SULIT

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

JABATAN KEJURUTERAAN MEKANIKAL

PENILAIAN ALTERNATIF

SESI 1 : 2021 / 2022

DJJ20063 : THERMODYNAMICS

NAMA PENYELARAS KURSUS : MOHD SHARIZAN BIN MOHD SHARIF

KAEDAH PENILAIAN	**: PEPERIKSAAN ATAS TALIAN**
JENIS PENILAIAN	**: SOALAN ESEI BERSTRUKUTR (2 SOALAN)**
TARIKH PENILAIAN	**: 7 FEBRUARI 2022**
TEMPOH PENILAIAN	**: 2 JAM**

LARANGAN TERHADAP PLAGIARISM (AKTA 174)
PELAJAR TIDAK BOLEH MEMPLAGIAT APA-APA IDEA, PENULISAN, DATA ATAU CIPTAAN ORANG LAIN. PLAGIAT ADALAH SALAH SATU PENYELEWENGAN AKADEMIK. SEKIRANYA PELAJAR DIBUKTIKAN MELAKUKAN PLAGIARISM, PENILAIAN BAGI KURSUS BERKENAAN AKAN DIMANSUHKAN DAN DIBERI GRED F DENGAN NILAI MATA 0.
(RUJUK BUKU ARAHAN-ARAHAN PEPERIKSAAN DAN KAEDAH PENILAIAN (Diploma) EDISI 6, JUN 2019, KLAUSA 17.3)

INSTRUCTION:

This section consists of **TWO (2)** structured essay questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan esei berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C1

(a) With the aid of a diagram, define these term.

Dengan bantuan gambarajah, tentukan maksud istilah berikut.

i. system.

Sistem.

ii. boundary

sempadan.

iii. surrounding

persekitaran.

[4 marks]

[*4 markah*]

CLO1
C2

(b)

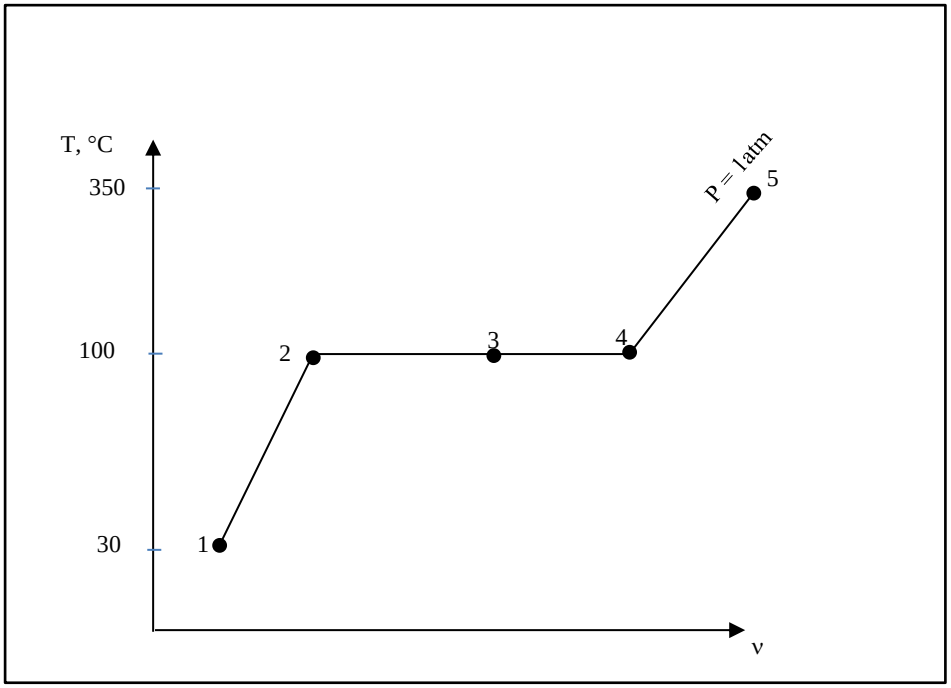
i. Explain dryness fraction.

Terangkan maksud pecahan kekeringan

[2 marks]

[*2 markah*]

ii. Complete the table 1 base on the P- ν diagram below.



Graph T-ν

Table 1

	phase	Condition
State 1		
State 2		
State 3		
State 4		
State 5		

[10 marks]

[*10 markah*]

(c)

CLO1
C2

i. With the aid of a diagram, explain close system in thermodynamics
Dengan bantuan gambar rajah, terangkan maksud sistem tertutup dalam termodinamik

[4 marks]
[*4 markah*]

ii. Isobaric and isothermal process are referred to as non-flow process. Show a comparison of these two processes in terms of graph (P- ν diagram) and equations for heat (Q) and work (W)
Proses isobarik dan isotermal dirujuk sebagai proses bukan aliran. Tunjukkan perbandingkan dua proses ini dari segi graf (graf P- ν) dan persamaan bagi haba (Q) dan kerja (W)

[5 marks]
[*5 markah*]

QUESTION 2
SOALAN 2

CLO2
C3

(a) In a steady flow system, air flows through a compressor at the rate 90kg/min. It enters at a pressure of 1.2 bar, a velocity of 15m/s, specific internal energy 1700kJ/kg and specific volume of 0.37 m^3/kg. It leaves the system at a pressure of 3.8 bar, a velocity of 35 m/s, specific internal energy 3100 kJ/kg and specific volume of 1.2 m^3/kg. During this passage through the system the air has a loss of heat of 30 kJ/s to the surroundings. Assuming the change in potential energy are negligible, determine :
Dalam sistem aliran sekata, udara mengalir melalui kompresor pada kadar 90kg/min. Ia memasuki pada tekanan 1.2 bar, halaju 15m/s, tenaga dalam tentu 1700 kJ/kg dan isipadu tentu 0.37 m^3/kg. Ia keluar dari sistem pada tekanan 3.8 bar, halaju 35 m/s, tenaga dalam tentu 3100 kJ/kg dan isipadu tentu 1.2 m^3/kg. semasa merentasi sistem udara kehilangan haba sebanyak 30 kJ/s ke persekitaran. Dengan mengabaikan perubahan tenaga keupayaan, kirakan:

i. Change of enthalpy
Perubahan entalpi

[3 marks]
[*3 markah*]

ii. Power of the system in kilowatts
Kuasa sistem dalam kilowatt

[7 marks]
[*7 markah*]

iii. Area of compressor outlet
Luas bahagian keluaran kompresor

[2 marks]
[*2 markah*]

CLO2
C3

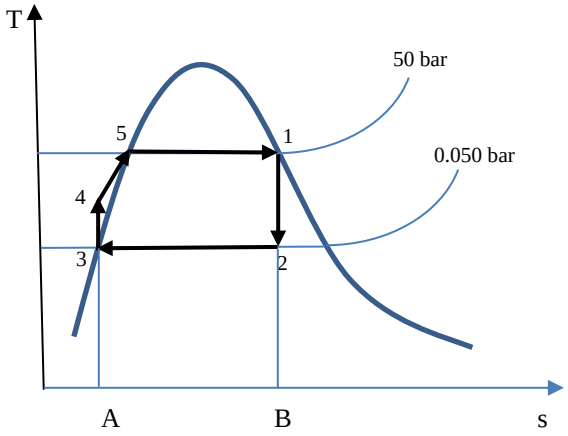
(b) A steam power plant operates between a boiler pressure of 50 bar and a condenser pressure of 0.050 bar. Calculate :
Sebuah loji kuasa stim beroperasi di antara tekanan dandang 50 bar dan tekanan pemeluapan 0.050 bar. Kirakan :

i. Cycle efficiency
Kecekapan kitaran

ii. Specific steam consumption for a Rankine cycle with dry saturated steam at the turbine entrance.
Penggunaan stim tentu untuk kitaran Rankine dengan wap tepu kering di bahagian masukan turbin.

The Rankine cycle is shown in the figure below.

Kitaran Rankine adalah seperti rajah dibawah.



[13 marks]

[*13 markah*]

SOALAN TAMAT

1. PROPERTIES OF PURE SUBSTANCE

Steam

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

Ideal Gas

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

2. FIRST LAW OF THERMODYNAMICS

$\Sigma Q = \Sigma W \qquad Q - W = U_2 - U_1$

Flow Process

$$\dot{m} = \rho CA(kg/s) = \frac{CA}{V} \qquad h = u + pv = Cp\,\Delta T$$

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

Non-Flow Process

1. **Isothermal Process** ($PV = C$)

$U_2 - U_1 = 0 \qquad Q = W$

$$W = P_1V_1 \ln\left(\frac{V_2}{V_1}\right) \quad @ \quad W = P_1V_1 \ln\left(\frac{P_1}{P_2}\right)$$

$$Q = P_1V_1 \ln\left(\frac{V_2}{V_1}\right) \quad @ \quad Q = P_1V_1 \ln\left(\frac{P_1}{P_2}\right)$$

2. **Adiabatic Process** ($PV^n = C$)

$U_2 - U_1 = mC_v(T_2 - T_1) \qquad W = \frac{P_1V_1 - P_2V_2}{\gamma - 1} = \frac{mR(T_1 - T_2)}{\gamma - 1}$

$Q = 0 \qquad \frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

3. **Politropic Process ($PV^n = C$)**

$$U_2 - U_1 = mC_v(T_2 - T_1) \qquad W = \frac{P_1V_1 - P_2V_2}{n-1} = \frac{mR(T_1 - T_2)}{n-1}$$

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

4. **Isobaric Process**

$U_2 - U_1 = mC_v(T_2 - T_1)$
$W = P(V_2 - V_1) = mR(T_2 - T_1)$
$Q = (h_2 - h_1) = mC_p(T_2 - T_1)$

5. **Isometric Process**

$U_2 - U_1 = mC_v(T_2 - T_1)$
$W = 0$
$Q = U_2 - U_1 = mC_v(T_2 - T_1)$

3. SECOND LAW OF THERMODYNAMICS

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

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

$$\text{Work Ratio} = \frac{(h_1 - h_2) - (h_4 - h_3)}{(h_1 - h_2)}$$

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