B Sc	Semester III	Credits: 4
Course: 3	Heat and thermodynamics	Hrs/Wk: 4

Student able to Learning:

- Students will be able to Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.
- They develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
- To apply the theories learnt and the skills acquired to solve real time problems
- To understand the concepts and significance of the various physical phenomena

UNIT I: Kinetic Theory of gases: (12 hrs)

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification,Mean free path, Degrees of freedom, Principle of equipartition of energy (Qualitative ideas only), Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

UNIT II: Thermodynamics: (12hrs)

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT III: Thermodynamic Potentials and Maxwell's equations: (12hrs)

Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of C_P-C_V (iii) Value of C_P/C_V (iv) Joule-Kelvin coefficient for ideal gases.

UNIT IV: Low temperature Physics:(12hrs) Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment , Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substancesat low temperatures.

UNIT V: Quantum theory of radiation: (12 hrs) Blackbody and its spectral energy distribution of black body radiation, Kirchoff's law, Wein'sdisplacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (Noderivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh-Jean's law from Planck's law, Solar constant and its determination using Angstrompyroheliometer, Estimation of surface temperature of Sun.

REFERENCE BOOKS:

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C.Srivastava, S.K.Saha&AbhayK.Jain, Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai PrakashNath&Co.Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
5. Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand& Co.,2012
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

B Sc	Semester III	Credits: 1
Course: 3	Heat and thermodynamics Lab	Hrs/Wk: 2

Details of Lab/Practical/Experiments/Tutorials syllabus:

Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermoemf- thermo couple - Potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan's constant- emissive method
10. Study of variation of resistance with temperature - Thermistor.
11. Calculation of temperature coefficient of given material using Carry Fosters bridge.

9. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

E. Measurable:

Assignments on: Maxwell's law of distribution of molecular velocities, Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases. Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature, Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations fromthermodynamic potentials, Joule Kelvin effect, Porous plug experiment ,Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression forJoule Thomson cooling, Liquefaction of air by Linde's method, Production of lowtemperatures by adiabatic demagnetization

10. Student seminars (Individual presentation of Courses) on topics relating to: Kinetic Theory of Gases, Carnots Engine and its efficiency, Carnot Theorem, Entropy, Maxwell Thermodynamic Equations, Joule Kelvin effect, Production of low temperatures, Plank Radiation law, Weins law,Pyrometers,
11. Quiz Programmes on: Kinetic theory of gases, Heat and Temperature entropy, Isothermal and Adiabatic process,Thermodynamic Potentials, Low temperature Physics , Thermal Radiation.
12. Individual Field Studies/projects: Carnots Engine, Pyrometers, Adaibatic demagnetization, Porus plug experiment. Liquification of gases.
13. Group discussion on:Kinetic theory of gases, Quantum theory of Radiation, Low temperature physics and thermodynamic potentials,
14. Group/Team Projects on: Carnots Engine, Pyrometers, Adaibatic demagnetization, Porus plug experiment. Liquification of gases.

F. General

5. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus
6. Group Discussions on:
7. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
8. Any similar activities with imaginative thinking.

Recommended Continuous Assessment methods:

MODEL QUESTION PAPER (Sem - End)

B.Sc DEGREE EXAMINATION
Semester – III
Paper 3: Heat &Thermodynamic

Time: 3 hrs **Maximum Marks : 75**

Section A

Answer Any Five Questions **5X5=25M**

1. Derive an expression for the coefficient of viscosity of a gas on the basis of kinetic theory of gases.
   వాయుస్నిగ్ధతాగుణకమును అణు చలన సిద్ధాంతము ద్వారా వివరింపుము
2. What are pyrometers? Describe disappearing filament optical pyrometer.
   మాయమైపోయే తీగ దృశా పిరోమీటర్ నిర్మాణమును వివరింపుము
3. What are pyrometers? Describe disappearing filament optical pyrometer
   కార్నడ్ సిద్ధాంతమును వ్రాసి వివరించుము
4. Obtain clausius- clapeyron equation from Maxwell's equations
   మాక్స్వెల్ సమీకరణం ద్వారా క్లాసియస్ -క్లాపిరాన్ సమీకరణాని ఉత్పాదించుము
5. Discuss the effects of Chloro and fluoro carbons on ozone layer
   ఓజోన్ పొరమీద క్లోరో - ఫ్లోరో కార్బన్ ల యొక్క చర్యను విరింపుము
6. What is Entropy. And explain how it changes in a reversible process
   ఎంట్రోపిని వివరింపుము. ఉత్క్రమినియా ప్రక్రియలో దాని మార్పునుము విరింపుము
7. The efficiency of a Cornot's engine is 60%. Calculate the increase in temperature of the source so that the efficiency becomes 70%.
   కార్నో ఇంజను యొక్క సామర్థ్యం60%. దాని సామర్థ్యం 0% అయితే దాని ఉత్పదక లోని ఉష్ణోగ్రత పెరుగుదల ఎంత
8. Calculate the surface temperature of the Sun, given the radius of the Sun = 7.04 x 10^5 Km, distance of the Sun from the earth = 14.72 x 10^7 Km, solar constant = 1400 W/m^2 and Stefan's constant = 5.7 x 10^{-8} $Wm^{-2}K^{-4}$.
   సూర్యుని ఉపరితల ఉష్ణోగ్రతను లెక్కించుము60%.. సూర్యుని వ్యాసార్ధం 7.04 x 10^5 Km భూమినుండి సూర్యునికి గల దూరం 14.72 x 10^7 Km సౌర సిద్ధాంతం 1400 W/m^2 మరియు స్టేపాన్ స్థిరాంకం

Section B

Answer ALL The Questions. **5X10 = 50M**

9. a) Derive Maxwell's distribution law of velocities.
   మాక్స్వెల్ వేగా వితరణ సూత్రాన్ని రాబట్టండీ

   (OR)

   b) Define coefficient of viscosity and thermal conductivity and derive the relation between them using Kinetic theory of gasses.
   స్నిగ్ధతాగుణము మరియు ఉష్ణ వాహకత్వముయు నిర్వహించి వాటి మధ్య సంబంధమును వ్రాయు అణు చలన సిద్ధాంతము ద్వారా రాబట్టుము

10. a) Derive Plank's law of radiation. Derive an expression for energy distribution?
ప్లాంక్ వికిరణ సూత్రాన్ని రాబట్టుము , శక్తి వితరణ సత్రాన్ని వివరింపుము
(OR)
b) Explain the construction and working of PyroHelio meter.
పైరోహేలియో మీటర్ యొక్క నిర్మాణము మరియు పనితనం వ్రాయుము
11. a) Describe the working of Cornot's engine and derive the expression for its efficiency
కార్నో ఇంజను పనితనం మరియు దాని సామర్థ్యమును ఉత్పాదించుము
(OR)
b) Explain T-S diagram and derive expression for effiency
T-S పఠమను వివరిచి దాని సామర్థ్యమును ఉత్పాదించుము
12. a) What are thermodynamic potentials? Derive Maxwell's thermodynamic relations.
ఉష్ణగతిక శక్మాలను నిర్వచించుము, తద్వారా మాక్స్వెల్ ఉష్ణగతిక సమీకరణాన్ని రాబట్టండి
(OR)
b) Define Joule Thomson effect and derive and expression for cooling
జౌల్ - థామ్సన్ ఫలితము వివరింపుము , జౌల్ - థామ్సన్ శీతలీకణానికి సమీకరణని వివరింపుము
13. **a)** Describe how low temperatures are produced by adiabatic demagnetization. Give the theory of the experiment.
స్థిరోష్ణ నిరయస్కాంతీకరణం ద్వారా అల్ప ఉష్ణోగ్రతలను ఏ విధంగా పొందవచునో వివరింపుము
(OR)
b) Explain the liquification of air by Linde's methode.
లిండే పద్దతి ద్వారా వ్రాయుద్రువీకరణము వివరింపుము