

UNIVERSITY OF FORT HARE

THERMAL PHYSICS
PHY 312

DEGREE EXAMINATIONS

JUNE

2025

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Time: 3 hours
Subject: PHY 312
Marks: 100

This paper consists of 4 pages including the cover page

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INSTRUCTIONS

1. Answer all the questions.
2. Write neatly and legibly.
3. Unless otherwise stated, all symbols retain their usual meanings.
4. Values of constants and formula sheet appear at the end of the question paper

QUESTION 3: [15 Marks]

- (a) State the First Law of Thermodynamics? [2]
- (b) Describe Joule's experiment and its significance? [2]
- (c) Derive $C_p - C_v = R$? [4]
- (d) Define enthalpy and heat capacity? [2]
- (e) Apply the first law to a turbine and derive shaft work expression under steady flow. [5]

QUESTION 4: [15 Marks]

- (a) State Kelvin-Planck and Clausius statements. [3]
- (b) Derive Carnot efficiency? [4]
- (c) Prove the equivalence of the two statements. [4]
- (d) Explain entropy change in irreversible processes? [2]
- (e) How does the second law limit engine efficiency? [2]

QUESTION 5: Entropy [15 Marks]

- (a) Define entropy and its physical significance? [3]
- (b) Derive entropy change for ideal gas (isothermal)? [4]
- (c) State and explain Clausius inequality? [2]
- (d) Explain the principle of increasing entropy? [2]
- (e) Describe and interpret a TS diagram? [4]