FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2018/2019 B.Eng. DEGREE EXAMINATION
COURSE: MCE 314: Mechatronics Laboratory I
INSTRUCTION: Attempt ALL QUESTIONS.
TIME ALLOWED: 3 Hours

Question One (Hydraulic System Design) (15 Marks)

Figure Q1 depicts an experimental setup of a hydraulic system during which the observations on Table Q1 were recorded. Based on this premise, answer the following:

i.   Calculate the force of the piston, applied during its activation and deactivation mode given the diameter of piston equal 75mm. (8 Marks)
ii. Identify any three components in the experimental setup. (3 Marks)
iii. State the functions of the components identified in (ii) in the experimental setup. (4 Marks)
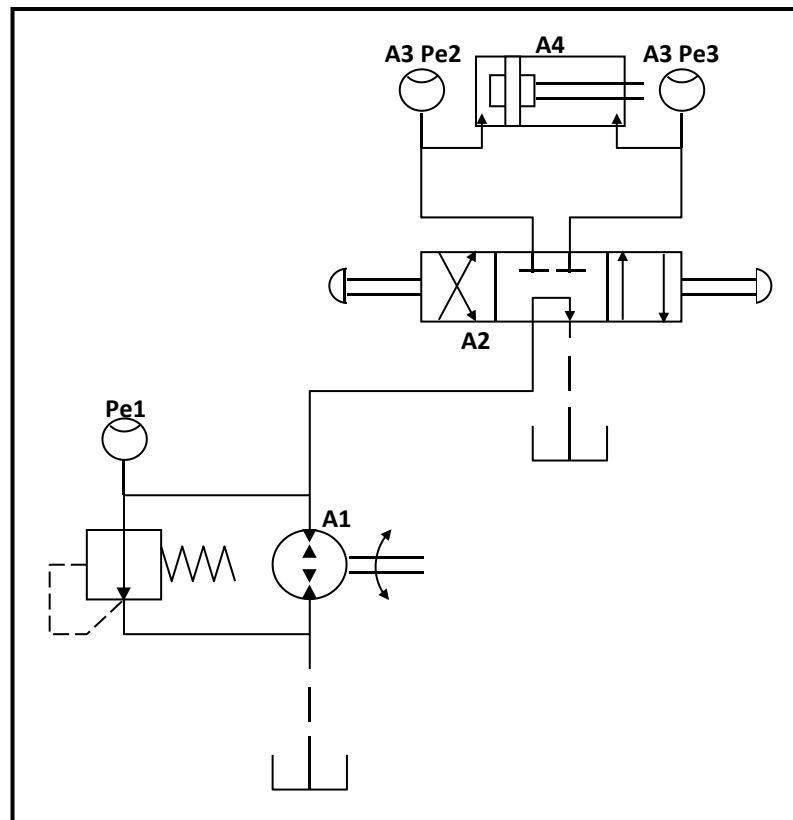
Figure Q1.

Table Q1.

| Toggle switch	Pe 2 (bar)	Pe 3 (bar)	Force, F
Handle raised	25	-	?
Handle lowered	-	20	?

Question Two (System Design) (20 Marks)

i. The University is currently faced with the challenge of poor of electric energy management; thus, you have been contacted to help design a switching system to help turn on and off lighting points within the university facility using a simple AND & OR Gates. Use appropriate block diagram/ schematic diagram where necessary to justify your design. (10 Marks)

ii. Given a Light Dependent Resistor (LDR), a Voltage Source and a Wheatstone bridge of resistors, design a light dependent control switching system. (10 Marks)

Question Three (Fundamentals of Hydraulic and Pneumatic systems) (15 Marks)

i. In your own words, explain the difference between Hydraulic and Pneumatic Systems (2 Marks)

ii. Identify, three (3) areas of application with two (2) examples each of Hydraulic and Pneumatic systems. (4 Marks)

iii. Identify four (4) main components of the Pneumatic Actuation System. (4 Marks)

iv. What are the characteristic advantages of Hydraulic systems over Pneumatic system? (2 Marks)

v. State 4 precautions to be taken when working on Pneumatic and Hydraulic systems. (3 Marks)

Question Four (Actuation Components identification) (10 Marks)

i. Identify the components labelled A, B, C and D. (5 Marks)
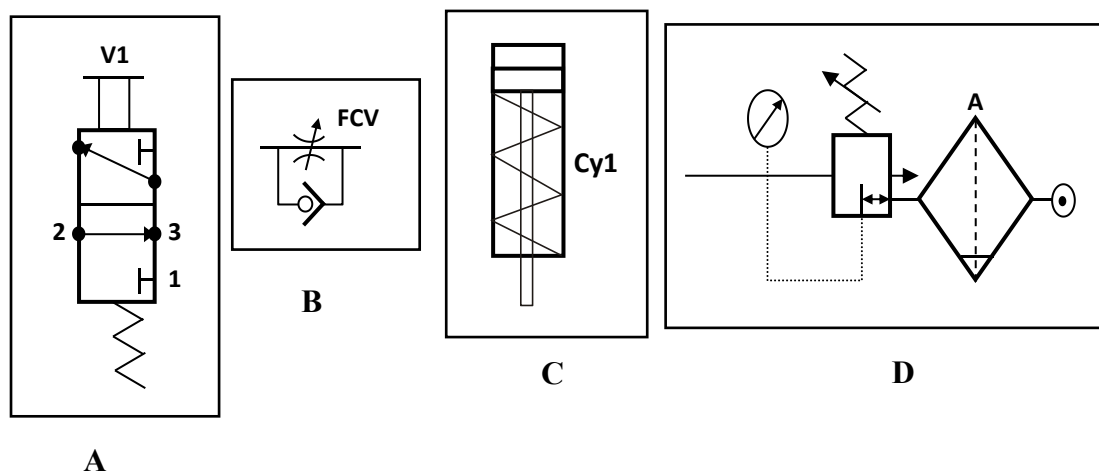
ii. Design a simple pneumatic circuit using the components in Q4(i). (5 Marks)

Question Five (Lathe and Milling Machine) (20 Marks)

i. Identify Four (4) parts of a Lathe Machine and state the functions of these parts. (4 Marks)

ii. Define the following CNC CODES: M4, M5, G0, G1, S, F (6 Marks)

iii. State two (2) precautions to be taken when working on the lathe and milling machine. (2 Marks)

iv. It is required to engrave the first letter of the university's name on a flat surfaced workpiece. Write the corresponding CNC Codes for this operation. [Assume any dimension of your choice] (8 Marks)

Question Six (Fundamentals of Electric Actuation Systems) (20 Marks)

i. In your own words explain how an electric motor works. (5 Marks)

ii. State the functions of the main parts of an electric motor. (5 Marks)

iii. Compare and Contrast between Electric Generator and Electric Motor. (5 Marks)

iv. Compare and Contrast Dynamo and Alternators. (5 Marks)