Reg. No..... (Pages 2) **K 5113**

Name.....

SECOND YEAR B.Sc. DEGREE EXAMINATION
MARCH/APRIL 2005

Part III—Group II—Physics

Paper II—THERMODYNAMICS AND STATISTICAL PHYSICS

(2003 Admissions)

Time : Three Hours Maximum : 50 Marks

Section A

Answer any **two** *questions.*
Each question carries 6 *marks.*

1. Describe the working of Diesel engine and derive the formula for its efficiency.
2. Define the concept of entropy. What is its physical significance ? Show that the entropy of a perfect gas remains constant in a reversible process but increases in irreversible process.
3. Describe the working of Carnot's engine. Deduce the efficiency of Carnot's engine.
4. State the basic assumption on which the quantum statistics is developed. Derive Bose-Einstein Law.

(2 × 6 = 12 marks)

Section B

Answer any **four** *questions.*
Each question carries 3 *marks.*

5. State and explain Third law of Thermodynamics.
6. Explain the concepts of reversible and irreversible process with suitable examples.
7. Distinguish between Otto engine and Diesel engine.
8. Derive an expression for the efficiency of Carnot's engine from (T-S) diagram.
9. Derive relations connecting P,V and T in adiabatic process.
10. Derive Planck's law of radiation on photon gas based on Bose-Einstein distribution law.

(4 × 3 = 12 marks)

Section C

Answer any **seven** *questions.*
Each question carries 2 *marks.*

11. State and explain Zeroth law of Thermodynamics.
12. What is an Isothermal process ? Write the equation for the Isothermal process.
13. What is the important feature of Second law of Thermodynamics ?
14. Explain the change in entropy in irreversible process.

Turn over

15. State Carnot's theorem.
16. Define absolute zero on thermodynamic scale.
17. What is the consequence of Third law of thermodynamics ?
18. What are the properties of liquid helium I ?
19. Explain the superfluidity of a material.
20. What are the characteristics of a black body radiation ?
21. What do you mean by micro and macrostates ?

(7 × 2 = 14 marks)

Section D

Answer any **four** *questions.*
Each question carries 3 *marks.*

22. Calculate the efficiency of Carnot's engine working between the temperatures 227°C and 15°C.
23. A Carnot's engine has the same efficiency working between the temperature limits 2500K and 1000K and between θK and 2000K. Find the value of θ.
24. The efficiency of an Otto engine is 75% and $\gamma = 1.5$. Calculate the compression ratio ρ.
25. Find the increase in entropy when 1.68 kg of ice at 0°C melts into water at the same temperature. Given that latent heat of fusion of ice $L = 335 \times 10^3$ J/kg.
26. Calculate the efficiency of a petrol engine with $\gamma = 1.5$ and $\rho = 6$.
27. A Carnot's engine whose temperature of the source is 300K takes 300 calories of heat at this temperature and rejects 200 calories of heat to sink. What is the temperature of the sink ?
28. 1 kg of water at 273 K is brought is contact with a heat source at 373 K. Calculate the increase in entropy of water when its temperature reaches 373 K.

(4 × 3 = 12 marks)