

**INSTRUCTION:**

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

**ARAHAN:**

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

**QUESTION 1****SOALAN 1**

- |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CLO1 | <p>(a) Describe</p> <p><i>Terangkan</i></p> <p>i. process<br/><i>proses</i></p> <p style="text-align: right;">[2 marks]<br/>[2 markah]</p> <p>ii. close system<br/><i>sistem tertutup</i></p> <p style="text-align: right;">[2marks]<br/>[2 markah]</p>                                                                                                                                                                                                                                                                                                                                                                                        |
| CLO1 | <p>(b) A gas with weight molecule of 30.02 is at a temperature of 28 °C, pressure 100 kN/m<sup>2</sup> and volume 0.22 m<sup>3</sup>. If the gas has a value of <math>C_v = 0.720</math> kJ/kg K, discuss:</p> <p><i>Gas dengan molekul berat 30.07 berada pada suhu 28 °C, tekanan 100 kN/m<sup>2</sup> dan isipadu 0.22 m<sup>3</sup>. Jika gas mempunyai nilai <math>C_v = 0.720</math> J/kg K, bincangkan:</i></p> <p>i. gas constant<br/><i>pemalar gas dan</i></p> <p style="text-align: right;">[4 marks]<br/>[4 markah]</p> <p>ii. mass of the gas<br/><i>jisim gas</i></p> <p style="text-align: right;">[5 marks]<br/>[5 markah]</p> |

- CLO1 (c) Use steam tables to determine the specific volume, the specific enthalpy and the specific entropy when given superheated steam at 25 bar and 350°C.  
*Gunakan jadual stim untuk menentukan isipadu tentu, entalpi tentu dan entropi tentu apabila diberi keadaan stim panas lampau pada 25 bar dan 350°C.*

[12 marks]

[12 markah]

**QUESTION 2****SOALAN 2**

- CLO1 (a) Explain the terms below with example:  
*Jelaskan terma dibawah bersama dengan contoh:*

- i. Steady flow

*Aliran sekata*

[3 marks]

[3 markah]

- ii. Unsteady flow

*Aliran tak sekata*

[3 marks]

[3 markah]

- CLO1 (b) An adiabatic gas turbine expands air from 1300 kPa and 500°C to 100 kPa and 127°C. Air enters the turbine through a 0.2 m<sup>2</sup> opening with an average velocity of 40 m/s, and exhausts through a 1 m<sup>2</sup> opening. Calculate.

Given:  $R = 0.287 \text{ kJ/k K}$   $C_p = 1.048 \text{ kJ/k K}$

*Suatu turbin gas adiabatik mengembang udara pada 1300 kPa dan 500°C kepada 100 kPa dan 127°C. Udara memasuki turbin melalui bukaan 0.2 m<sup>2</sup> dengan kelajuan purata 40 m/s, dan ekzos melalui bukaan 1 m<sup>2</sup>. Kirakan;*

*Diberi:  $R = 0.287 \text{ kJ/k K}$   $C_p = 1.048 \text{ kJ/k K}$*

- i. Specific volume and mass flow rate

*Isipadu tentu dan kadar alir jisim*

[12 marks]

[12 markah]

- ii. Work output by the turbine in kW

*Kerja keluaran oleh turbin di dalam kW*

[7 marks]

[7 markah]

### QUESTION 3

#### SOALAN 3

CLO1

- (a) State **THREE (3)** assumptions of Steady Flow Energy equation for:

*Nyatakan **TIGA(3)** anggapan Persamaan Tenaga Aliran Mantap untuk:*

- i. condenser

*pemeluwap*

[3 marks]

[3 markah]

- ii. throttle

*pendikit*

[3 marks]

[3 markah]

CLO1

- (b) A certain perfect gas at temperature  $18^{\circ}\text{C}$  and pressure  $225 \text{ kN/m}^2$ , occupying a volume of  $0.63 \text{ m}^3$  at initial state. The gas is heated at constant pressure until the temperature is  $47^{\circ}\text{C}$ . Given  $C_p$  for gas as  $0.34 \text{ kJ/kg K}$ , detail the final volume of the gas, the work done during the process and the heat transferred during the process.

*Gas sempurna pada suhu  $18^{\circ}\text{C}$  dan tekanan  $225 \text{ kN/m}^2$ , menduduki isipadu  $0.63 \text{ m}^3$  pada keadaan awal. Gas dipanaskan pada tekanan malar sehingga suhu adalah  $47^{\circ}\text{C}$ . Diberi  $C_p$  untuk gas sebagai  $0.34 \text{ kJ/kg K}$ , perincikan jumlah isipadu gas akhir, kerja yang dilakukan semasa proses dan haba dipindahkan semasa proses.*

[10 marks]

[10 markah]

CLO1

- (c) Air flows through a nozzle isentropically, at a rate of  $600 \text{ kg/hr}$ . The pressure at the inlet nozzle is  $2 \text{ MPa}$  and the temperature is  $127^{\circ}\text{C}$ . The outlet pressure is  $0.5 \text{ MPa}$ . Calculate the air outlet velocity if the initial air velocity is  $300 \text{ m/s}$  and the specific heat ratio is  $1.4$ .

Given  $C_p = 1.005 \text{ kJ/kg K}$

*Udara mengalir menerusi sebuah muncung secara seentropi, pada kadar  $600 \text{ kg/jam}$ . Tekanan di salur masuk muncung adalah  $2 \text{ MPa}$  dan suhu  $127^{\circ}\text{C}$ . Tekanan di salur keluar adalah  $0.5 \text{ MPa}$ . Kirakan halaju salur udara keluar jika halaju awal ialah  $300 \text{ m/s}$  dan haba tentu ialah  $1.4$ .*

*Di beri  $C_p = 1.005 \text{ kJ/kg.K}$*

[9 marks]

[9 markah]

## QUESTION 4

## SOALAN 4

CLO1

- (a) A steam power plant operates between a boiler pressure of 46 bar and a condenser pressure of 0.03 bar. If steam enters the turbine at a dry saturated state, discuss the feed pump work and the Rankine efficiency.

*Sebuah penjana kuasa steam bekerja di antara tekanan dandang 46 bar dan tekanan pemeluwap 0.03 bar. Sekiranya stim masuk ke dalam turbin pada keadaan tepu kering, bincangkan kerja pam suapan dan kecekapan kitar Rankine.*

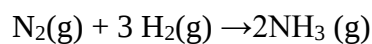
[15 marks]

[15 markah]

CLO1

- (b) Given the reaction of gas  $N_2$  and  $H_2$  with the equilibrium constant  $K_c$  1.2 atm and temperature  $375^\circ C$ .

*Diberi tidak balas di antara gas  $N_2$  dan  $H_2$  dengan pemalar keseimbangan  $K_c$  1.2 atm dan suhu  $375^\circ C$ .*



- i. Write the equation of  $K_c$  for the reaction above.

*Tuliskan persamaan  $K_c$  bagi tindak balas ini atas.*

[2 marks]

[2 markah]

- ii. Calculate the value of  $K_p$  for this reaction.

*Kirakan nilai  $K_p$  bagi tindak balas ini.*

[6 marks]

[6 markah]

- iii. Share the equilibrium constant for the reverse reaction at the same temperature.

*Kongsikan pemalar keseimbangan bagi tindak balas berbalik pada suhu yang sama.*

[2 marks]

[2 markah]

## SOALAN TAMAT