P.R. GOVERNMENT COLLEGE (A), KAKINADA

II B.Sc., PHYSICS- SEMESTER-IV Paper – IV
w.e.f. 2018-19 ADMITTED BATCH

THERMODYNAMICS

Course Code : PH4202 **No. of credits : 03**

4 Hours/Week **Total hours : 60**

Unit – I **33 hrs**

1. **Module – 1 Kinetic theory of gases: (11)**

Introduction(L) – Deduction of Maxwell's law of distribution of molecular speeds(T), C, C_p & C_{rms} and the relation among them(T) - Mean free path - Transport Phenomena(L) – Viscosity of gases – thermal conductivity – diffusion of gases(T).

2. **Module – 2 Thermodynamics: (12)**

Introduction – Reversible and irreversible processes(L) – Carnot's engine and its efficiency (T)– Carnot's theorem (L)– Second law of thermodynamics, Kelvin's and Clausius statements(T) –Entropy, physical significance (L)– Change in entropy in reversible and irreversible processes (L)– Entropy and disorder – Entropy of universe(L) – Temperature- Entropy (T-S) diagram(L).

3. **Module – 3 Thermodynamic potentials and Maxwell's equations: (10)**

Thermodynamic potentials – Derivation of Maxwell's thermodynamic relations (T)– Clausius-Clayperon's equation (T)– Derivation for ratio of specific heats(T) – Derivation for difference of two specific heats for perfect gas(T). Stephen – Boltzmann law - derivation

Unit – II **27 hrs**

4. **Module – 4 Low temperature Physics: (12)**

Introduction – Joule Kelvin effect – liquefaction of gas using porous plug experiment(L). Joule expansion – Distinction between adiabatic and Joule Thomson expansion – Expression for Joule Thomson cooling(T) – Liquefaction of helium, Kapitza's method (L)– Adiabatic demagnetization – Production of low temperatures(L) – Principle of refrigeration, vapour compression type(S). Working of refrigerator.

5. **Module – 5 Quantum theory of radiation 1: (8)**

   Black body-Ferry's black body(L) – Quantum theory of radiation - Planck's law – deduction of Wein's law, Rayleigh-Jeans law, from Planck's law (T)-

6. **Module – 6 Quantum theory of radiation 2: (7)**

   Measurement of radiation – Types of pyrometers(S) – Disappearing filament optical pyrometer experiment (S) – Angstrom pyroheliometer(L) - determination of solar constant, temperature of sun(T).

Textbooks

1. **Fundamentals of Physics**. Halliday/Resnick/Walker.*C. Wiley India Edition 2007*.
2. **Optics and Spectroscopy**. R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co*.
3. **Second Year Physics** – *Telugu Academy.*
4. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath (for statistical Mechanics) *S. Chand & Co*.

Reference Books

1. **Modern Physics** by G. Aruldhas and P. Rajagopal, *Eastern Economy Education.*
2. Berkeley Physics Course. Volume-5. **Statistical Physics** by F. Reif. *The McGraw-Hill Companies.*
3. **An Introduction to Thermal Physics** by Daniel V. Schroeder.*Pearson Education Low Price Edition*.
4. **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
5. **Modern Engineering Physics** by A.S. Vasudeva. *S.Chand & Co. Publications*.
6. **Feyman's Lectures on Physics** Vol. 1,2,3 & 4. *Narosa Publications.*

II B.Sc., SEMESTER – IV PAPER IV (Model Paper)
w.e.f. 2018-19 ADMITTED BATCH

THERMODYNAMICS

Course Code : PH4202 **No. of credits : 03**

Note:- Set the question paper as per the blue print given at the end of this model paper.

Time : $2\frac{1}{2}$ Hours Max Marks : 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Module	Essay Questions 10 marks	Short Questions 5 marks	Problems 5 marks	Marks allotted
I	1	1	-	15
II	1	1	1	20
III	1	1	-	15
IV	1	1	1	20
V	1	1	-	15
VI	-	1	1	10
Total Marks				95

Note: At least ONE problem should be answered.

QUESTION BANK

SUBJECT: PHYSICS **PAPER: IV** **SEMESTER: IV**

THERMODYNAMICS

Module – I (KINETIC THEORY OF GASES)

Essay questions - 10 M

1. Derive an expression for the Maxwell's law of distribution of molecular speeds in a gas.
2. Define Coefficient of Viscosity. On the basis of kinetic theory of gases, derive an expression for the coefficient of Viscosity.
3. Define Coefficient of Thermal Conductivity. On the basis of kinetic theory of gases, derive an expression for the coefficient of Thermal Conductivity.
4. Derive expressions for C, C_p, and C_{rms} & derive the relation between them
5. Define Coefficient of Diffusion. On the basis of kinetic theory of gases, derive an expression for the coefficient of Diffusion.

Short questions - 5 M

6. Derive the relation between C, C_p, and C_{rms}
7. Explain the Transport Phenomena with reference to a gas
8. Write a short note on Mean free path

Module – II (THERMODYNAMICS)

Essay questions - 10 M

9. Describe the working of Carnot's Engine and derive an expression for its Efficiency.
10. Define Entropy. Give the Physical significance of the entropy. Calculate the change in Entropy in irreversible cycle.
11. What is a T-S diagram? Give its uses. Obtain an expression for the efficiency of a Carnot's engine using T-S diagram.

Short questions - 5 M

12. What are reversible and irreversible processes? Give examples
13. State and Prove Carnot's theorem.
14. Obtain an expression for the change in entropy in Reversible cycle.
15. Write a short note on Entropy and disorder.

Problems - 5 M

16. Calculate the efficiency of a reversible engine working between 327^0C and 127^0C
17. Carnot engine has the same efficiency between 1500K and 500K and T K and 1000K. Find the value of T
18. Calculate the change of entropy when 300g of lead melts at 327^0C. Lead has a latent heat of fusion of 5.85 Cal g^{-1}

Module – III (THERMODYNAMIC POTENTIALS & MAXWELLS EQUATIONS)

Essay questions - 10 M

19. What are Thermodynamic Potentials? Derive the Maxwell's Thermodynamic Equations.
20. Derive Stephen – Boltzmann law using Maxwell's Equations
21. Obtain Maxwell's thermodynamic relations?

Short questions - 5 M

22. Derive the Equation for the difference of two specific heats of a perfect gas
23. Derive the Equation for the ratio of two specific heats
24. Derive Clausius – Clapeyron's equation from Maxwell's Equations.

25. Write about Thermodynamic Potentials.

Module – IV (LOW TEMPERATURE PHYSICS)

Essay questions - 10 M

26. What is Joule – Thomson Effect? Obtain an expression for the Cooling produced in this effect.
27. What is Adiabatic demagnetization? Explain the Principle of Adiabatic demagnetization.
28. What is Joule – Kelvin effect? Describe the porous plug experiment and indicate the results
29. What is refrigeration? Explain the principle of working of a vapour compression machine

Short questions - 5 M

30. Explain the principle of regenerative Cooling
31. Explain the method of cooling Helium vapour by Kapitza method

Problems - 5 M

32. Calculate the temperature of inversion of helium gas. Given that a = 3.44x13-3 nt-m^4/mol^2 and b = $0.0237x10^{-3}$ m^3/mol and R = 8.31 joule/(mol – K)
33. Calculate the temperature of inversion in case of H_2 and CO_2 from the given date. T_c for H_2 is -239.9ºC and fro Co_2 is 31ºC.

Module – V (Quantum theory of radiation 1)

Essay questions - 10 M

34. State Planck's hypothesis. Derive Planck's formula for the distribution of energy in black body radiation.
35. Derive Wein's law and Rayleigh-Jeans law from Planck's radiation law.

Short questions - 5 M

36. Describe Fery's black body
37. What is black body? What are the properties of black body radiation?

Module – VI (Quantum theory of radiation 2)

Short questions - 5 M

38. Write a note on Disappearing filament Optical pyrometer.
39. How do you determine Solar constant experimentally by using Angstrom Pyrheliometer?
40. Write a short note on Solar constant.
41. How temperature of sun is determined?

Problems - 5 M

42. Determine the temperature of sun with the help of wien's law, given b = 2.92×10^{-3} mK. Maximum wavelength = 4900 A^0.
43. A black body radiator at 0^0 c radiates energy of 3.2×10^2 Jm^{-2} sec^{-1}. Calculate the value of Stefan's constant.
44. Calculate the temperature of the sun from the following data. S = 1.34 KW/ m^2, radius of the Sun = 7.92×10^5 Km. Distance of the sun from the earth = 1.5×10^5 Km and Stefan's constant = 5.7×10^{-8} W m^{-2} K^{-4}.