

INSTRUCTION:

This section consists of **FOUR (4)** questions. Answers **ALL** questions.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan. Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

- | | |
|------|--|
| CLO1 | <p>(a) State the definition of the following terms: controller and control element
<i>Nyatakan definisi bagi istilah berikut: pengawal dan elemen kawalan</i></p> <p style="text-align: right;">[5 marks]
[5 markah]</p> |
| CLO1 | <p>(b) Explain the linearity phenomenon in control system by using a suitable diagram.
<i>Terangkan fenomena kelinearan dalam system kawalan menggunakan gambar rajah yang sesuai.</i></p> <p style="text-align: right;">[8 marks]
[8 markah]</p> |
| CLO1 | <p>(c) An analogue-to-digital converter of data acquisition board with 120W input power 20mA current is set for input signals with the amplifier at 100. Given the resolution of the instrument is 200V, calculate the number of bits.
<i>Sebuah papan kenyataan pengubah analog-ke-digital dengan kuasa masukan 120W dan 20mA arus ditetapkan untuk isyarat masukan dengan penguat sebanyak 100. Diberi resolusi alatan adalah 200V, kirakan bilangan bit.</i></p> <p style="text-align: right;">[12 marks]
[12 markah]</p> |

QUESTION 2

SOALAN 2

CLO1

- (a) Label A, B, C D and E elements as in Figure 2(a).

Labelkan setiap elemen A, B, C, D dan E berdasarkan Rajah 2(a).

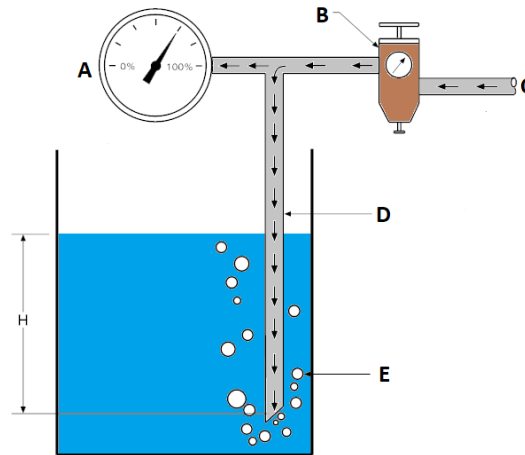


Figure 2(a)

Rajah 2(a)

[5 marks]

[5 markah]

CLO1

- (b) With the aid of a suitable diagram, elaborate the principle operation of the capsules that is widely used in pressure measurement.

Dengan menggunakan rajah yang bersesuaian terangkan prinsip operasi bagi sebuah kapsul yang biasanya digunakan secara meluas untuk mengukur tekanan.

[8 marks]

[8 markah]

CLO1

- (c) Water is flowing from a circular pipe that has a diameter of 0.30 m and its velocity is 4.60 m/s. Calculate the flow rate of the water of the pipe in litres per second (L/s).

Air yang mengalir didalam paip berbentuk bulatan yang beradius 0.30 m dan kelajuan air tersebut ialah 4.60m/s. Kirakan jumlah kadar pengaliran air dalam liter per saat (L/s).

[12 marks]

[12 markah]

QUESTION 3**SOALAN 3**

CLO2

- (a) Explain the operating principle of current to pressure (I/P) converter with a suitable diagram.

Terangkan prinsip kendalian penukar arus kepada tekanan (I/P) Bersama dengan rajah yang sesuai

[6 marks]

[6 markah]

CLO2

- (b) “This transmitter is used to measure the difference between two pressures. The low side and high side pressure. The reading can be either negative or positive depending on whether the low side or high side is the large value.”

Based on the information above, construct the diagram of differential pressure transmitter.

“Pengantar ini digunakan untuk mengukur perbezaan antara dua tekanan iaitu bahagian rendah dan bahagian tinggi tekanan. Bacaannya samada negatif atau positif bergantung kepada nilai terbesar bahagian rendah atau bahagian tinggi”

Berdasarkan maklumat di atas, bina gambarah penghantar perbezaan tekanan.

[9 marks]

[9 markah]

CLO2

- (c) With the aid of a suitable diagram, demonstrate the operation of self-balancing pneumatic mechanism.

Dengan rajah yang sesuai, tunjukkan cara operasi bagi mekanismeimbangan sendiri pneumatik.

[10 marks]

[10 markah]

QUESTION 4**SOALAN 4**

CLO2

- (a) Preventive maintenance for the PLC system should be scheduled with the regular machine or equipment maintenance, so that the equipment and controller are down for a minimum amount of time. However, the schedule for PLC preventive maintenance depends on the controller's environment—the harsher the environment, the more frequent the maintenance. The standard period for a maintenance check is 6 months to 1 year, but more frequent checks are required if the PLC is operated in more demanding conditions. Explain **FOUR (4)** examples of PLC preventive maintenance.

*Penyelenggaraan pencegahan untuk sistem PLC harus dijadualkan bagi penyelenggaraan mesin atau peralatan biasa, supaya peralatan dan pengawal tidak dapat berfungsi untuk jangka waktu minimum. Walau bagaimanapun, jadual penyelenggaraan pencegahan PLC bergantung pada persekitaran pengawal – semakin sukar persekitarannya, semakin kerap penyelenggaraannya. Tempoh standard untuk pemeriksaan penyelenggaraan adalah 6 bulan hingga 1 tahun, tetapi pemeriksaan lebih kerap diperlukan jika PLC dikendalikan dalam keadaan yang lebih kasar. Terangkan **EMPAT (4)** contoh penyelenggaraan pencegahan.*

[8 marks]

[8 markah]

CLO2

- (b) Based on Figure 4(b), the input ultrasonic switch is employed to detect the presence of an approaching vehicle. A separate photosensors detects the passing of a vehicle via the interruption of the light beam. In the response to these signals, the control circuit controls the output that drive the motor of the shutter door for opening and closing. Construct a program for the system using ladder diagram.

Berdasarkan Rajah 4(c), suis masukan ultrasonik digunakan untuk mengesan kehadiran kenderaan yang menghampiri. Fotosensor yang terpisah digunakan untuk mengesan pergerakan kenderaan melalui gangguan pancaran cahaya. Sebagai tindak balas kepada isyarat ini, litar kawalan mengawal keluaran yang menggerakkan motor pintu pengatup untuk dibuka dan ditutup. Bina aturcara untuk sistem tersebut menggunakan gambarajah tangga.

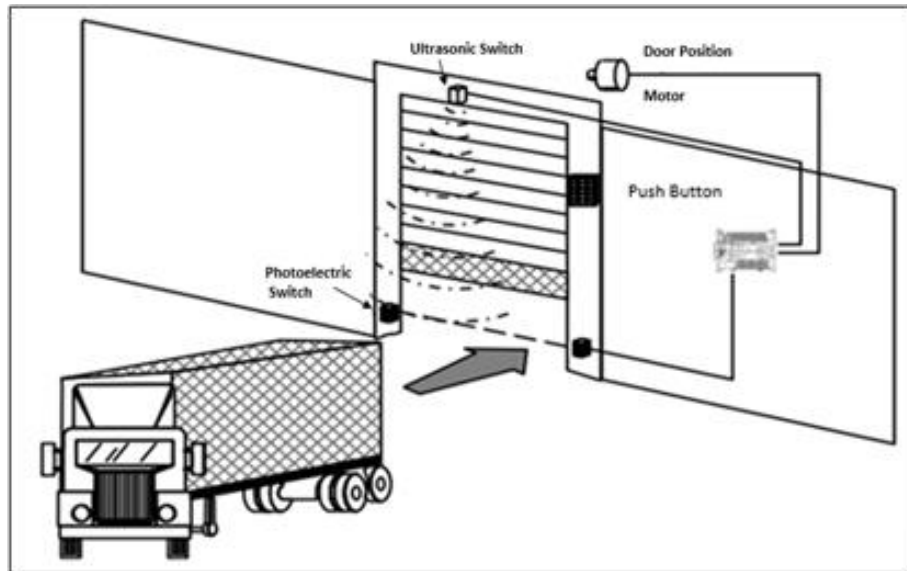


Figure 4 (b) / Rajah 4(b)

[12 marks]

[12 markah]

CLO2

- (c) A PLC program consists of a set instruction either in textual or graphical form, classify the PLC programming languages based on the following two main classifications.

Program PLC terdiri daripada satu set arahan sama ada dalam bentuk teks atau grafik, kelaskan bahasa pengaturcaraan PLC berdasarkan dua klasifikasi utama berikut.

[5 marks]

[5 markah]

SOALAN TAMAT

Appendix / Lampiran

Pressure Conversion:

$$\begin{aligned} 1 \text{ Pa} &= 1.4504 \times 10^{-4} \text{ psi} \\ 1 \text{ psi} &= 1 \text{ lb/in}^2 \\ 1 \text{ Atm} &= 101.3 \text{ kPa} = 14.7 \text{ psi} \\ 1 \text{ Bar} &= 100 \text{ kPa} = 100 \text{ N/m}^2 \end{aligned}$$

Length Conversion:

$$\begin{aligned} 1 \text{ cm} &= 10 \text{ mm} \\ 1 \text{ m} &= 100 \text{ cm} \\ 1 \text{ ft} &= 12 \text{ inch} \\ 1 \text{ inch} &= 0.0254 \text{ m} \end{aligned}$$

Level Formula:

$$\begin{aligned} h &= P/\gamma \\ F &= \gamma \pi d^2 h / 4 \\ W &= \gamma V \end{aligned}$$

Temperature Formula:

$$\begin{aligned} ^\circ\text{C} &= (^\circ\text{F} - 32) 5/9 \\ ^\circ\text{R} &= ^\circ\text{F} + 459.6 \\ ^\circ\text{K} &= ^\circ\text{C} + 273.15 \\ ^\circ\text{R} &= ^\circ\text{K} * 9/5 \end{aligned}$$

$$W_{\text{TH}} = 3/2 kT$$

$$V_{\text{TH}} = \sqrt{(3kT/m)}$$

$$\begin{aligned} k &= \text{Boltzmann's constant} = 1.38 \times 10^{-23} \\ &\text{J/K} \end{aligned}$$

$$Q = WC(T_2 - T_1)$$

$$Q = -kA(T_2 - T_1)/L$$

$$Q = hA(T_2 - T_1)$$

Heat Energy Conversion:

$$\begin{aligned} 1 \text{ Btu} &= 252 \text{ cal} \\ 1 \text{ Joule} &= 0.000948 \text{ Btu} \\ 1 \text{ Watt} &= 1 \text{ J/s} \end{aligned}$$

Pressure Formula:

$$\begin{aligned} P &= \gamma h = F/A = \rho gh \\ B &= \gamma V \end{aligned}$$

Flow Formula:

$$\begin{aligned} R &= VD\rho/\mu \\ Q &= VA \\ F &= \rho Q \end{aligned}$$

$$P_a/\gamma_a + V_a^2/2g + h_a = P_b/\gamma_b + V_b^2/2g + h_b$$

$$V = \sqrt{(2gh)}$$

$$Q = k (\pi/4)(d_s/d_p)^2 \sqrt{(2gh)}$$

$$Q = WR/L$$

$$Q = Av \sqrt{\Delta P/\rho}$$

$$Q = CA(T_2^4 - T_1^4)$$

$$L_2 = L_1[1 + \alpha(T_2 - T_1)]$$

$$V_2 = V_1[1 + \beta(T_2 - T_1)]$$

$$R_{T2} = R_{T1} [1 + \text{Coeff.}(T_2 - T_1)]$$