Menoufiya University		Dept.: Mech. Power Engineering
Faculty of Engineering		Year : Second
Shebin El- Kom		Subject: Mechatronics
Final Second Term Examination	Minufiya University	Code : MPE 224
Academic Year: 2014-2015		Time Allowed: 3 hours
Date: 7/6/2015		Total Marks : 85 Marks
Examiner: Dr/ Mohamed Hesham Belal		

Answer All The Following Questions:

Question No.(1):   [20 Mark]

(a)- [5]- Explain the terms: Mechatronics – Robot and Robotic – Resistance and Capacitance of Liquid-Level Systems.

(b)- [5]- Show with the aid of a net sketch an example for a simple mechatronic system used to maintain a constant speed of rotation of a shaft, then explain how the control system is operated?

(c)- [10]- Define the mathematical model and transfer function, Then obtain the transfer function for the electrical network as shown in Fig.(1).

Question No.(2):   [20 Mark]

(a)- [5]- Describe the major parts of robots, and classify the main groups of robot systems?

(b)- [5]- In logic systems, define logic gate and truth table. And explain with the aid of clear drawing and truth tables the following logic gates: AND, NOR, EXOR gates.

(c)- [10]- For the 3-DOF (RPR) manipulator arm shown in Fig.(2),
1- Assign frames and tabulate the joint-link parameter,
2- Determine the transformation matrices relating successive links,
3- Obtain the orientation and position of the end-effector relative to the base,
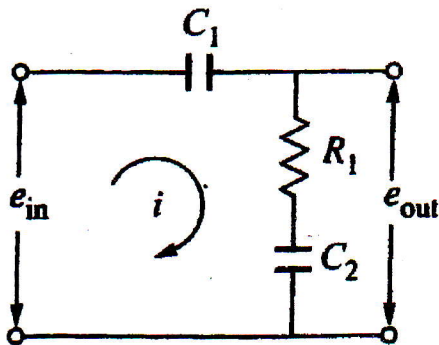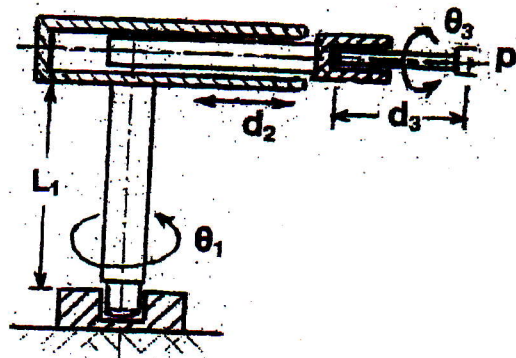4- Check the correctness of the results and describe it at the home position.

Fig.(1)

Fig.(2)

Question No.(3):   [25 Mark]

(a)- [5]- Draw the circuits for (P, I and D) electronic amplifiers and derive the transfer function for each?- And what are the advantages of analog-to-digital converter.

(b)- [5]- Define the automatic controller showing its important functions. Then classify them showing the advantages for each type.

(c)- [5]- For Data Acquisition System (DAS): define DAS, draw the block diagram of generalized DAS showing the function of each stage, classify DAS with comparison and what type is used nowadays and why.

Page (1/2)

(d)- [10]- Describe the block diagram and use the block diagram reduction technique to obtain the overall transfer function of the control system shown in the Fig.(3).

Fig.(3)
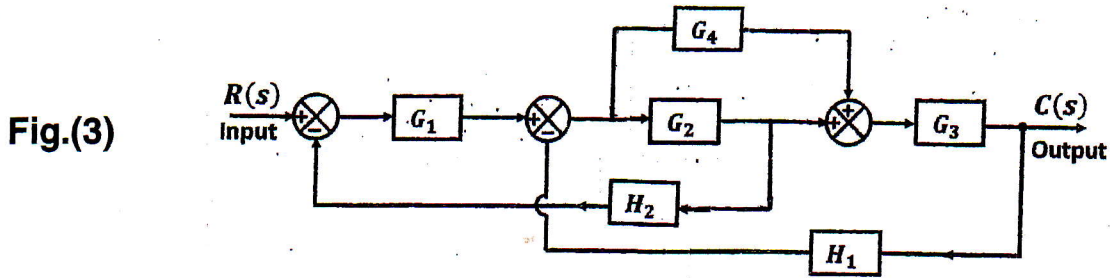
## Question No.(4):   [20 Mark]

(a)- [5]- In industrial applications, tabulate the comparison between pneumatic systems and hydraulic systems, and show the conditions for using him in robots.

(b)- [5]- Sketch and derive the block diagrams for the following cases: 1- Liquid Level of a laminar flow in a single tank, and   2- Pneumatic proportional controller.

(c)- [10]- For the position control system shown in Fig.(4), the input angular displacement r and the output linear displacement y are converted to electrical signals throughout two potentiometers of constant K_p. An electronic differential amplifier of constant K_a is used for the error signal amplification. The amplified signal is fed to an electric solenoid of resistance R, inductance L and back emf constant K_v. The solenoid with a shaft has a mass of M and the force developed by the solenoid is proportional to the armature current, where K_f is proportionality constant. The solenoid force has been transmitted to a mechanical system with spring of stiffness k and damping coefficient b. The input signal displacement of hydraulic servomotor is x and the output is y and has a total constant K_h.

    1- Write the time-domain system equations,

    2- Draw a detailed block diagram that shows the transfer functions for each block and all variables explicitly.

Fig.(4)
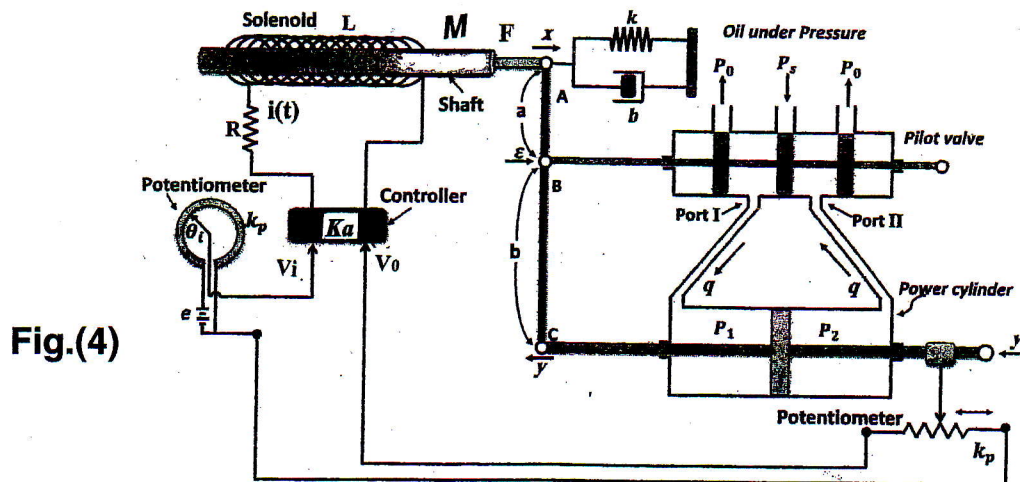
With my best wishes

This exam measure the following ILOs											
Question No.	Q1-a	Q2-a	Q3-a	Q4-a	Q1-b	Q2-b	Q3-b-c	Q4-b	Q1-c	Q2-c	Q3-c	Q4-c
	a-1	a-1	a-12	a-19	b-1	b-8	b-12	b-12	c5	c15	c15	c16
Skills	Knowledge & Understand				Intellectual				Professional			