SULIT

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

JABATAN KEJURUTERAAN MEKANIKAL

PENILAIAN ALTERNATIF

SESI DISEMBER 2020

DJJ20063 / DJJ2073 : THERMODYNAMICS

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KAEDAH PENILAIAN : PEPERIKSAAN ONLINE

JENIS PENILAIAN : SOALAN ESEI BERSTRUKTUR (2 SOALAN)

TARIKH PENILAIAN : 12 JULAI 2021

TEMPOH PENILAIAN : 1 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

DJJ20063 CLO2
DJJ2073 CLO1
C3

Nitrogen (molar mass 28 kg/kmol) expands reversibly in a perfectly thermally insulated cylinder from 3.5 bar, 200°C to a volume of 0.09 m^3. If the initial volume occupied was 0.03 m^3 and the nitrogen is assumed as a perfect gas with C_v = 0.741 kJ/kg.K, Calculate:

Nitrogen (jisim molar 28 kg/kmol) mengembang secara boleh balik di dalam silinder yang ditebat daripada 3.5 bar, 200°C kepada isipadu 0.09 m^3. Jika isipadu awal nitrogen adalah 0.03 m^3 dan nitrogen dianggap sebagai gas sempurna dengan C_v = 0.741 kJ/kg,K, kirakan:

i. The gas constant (R)
Pemalar gas (R)

[6 marks]
[*6 markah*]

ii. The final gas pressure
Tekanan akhir gas

[10 marks]
[*10 markah*]

iii. Heat transfer
Haba dibebaskan

[3 marks]
[*3 markah*]

iv. Work done and state weather it leaves or enter the system
Kerja yang dilakukan dan nyatakan sama ada kerja keluar atau memasuki sistem

[6 marks]
[*6 markah*]

QUESTION 2
SOALAN 2

DJJ20063 CLO2
DJJ2073 CLO1
C3

A steam power plant operates between a boiler pressure of 40 bar and a condenser pressure of 0.045 bar. If the plant operates with the Rankine cycle, Calculate:
Sebuah penjana kuasa stim beroperasi di antara tekanan dandang 40 bar dan tekanan tepu pemeluwap 0.045 bar. Sekiranya loji ini beroperasi dengar kitar Rankine, kirakan:

i. The work for turbine
Kerja turbin

[12 marks]
[*12 markah*]

ii. The pump feed work
Kerja pam suapan

[4 marks]
[*4 markah]*

iii. Rankine efficiency
Kecekapan kitar Rankine

[6 marks]
[*6 markah*]

iv. Specific steam consumption
Penggunaan stim tentu

[3 marks]
[*3 markah*]

SOALAN TAMAT

1. PROPERTIES OF PURE SUBSTANCE

Steam

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

Ideal Gas

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

2. FIRST LAW OF THERMODYNAMICS

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

Flow Process

$$\dot{m} = \rho CA = \frac{CA}{V} \qquad h = u + pv$$

$$h = Cp\,\Delta T$$

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

Non-Flow Process

1. Isothermal Process ($PV = C$)

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

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

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

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

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

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

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

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

$Q = \frac{\gamma - n}{\gamma - 1}$ x 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 = $mC_v(T_2 - T_1)$
$W = P(V_2 - V_1) = mR\,(T_2 - T_1)$
$Q = mC_p(T_2 - T_1)$

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

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

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

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

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

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