**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

(a) Define the instrument parameter terms as follows, accuracy, sensitivity, linearity, hysteresis, and reproducibility.

*Takrifkan parameter terma instrumentasi seperti berikut, ketepatan, kepekaan kelinearan, histerisis dan kebolehulangan.*

[5 marks]

[5 *markah*]

CLO1

(b) Figure 1 (b) shows a closed loop control system. Explain A, B, C and D elements of the system.

*Rajah 1 (b) di menunjukkan sistem kawalan gelung tertutup. Terangkan elemen A, B,C dan D bagi sistem ini.*

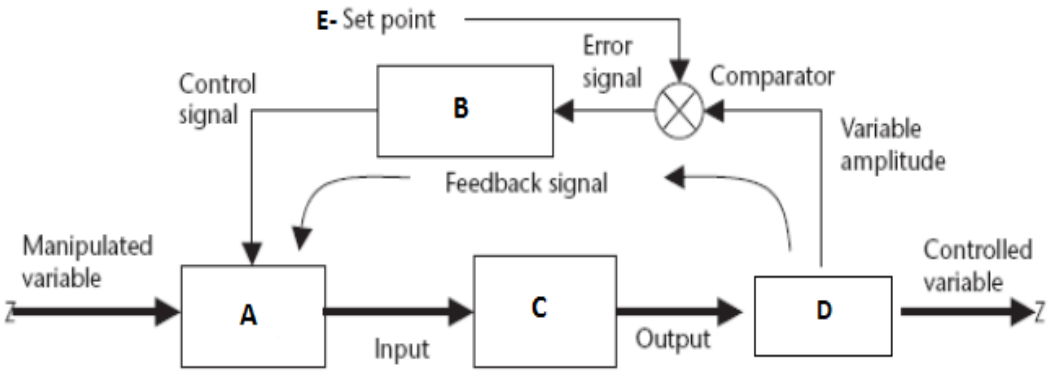


Figure 1(b)/ *Rajah 1(b)*

[8 marks]

[8 *markah*]

CLO1

(c) The pressure in a system has a range from 0 to 50 kPa. Calculate the current equivalent to pressure of 32 kPa, if the transducer output range is from 4mA to 20mA.

*Tekanan di dalam satu system mempunyai julat daripada 0 hingga 50 kPa. Kirakan nilai arus setara dengan bacaaan 32 kPa, sekiranya output transducer adalah pada julat 4mA sehingga 20mA.*

[12 marks]

[*12 markah*]

**QUESTION 2**

***SOALAN 2***

CLO1 (a) State **FIVE (5)** pressure measuring instrument.

*Senaraikan **LIMA (5)** instrumen pengukuran tekanan.*

[5 marks]

[5 *markah*]

CLO1 (b) Explain **FOUR (4)** types of heat transfer method

*Terangkan **EMPAT (4)** jenis kaedah pemindahan haba.*

[8 marks]

[*8 markah*]

CLO1 (c) If the pressure at point 2 is 130kPa, calculate the height of the column of water h in Figure 2(c) below. The diameter at point 2 and 3 are 30 cm and 15 cm, respectively.

*Jika tekanan pada titik 2 ialah 130 kPa, kirakan tinggi h bekas air di dalam Rajah 2(c) di bawah. Diameter pada titik 2 dan 3 adalah masing-masing 30 cm dan 15 cm.*

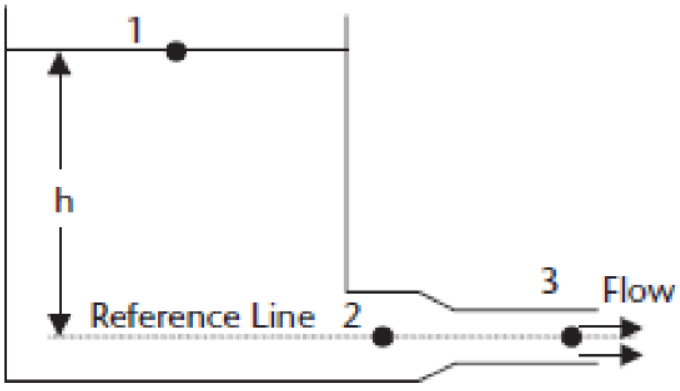


Figure 2(c)/ *Rajah 2(c)*

[12 marks]

[*12 markah*]

**QUESTION 3**

***SOALAN 3***

CLO2 (a) Explain the function of bellow, pneumatic amplifier and baffle & nozzle inside pneumatic differential pressure transmitter.

*Terangkan fungsi bellow, penguat pneumatik dan penyekat & muncung di dalam penghantar tekanan pembezaan pneumatik.*

[6 marks]

[6 *markah*]

CLO2 (b) Figure 3 (b) shows the utilization of control valve to throttle the flow of crude oil through a heater, fired by natural gas burners. The flow is normally controlled on the basis of the crude oil's exiting temperature from the heater. In this particular application, provide the best type of control valve and the reason.

*Rajah 3 (b) menunjukkan penggunaan injap kawalan untuk mendikit aliran minyak mentah melalui pemanas, yang dinyalakan oleh penunu gas asli. Aliran biasanya dikawal berdasarkan suhu keluar minyak mentah dari pemanas. Dalam aplikasi khusus ini, Sediakan jenis injap kawalan terbaik dan sebabnya.*

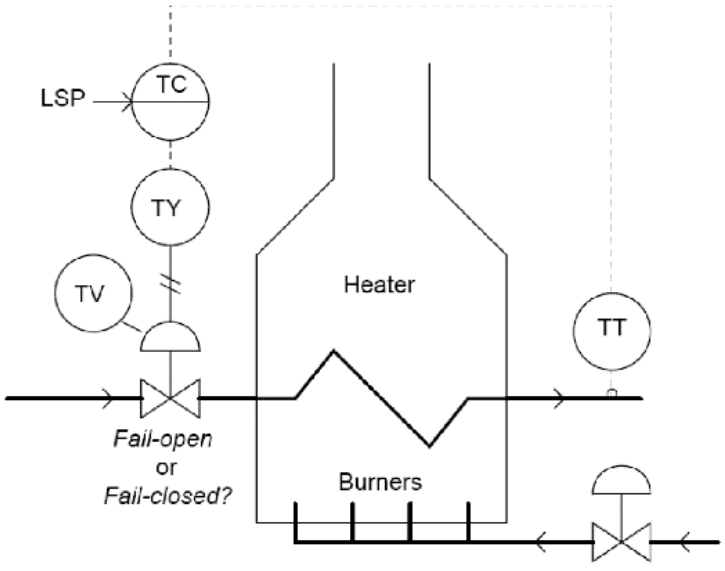


Figure 3 (b)/ Rajah 3(b)

[9 marks]

[9 *markah*]

CLO2 (c) Show the differences between the high pressure amplifying relay and the low pressure amplifying relay as shown in Figure 3(c) by using a table.

*Terangkan perbezaan antara geganti penguat tekanan tinggi dan geganti penguat tekanan rendah seperti yang ditunjukkan dalam Rajah 3(c) dengan menggunakan jadual.*

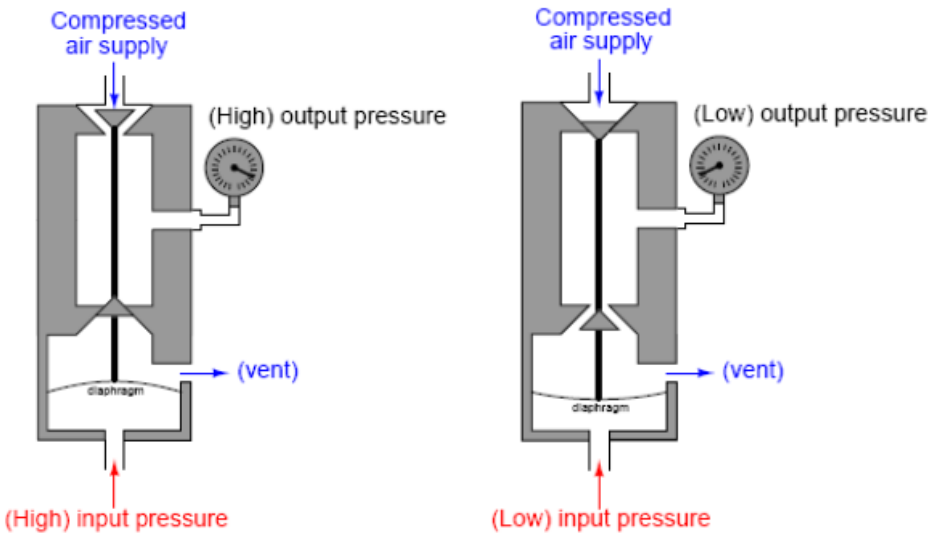


Figure 3(c)*/Rajah 3(c)*

[10 marks]

[*10 markah*]

**QUESTION 4**

***SOALAN 4***

CLO2 (a) Explain the Supervisory Control and Data Acquisition (SCADA) systems.
*Terangkan Sistem Kawalan Penyeliaan dan Pemerolehan Data (SCADA*).

[8 marks]

[8 *markah*]

CLO2 (b) The system used for filling / draining control operation is shown in Figure 4(b). Construct a ladder diagram for a PLC to perform the control function as below:
*Sistem yang digunakan untuk operasi kawalan pengisian / penyaliran ditunjukkan dalam Rajah 4(b). Bina gambar rajah tangga untuk PLC untuk melaksanakan fungsi kawalan seperti di bawah:*

**Step 1**: As the PB1 is pressed, MV1 opens and the water begins to fill the tank. At the same time, the stirring motor M starts operation.
***Langkah 1****: Apabila PB1 ditekan, MV1 terbuka dan air mula memenuhi tangki. Pada masa yang sama, motor kacau M mula beroperasi.*

**Step 2**: When the water level passes TLB2 and reaches TLB1, the MV1 closes and the stirring motor stops.
***Langkah 2****: Apabila paras air melepasi TLB2 dan mencapai TLB1, MV1 ditutup dan motor kacau berhenti.*

**Step 3**: Next MV2 opens and starts draining the water. When the water level drops below TLB2, MV2 closes.
***Langkah 3****: Seterusnya MV2 terbuka dan mula mengalirkan air. Apabila paras air turun di bawah TLB2, MV2 ditutup.*

**Step 4**: When the cycle of operation is repeated four times, the operation END indicator illuminates and the filling and draining operation will not restart even if PB1 is pressed.

***Langkah 4**: Apabila kitaran operasi berulang sebanyak empat kali, operasi END akan bernyala. Operasi pengisian dan pengeluaran tidak akan bermula semula walaupun PB1 ditekan.*

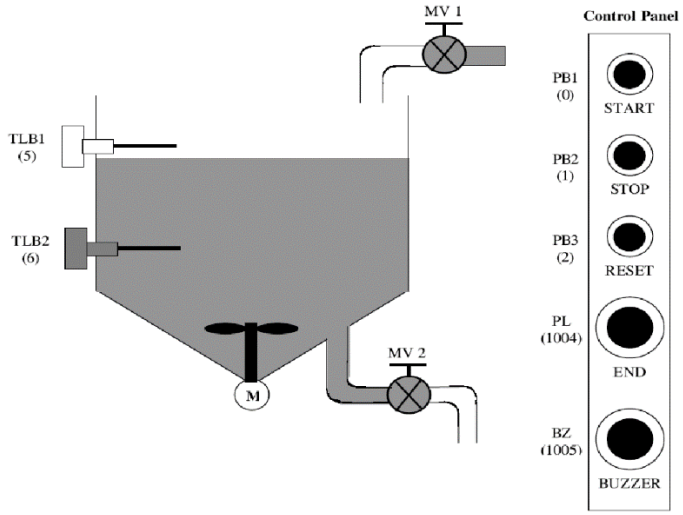


Figure 4(b)/*Rajah 4(b)*

[12 marks]

[*12 markah*]

CLO2 (c) Refer to Figure 4 (c) below, consider what will be the controller output value for a three mode controller having Kp as 4, Ki as 0.6/s, KD as 0.5 s, a set point output of 50% and subject to the error change in figure below immediately the change starts to occur.

*Rujuk Rajah 4 (c) di bawah, pertimbangkan apakah nilai output pengawal untuk pengawal tiga mod yang mempunyai Kp sebagai 4, Ki sebagai 0.6/s, KD sebagai 0.5 s, output titik set 50% dan subjek kepada perubahan ralat dalam rajah di bawah serta-merta perubahan mula berlaku*

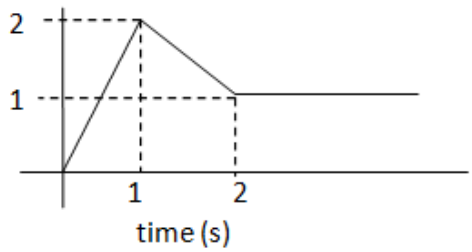


Figure 4(c)/*Rajah 4(c)*

[5 marks]

[*5 markah*]

**SOALAN TAMAT**