RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

Bachelor of Science in Applied Sciences
Second Year - Semester I Examination – July / August 2023

### PHY 2101 - THERMODYNAMICS AND RADIATION

Time: One (01) hour

Answer **all** questions.

Use of a non-programmable calculator is permitted.

1. Prove that $\frac{dP}{dV} = -\frac{\gamma P}{V}$ for an adiabatic process where, γ is polytrophic index for an adiabatic process and P,V have their usual meaning.

   (15 marks)

2.
   a) Explain the difference between a heat engine and a refrigerator. Derive the expression for coefficient of performance (C.O.P.) of a refrigerator.

   (15 marks)

   b) A reversed heat engine absorbs 250 kJ of heat from a low temperature region and has a mechanical input of 100 kJ.

   i.   What would be the heat transferred to the high temperature region?

   ii.   Evaluate the coefficient of performances of the reversed engine when working as a refrigerator and as a heat pump.

   (20 marks)

3. State the Kelvin-Planck statement of the Second Law of Thermodynamics.

   (10 marks)

4. In a thermal process, the pressure of a fixed mass of a gas is changed in such a manner that the gas molecules give out the heat energy of 30 J and work of 10 J. If the initial internal energy of the gas was 40 J, find the final internal energy of the system.

   (10 marks)

5. The image below shows the P-V diagram of a thermodynamic cyclic process for 1 mol of an ideal monotonic gas. This thermodynamic cyclic process is following the path ABCDA. What is the work done by the system?

(10 marks)
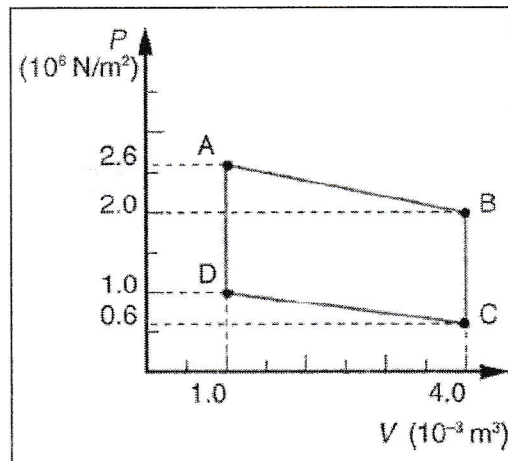
6. Using P-V diagrams and relevant polytrophic indexes, explain following thermodynamic processes;
    i.   Isobaric process
    ii.   Adiabatic Process
    iii.   Isothermal process
    iv.   Isochoric process

(20 marks)

End.