Student ID	

University of Bedfordshire

Unit Code:	CIS108-2
Unit Title	Dynamics, Measurements and Control
Academic Year	2021/22
Period of Study	**SEM 1 Paper 1**

Time Allowed:	2 HOURS
Unit Co-Ordinator:	Dr Mina Mortazavi

Instructions for Candidates

Do not open this paper until instructed to do so by the Senior invigilator

Equipment allowed:	Basic, non-programmable Calculator
Materials allowed:	*None*
Materials supplied	*Formula sheet supplied*
Additional Instructions:	Type of Exam: This is a closed book examination

There are TWO sections:

Answer All questions from section A and THREE out of FOUR questions from Section B

Section A: SHORT ANSWER QUESTIONS

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- ***Answer All Questions in SECTION A***
- ***Each question carries 5 marks***

Question 1

Find the equivalent resistor (R total) for the network presented in Figure 1A.

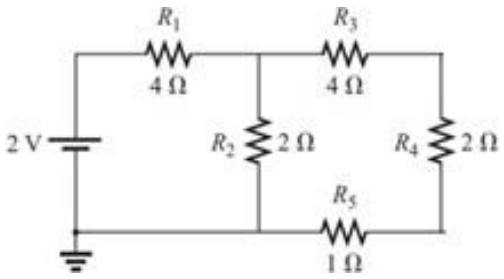


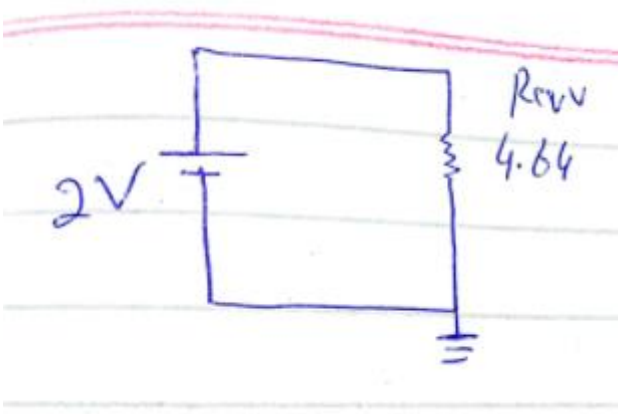
Figure 1A

[5 Marks]

Ans;
Equation R

= R3 +R4+ R3
=4+2+1
=7

Req= R2 + Req
=1/2 + 1/7
=9/14
= 0.64
Req= 9/14 +4
= 9+56/14
= 65/14
Req = 4.64



Question 2

You have been given a task to select a sensor; name four different selection criteria for your sensor selection, briefly explain two of them.

[5 Marks]

Ans;

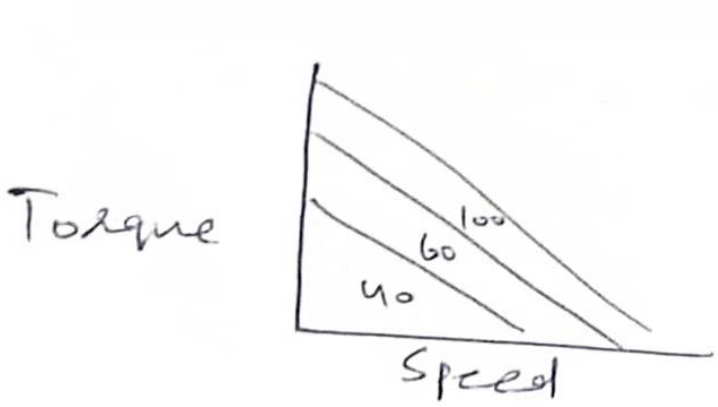
1. Temperature
2. Size
3. Protection Glass
4. Discrete or analog input

Question 3

Using a simple diagram, briefly explain the speed- torque relation for a DC motor.

[5 Marks]

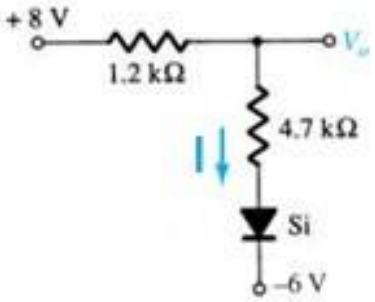
Ans;



DC motors are relatively simple machines.
When supply voltage is constant, the Torque T is inversely proportional to speed W.

Question 4

For the circuit presented in Figure 2A, find the current I and V_o, if the diode is a silicon type
($V_D = 0.7\ volts$)



[5 Marks]

Ans;

Vd = 0.7V
I = V1R1 - V2R2
=8×1.2 -4.7×0.7
=9.6 - 3.29
=6.31
V = Vin - Vg
=8 - 6
V=2V

Question 5

Overall transfer function for a control system is given by: $T(s) = \frac{3}{s^2+8s+3}$.

Considering the damping factor, which type of the system, this transfer function demonstrates?

[5 Marks]

Ans:

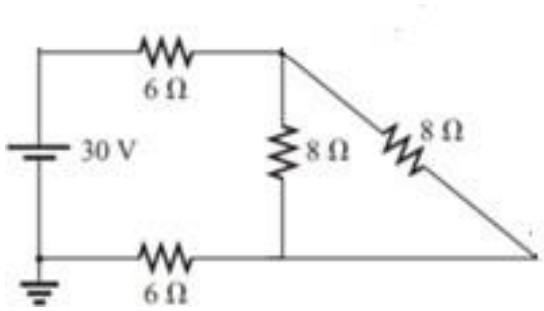
T(s)= 3/ s2+8s+3
T(s) =8/2 =4
T(s) =4>1
So overdamped

Section B: LONG ANSWER QUAESTIONS

- ***Answer any 3 (THREE) questions only.***
- ***Each question carries 25 marks.***

Question 1

a) Find the total current and the total power dissipated in circuit of Figure 1B.



[12 Marks]

Ans:

(a) $V = 30V$

$R = \frac{8 \times 8}{8+8}$

$= \frac{64}{16} \quad \frac{32}{8} = 4$

$= 4 + 6 + 6$

$= 16$

$RI = V$

$I = \frac{V}{R}$

$= \frac{30}{16}$

$= 1.87$

$Power = V^2 I$

$= (30)^2 \times 1.87$

$= 1687.5\ W$

b) Figure 2B presents a bridge circuit to measure the temperature.
If Rsensor is 650 Ω, calculate the V_{output}.

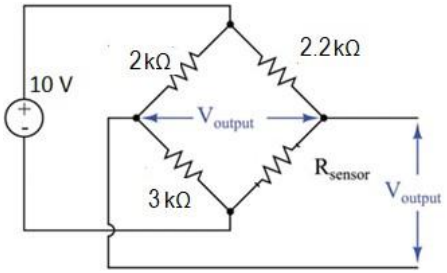
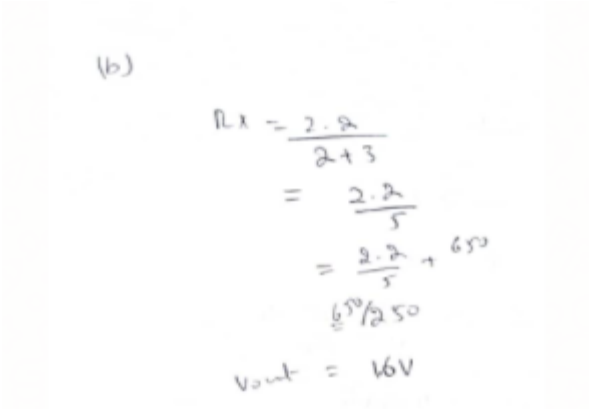


Figure 2B

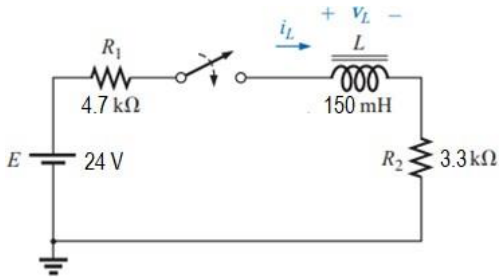
[5 Marks]



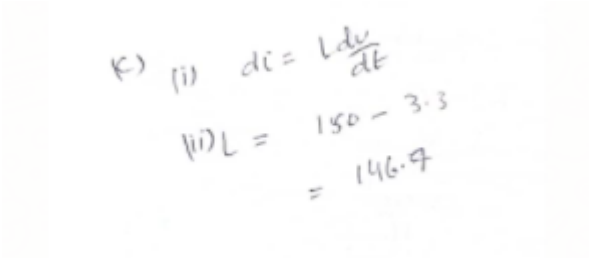
c) For the network of Figure 3B,

i. write the mathematical expressions for the current iL and the voltage VL following the closing of the switch.

ii. How long does it take for the iL to reach its maximum level?



[8 Marks]



Question 2

a) Find the equivalent capacitor between terminal **A** and **B** in Figure 4B. If a voltage of 40 V is applied across the terminal **AB**, calculate the energy stored in equivalent capacitor in Joules.

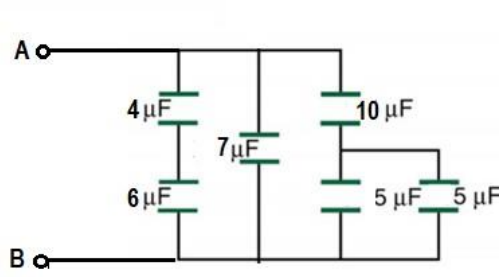
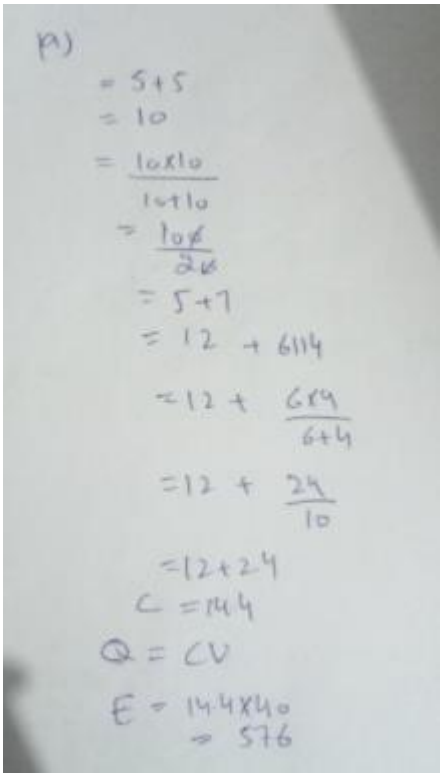


Figure 4B



b)

The combinational logic system presented in Figure 5B, accepts 2-bit binary numbers. Complete the Truth table below for this system.

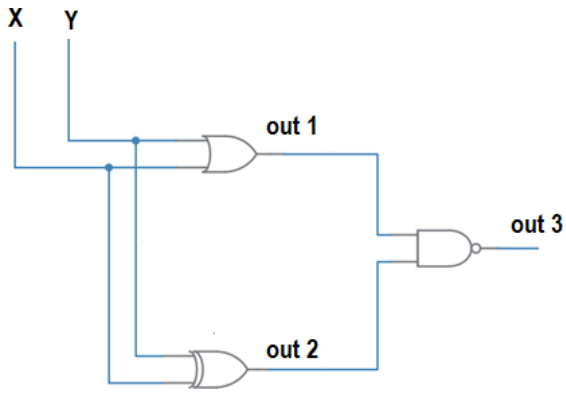
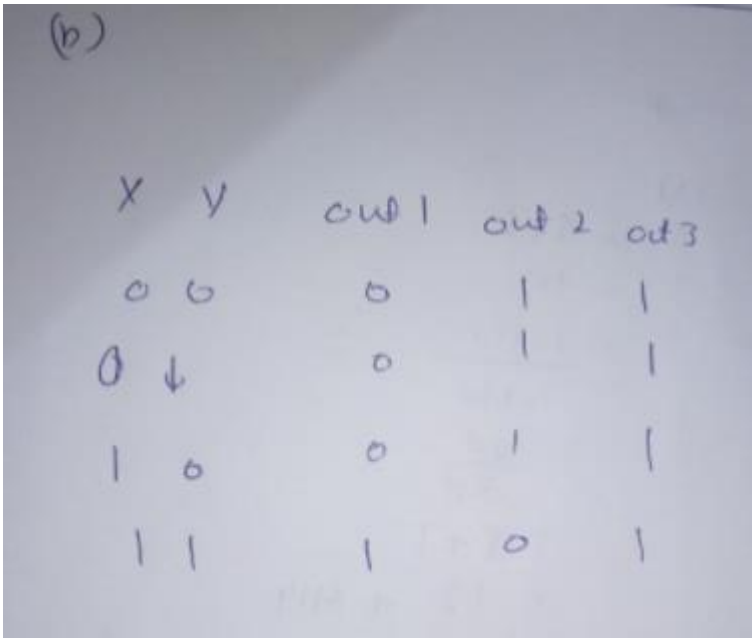


Figure 5B

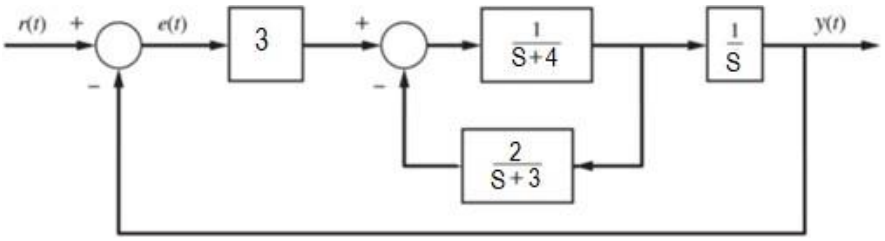
X	Y	Out 1	Out 2	Out 3
0	0			

0	1			
1	0			
1	1			



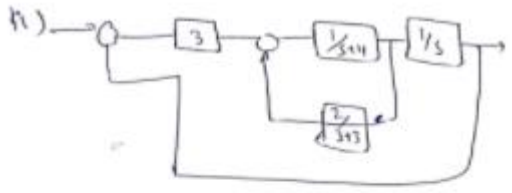
Question 4

a) Find the close loop transfer function for the system presented in Figure 7B.

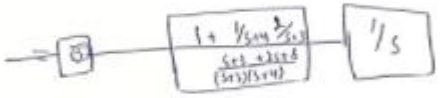


[10 Marks]

A)



$\frac{1}{s+4}$ and $\frac{2}{s+3}$ are ||



Now all are in series

$$= 3 + \frac{1+\left(\frac{1}{s+4}\right)\left(\frac{2}{s+3}\right)}{\frac{3s+11}{(s+3)(s+4)}} + \frac{1}{s}$$

$$= 3 + \frac{1+\frac{3}{3s+1}}{} + \frac{1}{s}$$

$$= 3 + \frac{4}{3s+1} + \frac{1}{s}$$

$$= \frac{9s+3+4+2s+1}{3s+1}$$

$$= \frac{11s+9}{3s+1}$$

b) Using Routh-Hurwitz method, determine if the control system presented in Figure 7B is stable or not. Why?

[8 Marks]

Routh-Hurwitz method, so its not stable.

c) Using a general diagram, present main components of a pneumatic actuator.

[7 Marks]

T-domain	S- domain	T-domain	S-domain
1	$\frac{1}{s}$	$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
t	$\frac{1}{s^2}$	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
e^{-at}	$\frac{1}{s+a}$	$e^{-at} \cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$	$\frac{df(t)}{dt}$	$sF(s)-f(0)$

Formula Sheet

$U = ½CV^2$

$\varepsilon\varepsilon_0 = 8.854 \times 10^{-12}$

$\mu_0 = 4\pi \times 10^{-7}$ H/m