

**VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA**  
**Odd Mid Semester Examination for Academic Session 2024-25**

COURSE NAME: B.Tech

SEMESTER: 3RD

BRANCH NAME: PRODUCTION ENGINEERING  
SUBJECT NAME: THERMAL & FLUID ENGINEERING

FULL MARKS: 30

TIME: 90 Minutes

Answer All Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. [2 × 3]

- a) State the zeroth law of thermodynamics and the principle of thermometer. - CO1
- b) What do you mean by free expansion? What are the conditions when an ideal gas undergoes free expansion? - CO2
- c) Define Reynolds Number? How its helpful to determine the flow of fluid? - CO3

Q2. [8]

What is adiabatic process? Derive the work done involved in this process. - CO1

A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1m<sup>3</sup> to 0.4 MPa, 0.03m<sup>3</sup>. Assuming that the pressure and volume are related by  $p v^n = \text{constant}$ . Find the work done by the gas system where  $n = 1.67$ .

OR

Derive the steady state energy equation of 1<sup>st</sup> law of thermodynamics of an open system? - CO1  
Also mention the unsteady flow equation of 1<sup>st</sup> of thermodynamics.

Q3. [8]

A fluid system contained in a piston cylinder machine passes through a complete cycle of four processes. The summation of heat transfer is -340 KJ/cycle. The system completes 250 cycle per minute. Complete the following table and find the network transfer in K watt. - CO2

Process	Q(KJ/min)	W(KJ/min)	dU(KJ/min)
1-2	0	4340	?
2-3	42000	0	?
3-4	-4200	?	-73200
4-1	?	?	?

OR

A piston cylinder device contains 0.05m<sup>3</sup> of a gas initially at 200 Kpa. At this state a linear spring which has spring constant of 150 KN/m is just touching the piston but exerting no force on it. Now, heat is transferred to the gas causing the piston to rise and to compress the spring until the volume inside the cylinder doubles. - CO2

If the cross-sectional area of the piston is 0.25m<sup>2</sup>. Find: -

1. Find pressure inside the cylinder
2. Work done by the gas

Q4. [8]

What is Bernoulli's equation and how it is useful? Mention its working principle in venturi-meter with a proper diagram. - CO3

OR

Define 2<sup>nd</sup> law of thermodynamics. What are the two statements given by 2<sup>nd</sup> law of thermodynamics. Discuss both the statements briefly. - CO3