

Solve all problems.

Assume any missing data.

Draw all figures those are used to solve the problems.

Problem (1) (25 Degrees).

- a) A drop of water at 20 °C is forming under a solid surface. The configuration just before separating and falling in the air as a drop is shown in Fig. (1). Assume the forming drop has the volume of a hemisphere and the surface tension of water at this condition is 0.073 N/m. What is the diameter of the hemisphere just before separating?

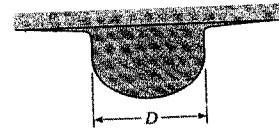


Fig. (1)

- b) For the closed tank with Bourdon-tube gages tapped into it Fig. (2), what is the specific gravity of the oil and the pressure reading on gage C?

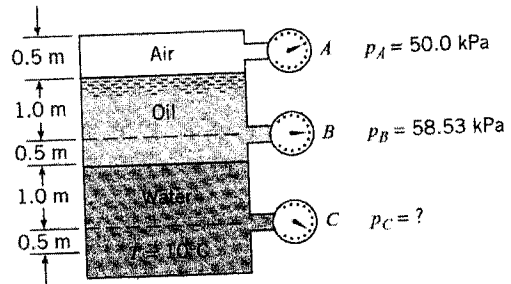


Fig. (2)

Problem (2) (25 Degrees).

- a) A gas flows along the x axis with speed of $V = 5x$ m/s and a pressure of $p = 10x^2$ N/m², where x is in meters. (i) Determine the time rate of change of pressure at the fixed location at $x = 1$. (ii) Determine the time rate of change of pressure for a fluid particle flowing past $x = 1$. (iii) Explain without using any equations why answers in parts (i) and (ii) are different.

- b) Find the vorticity components at a point ($x = 1$, $y = 1$, $z = 1$) for the following flow field; $\mathbf{u} = 2x^2 + 3y$, $\mathbf{v} = -2xy + 3y^2$, and $\mathbf{w} = 1.5z^2 + 2xz - 9y^2z$.

Problem (3) (25 Degrees).

This bend discharges water into the atmosphere. Determine the force components at the flange required to hold the bend in place. The bend lies in a horizontal plane. Assume viscous forces are negligible. The interior volume of the bend is 0.25 m^3 , $D_1 = 60 \text{ cm}$, $D_2 = 30 \text{ cm}$, and $V_2 = 10 \text{ m/s}$. The mass of the bend material is 250 kg .

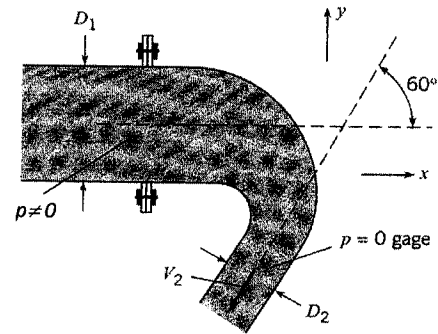


Fig.(3)

Problem (4) (25 Degrees).

- a) A steady, fully developed, laminar flow of incompressible fluid is directed between two fixed, infinite, parallel plates as shown in Fig. (4).

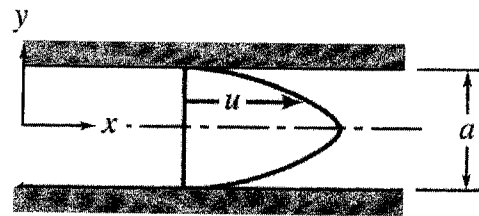


Fig. (4)

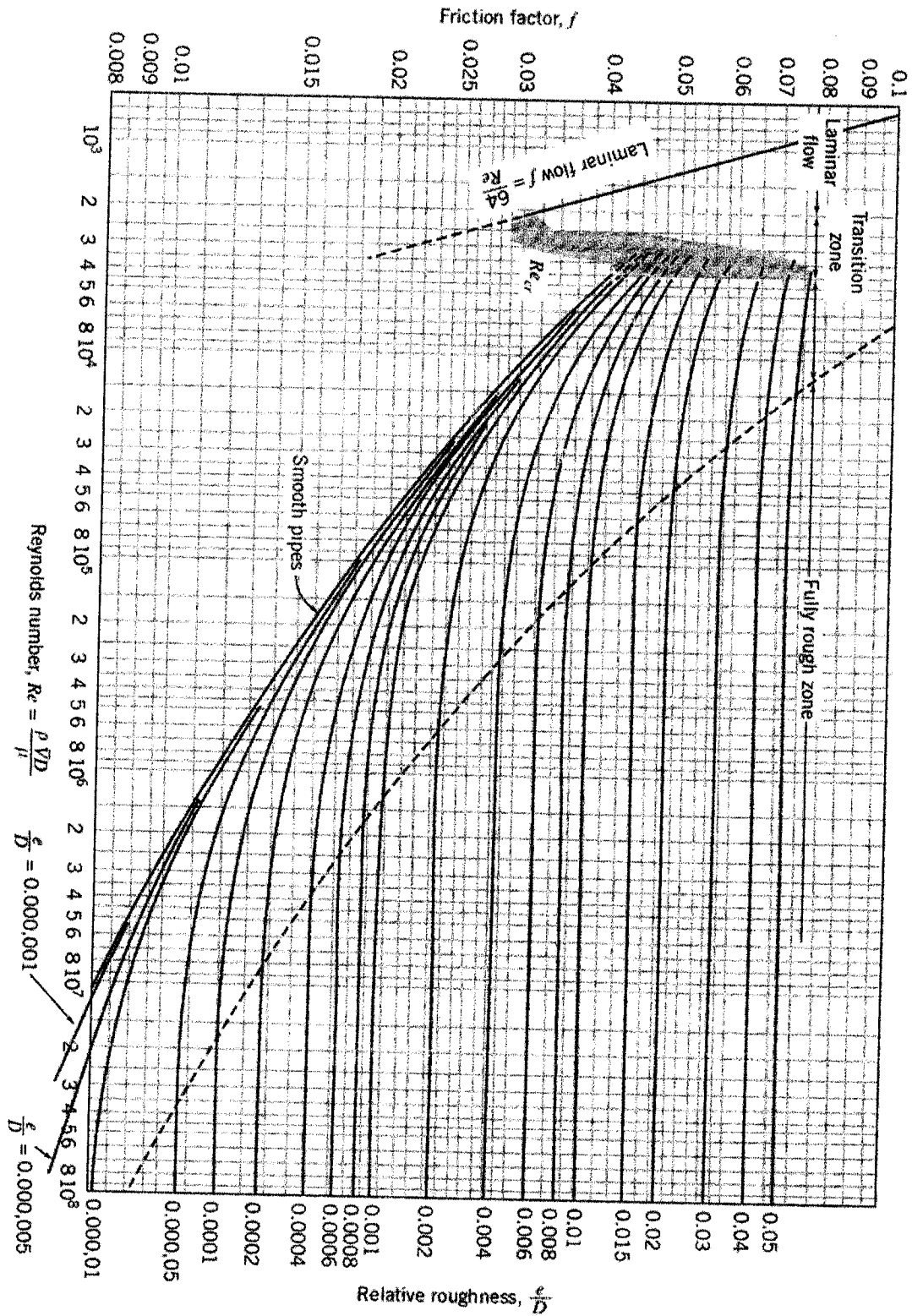
Derive an expression for the velocity as a function of y , $u = f(y)$, by applying

the momentum equation on an infinitesimal element, then compute the shearing stress distribution at any point, and the flow rate per unit length.


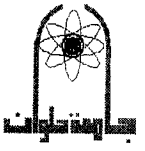
- a) A hydraulic system operates at a gage pressure of 20 Mpa and $55 \text{ }^\circ\text{C}$. the hydraulic fluid is SAE 10W oil. A control valve consists of a piston 25 mm in diameter, fitted to a cylinder with a mean radial clearance of 0.005 mm . Determine the leakage flow rate if the gage pressure in the low pressure side of the piston is 1.0 Mpa . (The piston length = 15 mm long).

Good Luck; Osama Khorais

Handwritten signature: Osama Khorais



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 كلية الهندسة بحلوان	Dept/Division : MECHANICAL ENG. Mechatronic Engineering	 جامعة أسيوط	
	Academic level: Third Year		Semester: First 2015/2016
	Course code & title: MEC 7314 -- QUALITY CONTROL		
	Instructor: Dr. Ahmed Abd Elmoaty -- Dr. Ahlam Abo Shady		
Total mark: 70 mark		Time allowed: 3 hrs	

Instructions:

مصرح باستخدام الجداول

Part 1

Answer the following questions

Question #1 (Mark 13)

- a- Explain: the AOQ curve, Inspection levels
- b- Construct the OC curves for the single sampling plan $N= 1600$, $n= 70$ and $C= 3$. Use about 5 points
- c- Design the sampling plans has the following specifications.

Types of samples	N	AQL	α	P_1	β	P_2	N_2	INSP.LEVEL
1 -Single sample	1220 units	0.65	-----	0.04	0.2	-----	----	II
2 -Double sample	3650 units	----	0.05	0.02	0.1	0.082	$2N_1$	II
3 -Single sample	1500 units	-----	0.05	0.04	0.30	0.35	$2N$	-----

d- The last 10 lots have had the following number of observed defectives"

0, 1, 0, 3, 0, 4, 5, 4, 2, and 0

What sequence of Normal, Tightened and Reduced inspection plans were used.

Question #2 (Mark 13)

- 1. Explain: The life history curve.
- 2. Define: Mean time between failure, and The types of reliability systems
- 3. The following system consists of Fourteen components are arranged in series with the following information.

Comp. Identification	1	2	3	4	5	6	7	8
λ (t=200)	0.0051	0.058	0.043	0.048	0.0062	0.028	0.071	0.0083
Cost /unite \$	9	7	6	14	4	12	3	3
Quantity	2*	1	2*	1	3*	1	1	3*

All numbers of components mark * are parallel redundancy.

- 1. If these data follows the exponential distribution, Determine system's Failure Rate and MTTF at time 200 hours for Present system.
- 2. Determine system's reliability and unreliability
 - a- For present system
 - b- For system with components 2 and 6 tripled (Tripling is accomplished through parallel redundancy)
 - c- Calculate the total cost of the system.

Question #3 (Mark 9)

- 1- Define:
 - a- Third party audit, Tow types of international standard for automotive industry systems.
 - b- Essential components for any QA systems.
 - c- Vendor and Vendee relationship
- 2- Explain:
 - a- Three types of QA functions.
 - b- Types of recourse management.

Part 2

Question #4 (Mark 15)

- 1- What constitutes a cause and effect relationship?
- 2- Surface defects have been counted on 25 rectangular steel plates, and the data are shown below. Set up a control chart for nonconformities using these data.

Does the process producing the plates appear to be in statistical control?

Plate Number	No. of nonconformities	Plate Number	No. of nonconformities
1	1	14	0
2	0	15	2
3	4	16	1
4	3	17	3
5	1	18	5
6	2	19	4
7	5	20	6
8	0	21	3
9	2	22	1
10	1	23	0
11	1	24	2
12	0	25	4
13	8		


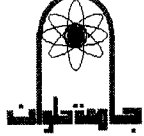
Question #5 (Mark 10)

1. Diodes are produced in lots of size 1000. We wish to control the process of producing these diodes by taking sample of size 64 from each lot. If the nominal value of the fraction nonconforming is $\bar{p} = 0.1$.
 - a) Determine the parameters of the appropriate control chart.
 - b) What is the minimum sample size that would give apposite lower control limit for this chart?

Question #6 (Mark 10)

Control chart for \bar{X} and R are maintained on a certain dimension of a product measured in inches, the subgroup size is 4. The values of \bar{X} and R are computed for each sub group, after 20 subgroup the $\sum \bar{X} = 41.340$ and $\sum R = 0.320$, compute the values of 3 sigma limits for the \bar{X} and R charts, and estimate the value of the standard deviation on the assumption that the process is in statistical control.

٢ ص١٦ / ١ / ١٦ دوائر ميكانيكية

 كلية الهندسة بحلوان	MECHANICAL ENGINEERING Dept-Mechatronic Section		
	Academic level: Third First term- Jan 2016		
	ELC7311	Interfacing circuits	
	Instructors:	Dr. Rania Darwish	
	Final Exam	Three hours	

Question 1: [15 points]

- Conduct a comparison between isolated input/output and memory mapped input/output interfacing techniques.
- Describe the operation performed by the following instructions:

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MOV DX, 0300H
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IN AL, DX
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- For a certain Mechatronic application, design an interface circuit using Isolated Input Output technique. The designed circuit should comprise four input ports with base address (0300H), and four output ports with base address (0300H). Also, implement a C++ program that reads an input value from the input port with an address (0300H). Then, as long as the inputted value does not exceed 255, the program outputs the inputted value on port number (3001 H). Assume one second delay between successive outputs.

Question 2: [15 points]

- Discuss DMA definition and operation in brief.
- Design an interface circuit to control the rotation of four stepper motors using Isolated Input Output technique. Then, develop a C++ program to successively rotate the stepper motors in a clock wise direction (i.e. only one motor will rotate at a time). The rotation sequence of the stepper motors should continue as long as no hitting for any key at the keyboard occurred.

Assume:

- The port addresses are (0300H, 0301H, 0302H, and 0303H).
- Clockwise Sequence is (01, 02, 04, 08).
- A time delay of two seconds separates successive motors' rotations.



Question 3: [15 points]

- Describe in details the typical data transmission session through a parallel port during sending a character to the printer.
- Develop a C++ program that successively sends to a printer through a parallel port the following characters A, B, C, D, and E.

Question 4: [15 points]

- a. Discuss with the aid of functional block diagram the organization and architecture of Programmable Peripheral Interface IC (PPI 8255).
- b. An 8255 Programmable Peripheral Interface IC is used with Port A input, Port B and Port C **output**.
 - Design the required format of the control word to program the 8255 chip for this mode of operation.
 - For a certain automatic control operation, develop a C++ program to control the rotation of two stepper motors connected to Port B, and Port C. The operation should go as follows: if integer 1 is read at input Port A, stepper motor 1 connected to Port B begins to rotate in clockwise direction, and if integer 2 is read at input Port A, stepper motor 2 connected to Port C begins to rotate in clockwise direction.

Assume that: addresses for Port A, Port B, Port C, and CR are as follows: 0300H, 0301H, 0302H, and 0303H. Clockwise Sequence is (01, 02, 04, 08).

 Helwan University	Department	Mechanical Eng. "Mechatronics"	Division	Mechatronics	
	Course Title	Power Electronics			
	Academic Level	Third	Semester	First 2015-2016	
	Course Code	Pow 7313	Exam Marks	100 marks	
	Instructor(s)	Dr. Mohamed N. Elzamy & Dr. Abdalla A. Sayed, & Dr Ahmed Ayman			
	Instructions		Time Allowed	3 hours	

Question 1 (17degree)

(a) Describe briefly the static (i-v) characteristics of thyristor and explain what is meant by holding current.

(b) Draw and explain briefly SCR gate triggering circuit using pulse signal with UJT oscillator.

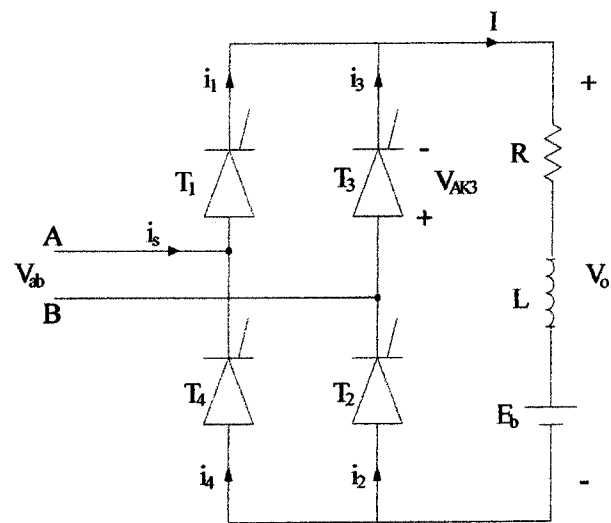
(c) In the single phase rectifier circuit shown in fig.(1) the inductance L is so large such that the current

I is maintained constant.

- i. Derive an expression for the average value of load voltage V_o
- ii. Calculate the average and rms values of i_2
- iii. Calculate the rms value of i_s and the power factor at the AC terminal.
- iv. Sketch the waveforms of V_{ab} , V_o , I , i_4 , i_s and V_{AK3}

$$V_{ab} = 110\sqrt{2} \sin \omega t \quad \alpha = 45^\circ \quad R = 5 \Omega$$

$$E_b = 25 \text{ V}$$

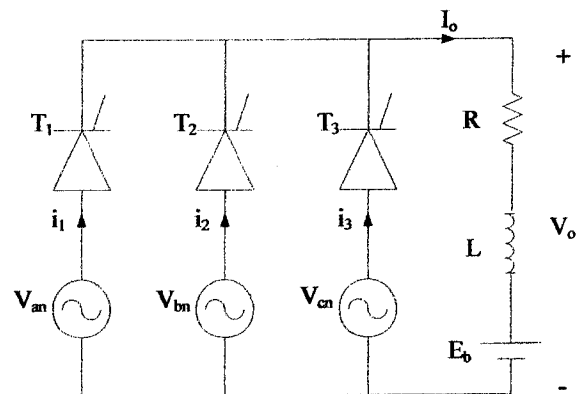


fig(1)

Question (2) (17 degree)

In three phase rectifier circuit shown in fig.(2), $E_b = 20 \text{ V}$, $R = 10 \Omega$ and L is so large such that the current I_o is maintained constant. Calculate for $\alpha = 60^\circ$

- i. The average value of I_o
- ii. The rms value of current i_1
- iii. Sketch waveforms of V_{an} , V_{bn} , V_{cn} , V_o , V_{AK2} and i_3 .



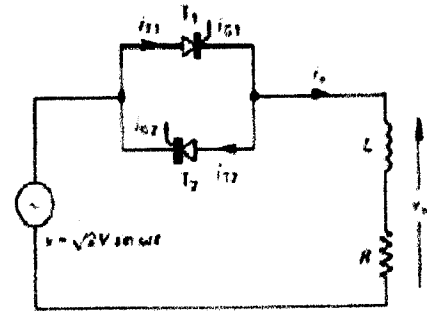
fig(2)

$$V_{an} = 110\sqrt{2} \sin \omega t, \quad V_{bn} = 110\sqrt{2} \sin(\omega t - 2\pi/3)$$

$$V_{cn} = 110\sqrt{2} \sin(\omega t + 2\pi/3)$$

Question 3 (17 degree)

A single phase AC voltage regulator as shown in the fig. is supplied from 220V, 50Hz. The regulator feeds R-L load with $X_L = 10 \text{ Ohm}$ and $R = 10 \text{ } \Omega$. The delay angle α for thyristors = 45° .



- 1) with $L = 0$, find out the numerical expression of the rms of The output voltage.
- 2) with $X_L = 10 \text{ Ohms}$, $R = 10 \text{ } \Omega$ calculate the rms of the output voltage $V_{o(rms)}$, and $I_{o(rms)}$ for continuous case.
- 3) for $\alpha = 45^\circ$, and $\alpha = 60^\circ$ draw the input voltage $v_s(t)$, the output voltage and the load current i_o

Question 4 (17 degree)

- a) discuss two different techniques to control the output voltage of step down DC chopper.
- b) A step down class A dc chopper is fed with 110 v dc, supplies a series RL load with free wheeling diode $R = 0.25 \text{ } \Omega$, $L = 1 \text{ mH}$ if the switching frequency of the chopper is 400 HZ and $T_{ON} = 625 \text{ } \mu \text{ sec}$, assume continuous load current.
 - 1- Calculate the average value of the output voltage $V_{o(ave)}$
 - 2- Find the maximum and minimum steady state load current I_{max} , I_{min}
 - 3- Determine the steady state ripple of the output load current.

Question 5 (15 degree)

- a) State the difference between the trigger circuit of thyristor & the trigger circuit of transistor.
- b) Which you prefer in the inverter thyristors or transistors, & Why??
- c) State the importance of the isolation in the trigger circuits?

Question 6 (17 degree)

The single-phase full-bridge inverter has a load of $R = 10 \text{ } \Omega$, $L = 4 \text{ mH}$, and DC input voltage is 100 V. The output frequency 50 Hz. Determine:

- The Fourier expression of the output voltage and output current.
- The rms output voltage at the fundamental frequency.
- The total harmonic distortion of output voltage.
- The peak reverse voltage of each transistor.