SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN PETROKIMIA

PEPERIKSAAN AKHIR

SESI II : 2023/2024

DGP30102 : PROCESS INSTRUMENTATION & CONTROL

TARIKH : 11 JUN 2024
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Lampiran

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Define the error detection and controller in the control loops.

Definisikan istilah pengesan ralat dan pengawal yang terdapat dalam kawalan gelung.

[5 marks]

[5 *markah*]

CLO1 (b) A linear pressure sensor has a time constant of 3.1 seconds, and a transfer function of 29 mV/kPa . When the pressure changes from 17 to 39 kPa, the output after 1.3 seconds is 24.536 kPa. Based on the statement given, approximate the pressure error at that time with the aid of a labelled graph.

Sebuah pengesan tekanan linear mempunyai masa tetap 3.1 saat, dan rangkap pindah 29 mV/kPa. Bila tekanan berubah dari 17 kepada 39 kPa keluaran selepas 1.3 saat adalah 24.536 kPa. Berdasarkan pernyataan yang diberi, anggarkan ralat tekanan pada masa tersebut dengan bantuan graf berlabel.

[8 marks]

[8 *markah*]

CLO1 (c) The pressure sensor was operated as shown in Table 1 (c). Calculate the Y value and then sketch the corresponding linear graph.

Pengesan tekanan beroperasi seperti ditunjukkan dalam Jadual 1(c). Kirakan nilai Y dan seterusnya lakarkan graf linear yang sepadan.

Table 1(c)/ Jadual 1(c)

Pressure (kPa)	5	100	220
Current (mA)	5	**Y**	60

[12 marks]

[12 *markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Conductive probes could be used for level setting. Label the conductive probe A, B C and D in Figure 2(a).

Terminal konduktif boleh digunakan sebagai penunjuk tetapan aras. Labelkan terminal konduktif A, B C dan D dalam rajah 2(a).

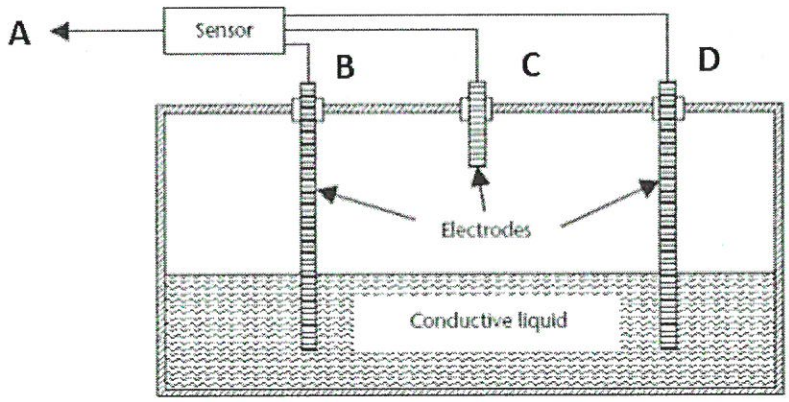

Figure 2(a)/ *Rajah 2(a)*

[5 marks]

[5*markah*]

CLO2 (b) The heat required to raise the temperature of a 3.8kg mass 65°F is 500 KJ. Approximate the specific heat of the mass in cal/g °C.

Haba yang diperlukan untuk meningkatkan suhu 3.8kg jisim 65°F adalah 500KJ. Anggarkan spesifik haba untuk jisim tersebut dalam cal/g °C

[8 marks]
[8 *markah*]

CLO2 (c) If the pressure at point 2 is 90 psi, calculate the height of the water column, h in Figure 2 (c). The radius at point 2 and 3 are 25 cm and 12.5 cm, respectively.

Jika tekanan pada titik 2 ialah 90 psi, kira tinggi h bekas air di dalam Rajah 2(d) di bawah. Radius pada titik 2 dan 3 adalah masing-masing 25 cm dan 12.5 cm.

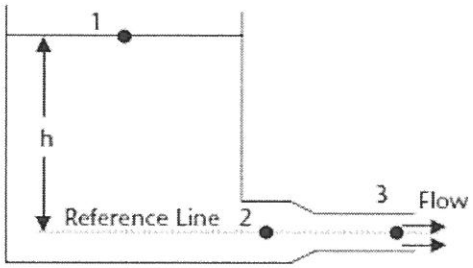

Figure 2(c)/ *Rajah 2(c)*

[12 marks]
[12 *markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Explain Differential Pressure Transmitter and control valve

Terangkan Transmitter Perbezaan Tekanan dan injap kawalan

[6 marks]

[6 *markah*]

CLO2 (b) By referring to Figure 3 (b), write the instrument principle operation and the name of A, B, C, and D.

Dengan merujuk Rajah 3 (b), tuliskan operasi instrument dan namakan A,B, C, dan D.

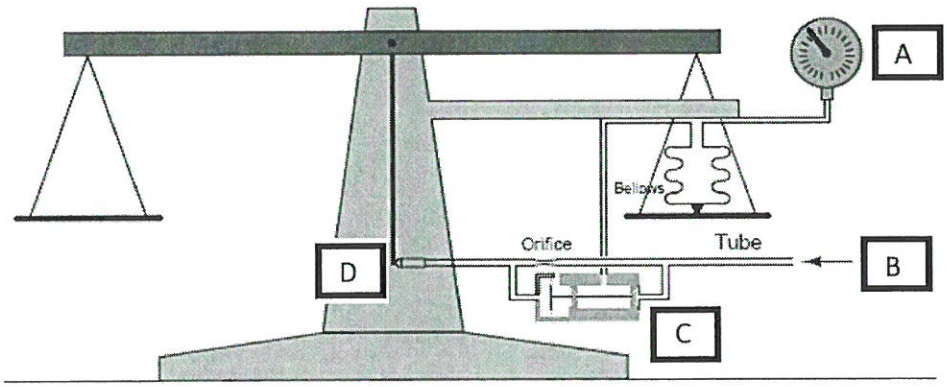

Figure 3(b)/ *Rajah 3(b)*

[9 marks]

[9 *markah*]

CLO2 (c) By referring to Figure 3 (c), a control valve is used to control the flow of crude oil in a separation process. The crude oil flow is normally controlled on the basis to the end product. For this particular application, provide the best type of control valve and reasons.

Merujuk kepada Rajah 3 (c), andaikan injap kawalan untuk mengawal aliran minyak mentah melalui proses pengasingan digunakan. Aliran biasanya dikawal pada dasar minyak mentah untuk mendapatkan produk terakhir. Dalam aplikasi ini, sediakan jenis injap kawalan tarbaik dan sebab tentukan cadangan anda.

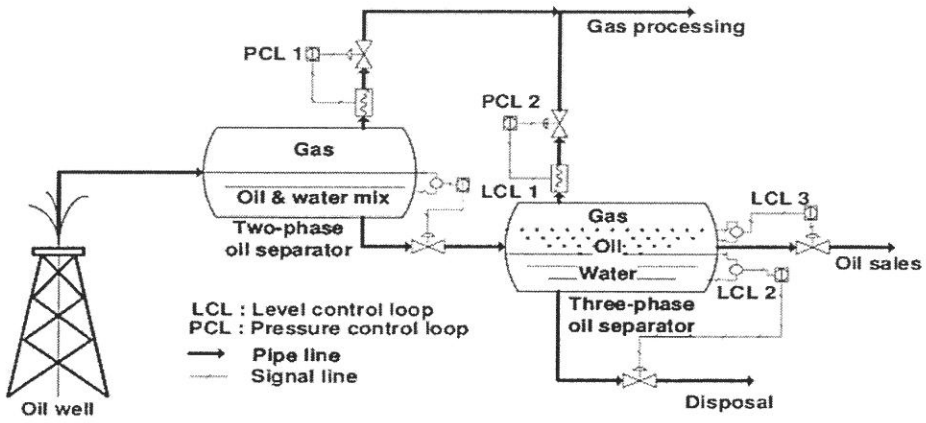

Figure 3(c)/ Rajah 3(c)

[10 marks]

[10 *markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Explain the type of the controller in Figure 4 (a).

Terangkan jenis pengawal dalam Rajah 4(a)

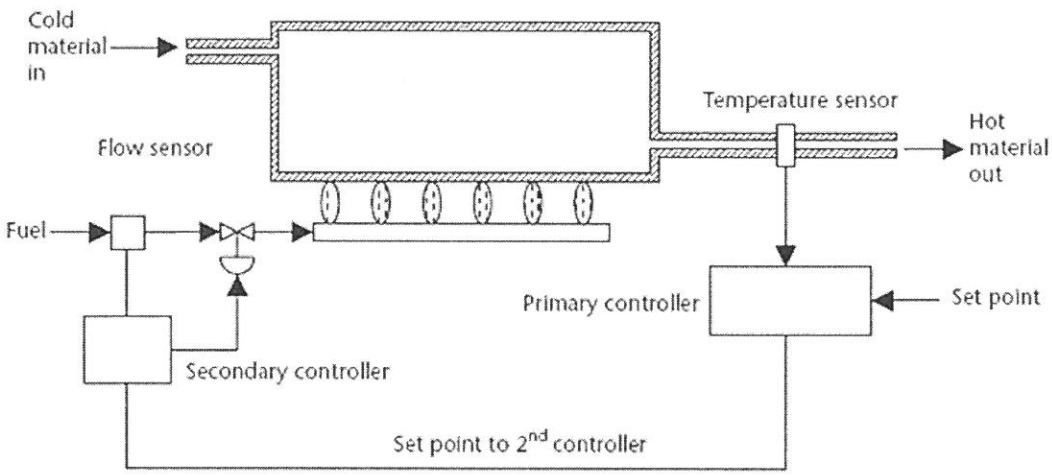

Figure 4(a)/ Rajah 4(a)

[8 marks]

[8 *markah*]

CLO2 (b) Construct a ladder diagram for a set of linear motion gear (LMG), rotational motion gear (RMG) and pneumatic cylinder (PC) in the following manner:
Sequence of operation:
Binakan gambarajah tetangga untuk satu set gear gerakan linear (LMG), Gear gerakan pusingan (RMG) dan silinder pneumatic (PC) mengikut urutan berikut :
Turutan operasi

i. Linear motion gear (LMG) : 10 seconds ON
Gear gerakan linear (LMG): 10 saat ON
ii. Rotational motion gear (RMG) : 7 seconds ON
Gear gerakan pusingan (RMG): 7 seconds ON
iii. Pneumatic cylinder (PC) : 3 seconds ON
Silinder pneumatic (PC) : 3 seconds ON
iv. The sequence now repeat with LMG ON
Turutan akan berulang dengan LMG ON

[12 marks]
[12 markah]

CLO2 (c) If the set point is suddenly changed from 50% to 45% with a proportional band setting at 50%, determine the output change of the proportional controller.

Jika nilai tetapan berubah dari 50% to 45% pada jalur berkadar yang bertetapan 50%, nyatakan perubahan keluaran pada pengawal berkadar.

[5 marks]
[*5 markah*]

SOALAN TAMAT

Appendix / Lampiran

Pressure Conversion:

1Pa = 1.4504 x 10^{-4} psi
1 psi = 1 lb/in^2
1 Atm = 101.3 kPa = 14.7 psi
1 Bar = 100 kPa = 100 N/m^2

Heat Energy Conversion:

1 Btu = 252 cal
1 Joule = 0.000948 Btu
1 Watt = 1 J/s

Length Conversion:

1cm = 10 mm
1 m = 100 cm
1 ft = 12 inch
1 inch = 0.0254m

Pressure Formula:

$P = \gamma h = F/A = \rho gh$
$B = \gamma V$

Level Formula:

$h = P/\gamma$
$F = \gamma \pi d^2 h/ 4$
$W = \gamma V$

Flow Formula:

$R = VD\rho/ \mu$
$Q = VA$
$F = \rho Q$

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

$V = \sqrt{(2gh)}$
$Q = k\ (\pi/4)(d_s/d_p)^2 \sqrt{(2gh)}$
$Q = WR/ L$
$Q = Av \sqrt{\Delta P/\rho}$

Temperature Formula:

°C = (°F -32) 5/9
°R = °F +459.6
°K = °C + 273.15
°R = °K * 9/5

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

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

k = Boltzmann's constant = 1.38 x 10^{-23} J/K
$Q = WC(T_2 - T_1)$
$Q = -kA(T_2-T_1)/L$
$Q = hA\ (T_2-T_1)$

$Q = CA\ (T_2^4 - T_1^4)$
$L_2 = L_1[1 + \alpha\ (T_2 - T_1)]$
$V_2 = V_1[1 + \beta\ (T_2 - T_1)]$

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