SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SEMESTER II : 2023/2024

FM20014: MECHANICAL ENGINEERING TECHNOLOGY

TARIKH : 31 MEI 2024
MASA : 3.00 PETANG – 5.00 PETANG (2 JAM)

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

Subjektif (10 soalan)

Dokumen sokongan yang disertakan : Jadual stim, Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:
This section consists of **TEN (10)** subjective questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **SEPULUH (10)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 Refer to Figure Q1 below, name and define a, b and c.

Berdasarkan Rajah S1 di bawah, namakan dan takrifkan a,b dan c.

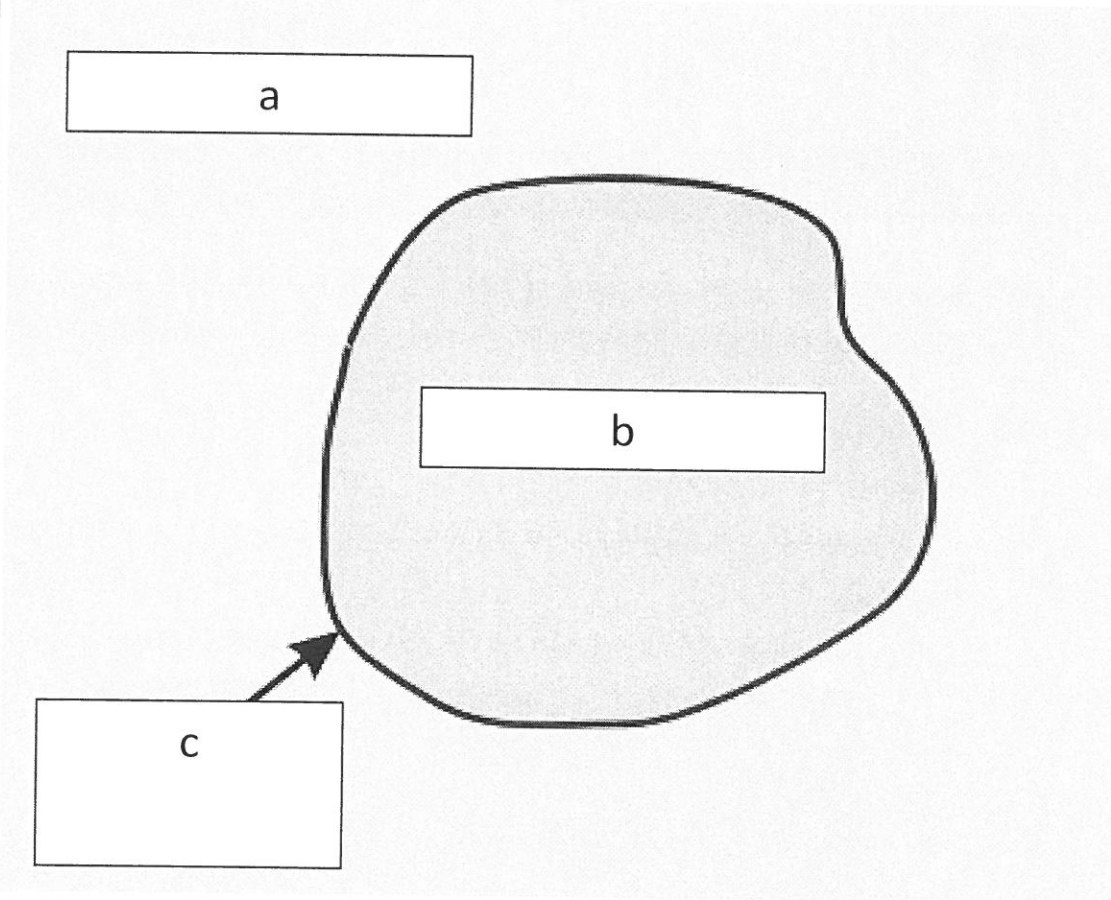

Figure Q1/*Rajah S1*

[6 marks]

[*6 markah*]

QUESTION 2

SOALAN 2

CLO1 Explain the types of properties of fluid complete with formula and unit for mass density, specific weight, specific volume and specific gravity.

Terangkan jenis-jenis sifat bendalir lengkap bersama formula dan unit bagi ketumpatan jisim, berat tentu, isipadu tentu dan graviti tentu.

[12 marks]

[12 *markah*]

QUESTION 3

SOALAN 3

CLO1 A hydraulic jack lifts a load of 16.3 kN with force of 1320 N applied to small cylinder as shown in Figure Q3. The area of the large cylinder is 91 cm^2. Express :

Sebuah jek hidraulik mengangkut beban 16.3kN dengan daya 1320 N dikenakan pada silinder kecil seperti yang ditunjukkan dalam Rajah Q3. Luas silinder besar ialah 91cm^2. Nyatakan:

(a) the mass density of oil.

ketumpatan jisim minyak.

(b) the diameter of a small cylinder if the small cylinder is 0.7 m below the large cylinder.

diameter silinder kecil jika silinder kecil adalah 0.7m di bawah silinder besar.

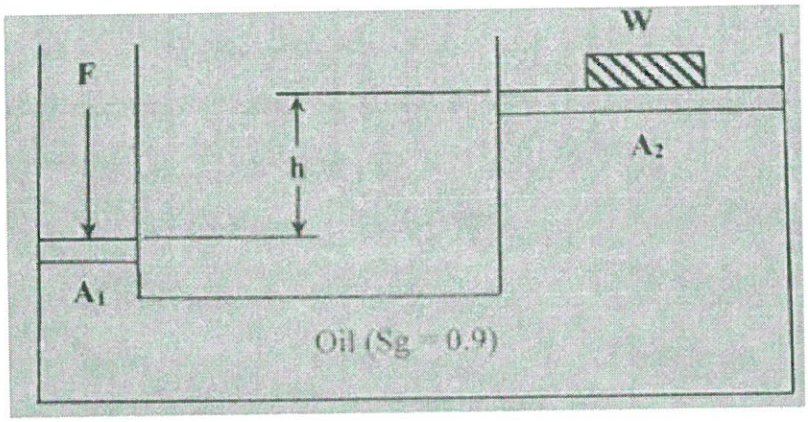

Figure Q3/*Rajah S3*

[12 marks]

[12 *markah*]

QUESTION 4
SOALAN 4

CLO1

A vertical venturi meter measures the flow of oil of specific gravity 0.82 and has an entrance of 135 mm diameter and throat of 55 mm diameter. There are pressure gauges at the entrances and at the throat, which is 350 mm above the entrance. If the coefficient for the meter is 0.96 and pressure difference is 28.5 kN/m^2, calculate the actual discharge in m^3/s.

Meter venturi menegak mengukur aliran minyak dengan gravity tentu 0.82 dan mempunyai diameter masukan 135 mm dan diameter kerongkong 55 mm. Terdapat tolok tekanan di bahagian masukan dan kerongkong, iaitu 350 mm di atas pintu masuk. Jika pekali untuk meter ialah 0.96 dan perbezaan tekanan ialah 28.5 kN/m^2, hitung kadar alir sebenar dalam m^3/s.

[14 marks]
[14 *markah*]

QUESTION 5
SOALAN 5

CLO1

Identify the suitable answer for the table Q5 below.
Tentukan jawapan yang sesuai bagi jadual Q5 di bawah.

Table Q5 / *Jadual Q5*

Quantity *Kuantiti*	SI Unit *Unit SI*	Symbol *Simbol*
Length *Panjang*		
Temperature *Suhu*		
Amount of Substance *Amaun Bahan*		

[6 marks]
[*6 markah*]

QUESTION 6

SOALAN 6

CLO1

Explain:

Terangkan:

(a) the Zeroth's Law of Thermodynamics [4 marks]

Hukum Sifar Termodinamik [4 *marks*]

(b) First Law of Thermodynamics [4 marks]

Hukum Pertama Termodinamik [4 *marks*]

(c) Second Law of Thermodynamics [4 marks]

Hukum Kedua Termodinamik [4 *marks*]

QUESTION 7

SOALAN 7

CLO1

Relate the values given in Table Q7 below to solve the specific enthalpy of h_1, h_2, and h.

Hubungkan nilai yang diberikan dalam Jadual Q7 di bawah untuk penyelesaian entalpi tentu h_1, h_2, *dan h.*

Table Q7 / *Jadual Q7*

t(°C) / p(bar)	300	320	350
20	3025	h_1	3138
25		h	
30	2995	h_2	3117

[12 marks]

[12 *markah*]

QUESTION 8
SOALAN 8

CLO1

A perfect gas is contained in a rigid vessel at 5 bar and 415 °C. The gas is then cooled until the pressure falls to 2.5 bar. Calculate the heat rejected per kg of gas. Given: Molar mass, M = 26 kg/kmol and specific heat ratio, γ = 1.26.

Gas sempurna terkandung dalam bekas yang padat pada tekanan 5 bar dan suhu 415 °C. Gas tersebut kemudian disejukkan sehingga tekanannya turun kepada 2.5 bar. Kirakan haba yang ditolak keluar setiap kg gas. Diberi: Molar jisim, M = 26 kg/kmol dan nisbah haba tentu, γ = 1.26.

[14 marks]
[14 *markah*]

QUESTION 9
SOALAN 9

CLO1

Explain the instructions used in autocad software to construct **Figures 9a** and **9b** below. (All Units in mm)

Terangkan arahan-arahan yang digunakan dalam perisian autocad untuk membina ***Rajah 9a*** *dan* ***9b*** *di bawah.(Semua ukuran dalam unit mm)*

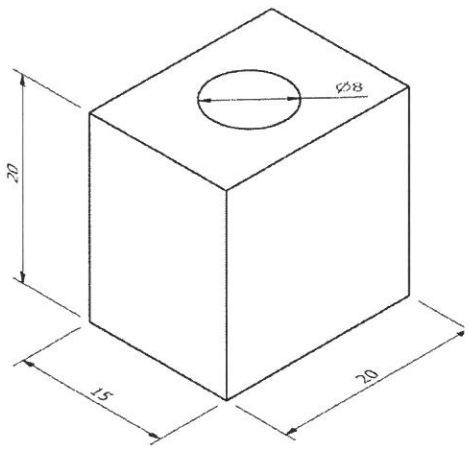

Figure 9a

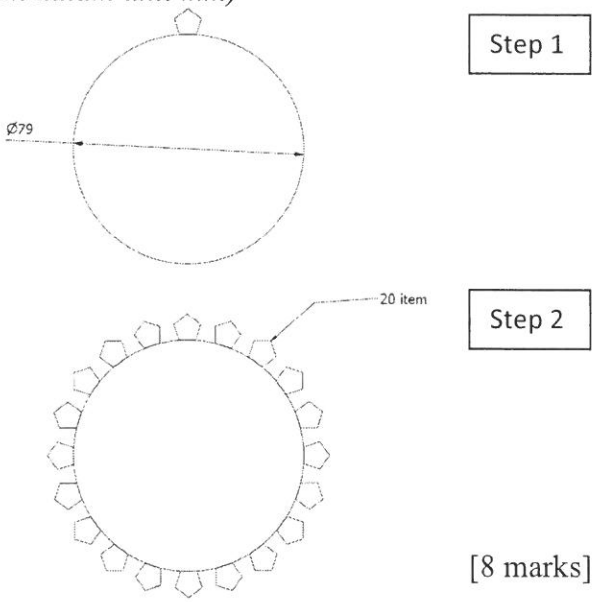

Figure 9b

[8 marks]
[8 markah]

QUESTION 10

SOALAN 10

CLO1 List **FOUR (4)** hand tools used in mechanical workshops.

*Senaraikan **EMPAT (4)** alatan tangan yang digunakan di bengkel mekanikal.*

[4 marks]

[4 markah]

SOALAN TAMAT

POLITEKNIK MALAYSIA

LIST OF FORMULA

FM20014 - MECHANICAL ENGINEERING TECHNOLOGY

FLUID DYNAMICS

$$Z_1 + \frac{P_1}{\omega} + \frac{v_1^2}{2g} = Z_2 + \frac{P_2}{\omega} + \frac{v_2^2}{2g}$$

$$Q_{act} = c_d A_1 \sqrt{\frac{2gH}{m^2 - 1}}$$

$$H = \frac{P_1 - P_2}{\omega} + (Z_1 - Z_2)$$

$$H = x\left(\frac{\omega_{Hg}}{\omega_{sub}} - 1\right)$$

$$m = \frac{d_1^2}{d_2^2}$$

PROPERTIES OF PURE SUBSTANCE

Steam

$$v = xv_g$$
$$h = h_f + xh_{fg}$$
$$u = u_f + x(u_g - u_f)$$
$$s = s_f + xs_{fg}$$

Ideal Gas

$$PV = mRT$$
$$R = \frac{R_0}{M}$$
$$R = C_p - C_v$$
$$\gamma = \frac{C_p}{C_v}$$

FIRST LAW OF THERMODYNAMICS

$$\sum Q = \sum w$$
$$Q - W = U_2 - U_1$$

Flow Process

$$\dot{m} = \rho CA = \frac{CA}{V}$$

$$h = u + pv$$
$$h = C_p \Delta T$$

$$Q - W = \dot{m}\left[(h_2 - h_1) + \left(\frac{C_2^2 - C_1^2}{2}\right) + (Z_2 - Z_1)g\right]$$

Non-Flow Process

Isothermal Process (PV=C)

$$U_2 - U_1 = 0$$
$$Q = W$$
$$W = P_1 V_1 ln\left(\frac{V_2}{V_1}\right) @ W = P_1 V_1 ln\left(\frac{P_1}{P_2}\right)$$
$$Q = P_1 V_1 ln\left(\frac{V_2}{V_1}\right) @ Q = P_1 V_1 ln\left(\frac{P_1}{P_2}\right)$$

Isobaric process

$$U_2 - U_1 = mC_v(T_2 - T_1)$$
$$W = P(V_2 - V_1) = mR(T_1 - T_2)$$
$$Q = mC_p(T_2 - T_1)$$

POLITEKNIK MALAYSIA

LIST OF FORMULA

FM20014 - MECHANICAL ENGINEERING TECHNOLOGY

Adiabatic Process ($PV^{\gamma}=C$)

$$U_2 - U_1 = mC_v(T_2 - T_1)$$

$$W = \frac{P_1V_1 - P_2V_2}{\gamma - 1} = \frac{mR(T_1 - T_2)}{\gamma - 1}$$

$$Q = 0$$

$$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$$

Politropic Process($PV^{n}=C$)

$$U_2 - U_1 = mC_v(T_2 - T_1)$$

$$W = \frac{P_1V_1 - P_2V_2}{n - 1} = \frac{mR(T_1 - T_2)}{n - 1}$$

$$Q = \frac{\gamma - n}{\gamma - 1} \times W$$

$$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} = \left(\frac{V_1}{V_2}\right)^{n-1}$$

Isometric Process

$$U_2 - U_1 = mC_v(T_2 - T_1)$$

$$W = 0$$

$$Q = U_2 - U_1 = mC_v(T_2 - T_1)$$

SECOND LAW OF THERMODYNAMICS

$$W_{net} = Q_H - Q_L$$

Heat Engine

$$\eta_{th} = \frac{W_{net,out}}{Q_H} = 1 - \frac{Q_L}{Q_H}$$

Refrigerator

$$COP_{R,rev} = \frac{T_L}{T_H - T_L} = \frac{1}{T_H/T_L - 1}$$

Heat Pump

$$COP_{HP,rev} = \frac{T_H}{T_H - T_L} = \frac{1}{1 - T_L/T_H}$$

Power Cycle

$$\eta_{Rankine} = \frac{W_T - W_P}{Q_B} = \frac{(h_1 - h_2) - (h_3 - h_4)}{(h_1 - h_4)}$$

$$Work\ ratio = \frac{W_T - W_P}{W_T} = \frac{(h_1 - h_2) - (h_4 - h_3)}{(h_1 - h_2)}$$

$$s.s.c = \frac{3600}{W_T - W_P} = \frac{3600}{(h_1 - h_2) - (h_4 - h_3)}$$