbols for cylinders. vii. Explain the relationships between pressure, speed, force and flow rate.
5. The Design Of The Hydraulics System 5.1 Design Criteria 5.2 Pressure Intensifier 5.3 Accumulator 5.4 Symbols 5.5 Computational Examples 5.6 Hydraulics Circuit with manual and electrical control: 5.6.1 Single and double acting cylinder simple circuit 5.6.2 Dual Pumps Circuit 5.6.3 Un-loading Pump Circuit 5.6.4 Circuit with Pressure Intensifier 5.6.5 Circuit with Accumulator 5.6.6 Reciprocating Circuit	**Hours : 5** **NOSS-MLVK : - N/A** Student will be able to: i. Explain the principles and symbols of directional control valves. ii. Explain the different port configurations of directional control valves. iii. Explain the different ways valves are moved. iv. Describe the construction of different types of directional valves. v. Explain the importance of standard valve bases and manifolds. vi. Explain the principles and symbols of accumulators. vii. Explain reasons for using accumulators. viii. Explain the purpose of back up gas bottles. ix. Explain the safety aspects involved with accumulators. x. Describe the construction of different types of accumulators.
6. The Pneumatics System 6.1 Introduction 6.2 Pneumatics Power Source 6.3 Fluid Conditioner 6.4 System Air Consumption 6.5 Pneumatics Piping System 6.6 Pneumatics Valves 6.7 Pneumatics Actuators	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Describe further elements needed for controlling pneumatic circuits. ii. Explain the advantages of pneumatics compared to other systems. iii. Explain the classification of pneumatic components. iv. Explain some of the basic principles of control systems.

Department	:	Mechanical Engineering Department UTM SPACE UTM K.L	**Page** : 4/ 5
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7. The Design Of The Pneumatics System 7.1 Introduction 7.2 Plant Lay-out 7.3 Design of the Pneumatics System 7.4 Design Calculations: 7.4.1 Quantity of air flow 7.4.2 Flow through valves 7.4.3 Flow through pipes 7.4.4 Pressure drop through fittings 7.4.5 Cylinder sizing 7.4.6 Cylinder air consumption 7.4.7 Design Study 7.5 Pneumatics Circuit 7.5.1 Direction control 7.5.2 Speed Control 7.5.3 Pilot Operation 7.5.4 Sequential control of actuators 7.5.5 Cascade Circuit	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Define ON/OFF control. ii. Explain sequential operation. iii. Explain opposing signals. iv. Describe methods of overcoming opposing signals. v. Describe the Cascade system of control. vi. Design circuits for sequential control.
8. The Electro-pneumatic System 8.1 Introduction 8.2 Switches 8.3 Solenoids 8.4 Electrical relays 8.5 Solenoid Valves 8.6 Control of Double solenoid 2-position valves 8.7 Electrical Control Circuit 8.8 Control of Single Solenoid Valves 8.9 Relay Circuit 8.10 Cascade circuits using double solenoid valves	**Hours : 4** **NOSS-MLVK : - N/A** Student will be able to: i. Explain the multiple cylinders pneumatics circuit. ii. Explain to your students about the steps diagram and the operational sequences. iii. Know the function switches, solenoids and relays. iv. Explain the relay circuit including the relay latching circuit, and the AND and OR logics. v. Explain about the solenoid valves. Single and double solenoid valves. vi. Draw ladder diagram to activate the circuit vii. Use pressure switches and the time delay relay. viii. Developing the ladder diagram for the multiple cylinders that controlled by the dual solenoid DCV.

Department	:	Mechanical Engineering Department UTM SPACE UTM K.L	**Page** : 5/ 5
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Generic Skills Addressed :

1. Team Working
2. Problem Solving
3. Life Long Learning
4. Communication
5. Ethics

Text Book :

References :

1. Khairur Rijal Jamaludin, Reka Bentuk Sistem Kuasa Bendalir, Penerbitan UTM, 2004.
2. Esposito, A. Fluid Power With Applications, Six Edition, Prentice Hall, 2003.
3. Sullivan, J.A. Fluid Power, Theory and Application, Third Edition, Prentice Hall, 1989.
4. Wan Norsani Wan Nik, Hidraulik Kuasa, Terjemahan dari Power Hydraulics, Pinches, M.J. and Ashby, J.G., Penerbit Universiti Teknologi Malaysia, 1995.
5. Wan Norsani Wan Nik dan Yahaya Ramli, Buku Panduan Kuasa Bendalir, Jilid 1: Reka bentuk sistem, penyenggaraan dan penyelesaian masaalah, Terjemahan dari Plant engineering-Hand book manual, Anton H. Hehn, Penerbit Universiti Teknologi Malaysia, 1999.
6. Pinches, M.J. and Callear B.J., Power Pneumatics, Prentice Hall, 1996.
7. Croser P., Pneumatics, Basic Level Textbook, Festo Didactic, 1989.
8. Karassik, I.J., Krutzsch, W.C., Fraser, W.H., Messina, J.P., Pump Handbook, Second Edition, McGraw-Hill, 1986.
9. Kokernak, Robert P, Fluid Power Technology, Prentice Hall (ISBN 013912487X)
10. Reeves, William W, Technology of Fluid Power, Delmar Publication, 1997 (ISBN 0827366647)

Prepared by	**:**	**Subject Coordinator**	**Certified by**	**:**	**Head Department**
Name	**:**	**DR. SHAMSUL SARIP**	**Name**	**:**	
Signature	**:**		**Signature**	**:**	
Date	**:**		**Date**	**:**	

ASSESSMENT

Assessments	PERDANA	SPACE	PROGRAM KERJASAMA
Test 1	20%	20%	15%
Test 2	20%	20%	15%
Test 3	-	-	-
Assignment	5%	5%	5%
Quiz	5%	5%	5%
Lab / Skills	-	-	-
Lab Report	-	-	-
Project	-	-	-
UTM Evaluation	-	-	-
Course Work	**50%**	**50%**	**40%**
Final Exam	**50%**	**50%**	**60%**
Total	**100%**	**100%**	**100%**

Guideline assessment on UTM evaluation (Collaboration Program) :

Assessment by UTM 60% (if applicable) – please state how the assessment is done

GRADE

PERCENTAGE	GRADE	POINT VALUE
95 - 100	A +	4.00
80 – 89	A	4.00
75 – 79	A -	3.67
70 – 74	B +	3.33
65 – 69	B	3.00
60 – 64	B -	2.67
55 – 59	C +	2.33
50 – 54	C	2.00
45 – 49	C -	1.67
40 – 44	D +	1.33
35 – 39	D	1.00
30 – 34	D -	0.67
0 – 29	E	0.0

Course Plan

WEEK	MEETING	TOPIC	TITLE
1	LECTURE TUTORIAL 1	1	*1. The Introduction of the Fluid Power System.* Introduction. Prospect in Fluid Power Industries. Advantages of the Fluid Power System. Fluid Power Applications. Fluid Power Components
2	LECTURE	2	2. Hydraulic Power Source 2.1 Introduction to pumps. 2.2 Classification of hydraulics pumps. 2.3 Gear Pumps. 2.4 Vane Pumps. 2.5 Piston Pumps. 2.6 Various types of Positive Displacement pumps
3	LECTURE TUTORIAL 2	2	2.7 Positive Displacement pumps performance. 2.8 Pumps selection. 2.9 Pumps noise. 2.10 Pumps Circuit. 2.11 Pumps prime mover. 2.12 Examples of the Hydraulics Pump Circuit Design.
4	LECTURE QUIZ 1 TUTORIAL 3	3	3. Conductor's and the Actuator Control System 3.1 Introduction to the various types of pipes, tubes and hydraulics hoses. 3.2 Conductors sizing. 3.3 Derivation of the Design Formulas. 3.4 Actuator Control System. 3.5 Hydraulics oil reservoir
5	LECTURE TUTORIAL 4	4	4. Acctuator 4.1 Linear Actuator 4.2 Cylinder Loading/strut 4.3 Semi Rotational Actuators 4.4 Hydraulics Motor
6	LECTURE	5	5. The Design Of The Hydraulics System 5.1 Design Criteria 5.2 Pressure Intensifier 5.3 Accumulator 5.4 Symbols 5.7 Computational Examples

7	LECTURE TUTORIAL 5 TEST 1	5	5.8 Hydraulics Circuit with manual and electrical control: 5.8.1 Single and double acting cylinder simple circuit 5.8.2 Dual Pumps Circuit 5.8.3 Un-loading Pump Circuit 5.8.4 Circuit with Pressure Intensifier 5.8.5 Circuit with Accumulator 5.8.6 Reciprocating Circuit
SEMESTER BREAK – 1 WEEK			
8	LECTURE TUTORIAL 6	6	**6. The Pneumatics System** 6.1 Introduction 6.2 Pneumatics Power Source 6.3 Fluid Conditioner 6.4 System Air Consumption 6.5 Pneumatics Piping System 6.6 Pneumatics Valves 6.7 Pneumatics Actuators
9	LECTURE Tutorial 3	7	**7. The Design Of The Pneumatics System** 7.1 Introduction 7.2 Plant Lay-out 7.3 Design of the Pneumatics System 7.4 Design Calculations: 7.4.1 Quantity of air flow 7.4.2 Flow through valves 7.4.3 Flow through pipes 7.4.4 Pressure drop through fittings 7.4.5 Cylinder sizing 7.4.6 Cylinder air consumption 7.4.7 Design Study
10	LECTURE	7	7.5. Pneumatics Circuit 7.5.1 Direction control 7.5.2 Speed Control 7.5.3 Pilot Operation 7.5.4 Sequential control of actuators 7.5.5 Cascade Circuit
11	LECTURE **Test 2**	8	**8. The Electro-pneumatic System** 8.1 Introduction 8.2 Switches 8.3 Solenoids 8.4 Electrical relays 8.5 Solenoid Valves
12	LECTURE	8	8.6 Control of Double solenoid 2-position valves 8.7 Electrical Control Circuit

			8.8 Control of Single Solenoid Valves 8.9 Relay Circuit 8.10 Cascade circuits using double solenoid valves
13	LECTURE Tutorial 5	9	1. Revision
14	LECTURE		2. Revision
STUDY WEEK - 1 WEEK			
FINAL EXAM - 2 WEEKS			

Course Requirement :

1. Seminar for students :
   - Payment for Speaker (RM ……)
   - Token (RM ….)

2. Students visit
   - Transportation (provided by UTM)
   - Lodging (Payment by students)

3. Project
   - Component (claim to UTM max : RM50.00)

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