

SRM UNIVERSITY
FACULTY OF SCIENCE AND HUMANITIES
DEPARTMENT OF PHYSICS AND NANOTECHNOLOGY
SECOND Year B.Sc. Physics (2015-2016 Regulation)

Lesson Plan

Course Code: UPY15301

Course Title: Heat and Thermodynamics

Class: IInd B.Sc. PHYSICS

Semester: IIIrd

Course Time: JUNE – NOVEMBER, 2017

Location: SRM UNIVERSITY

OBJECTIVES

1. To know the fundamentals of heat
2. To understand the concepts involved in transmission of heat
3. To understand the basic principle and laws of thermodynamics
4. To understand the concepts of entropy

Assessment Details:

Cycle Test – I	:	10 Marks
Cycle Test – II	:	10 Marks
Model Exam	:	20 Marks
Surprise Test	:	5 Marks
Attendance	:	5 Marks

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Semester	Course Code	Course Title	L	T	P	Total of L+T+P	C
3	UPY15301	HEAT AND THERMODYNAMICS	4	1	0	5	4

Syllabus

UNIT I - INTRODUCTION TO HEAT:

Basic Definitions – Newton’s law of cooling – Specific heat of a liquid calendar and Barne’s continuous flow method – Two specific heats of a gas – Specific heat of a gas by Jolly’s differential steam calorimeter – Regnault’s method – Dulong and Petit’s law – Einstein’s theory of specific heat - Debye’s theory of specific heat - variation of specific heat ad atomic heat with temperature - Transference of heat.

UNIT II - TRANSMISSION OF HEAT:

Conduction – Coefficient of the thermal conductivity – Rectilinear flow of heat along a metal bar - Methods of radial flow of heat - Spherical shell method and flow of heat along the wall of a cylindrical tube - Determination of thermal conductivity of rubber and bad conductor – Lee’s disc method to find thermal conductivity of bad conductor. Conduction – Radiation – Black body – Wein’s Law – Raleigh Law and its significance –Jean’s Law – Stefan’s law – Experimental Determination of Stefan’s constant – Mathematical derivation of Stefan’s law.

UNIT III - KINETIC THEORY OF GASES:

Maxwell’s law of distribution of molecular velocities – Experimental verification of molecular velocities – Equilibrium speed distribution of velocities - Mean free path of gaseous molecules – Transport phenomena – Diffusion of gases – Viscosity and thermal conduction of gases – Vander walls equation of state – Determination of Vander walls constant – Comparison of vanderwall’s equation with Andrews experiment - Relation between Vander Wall’s constant and critical constants.

UNIT IV - LAWS OF THERMODYNAMICS:

First law of thermodynamics – Isothermal and Adiabatic process – Gas equation during an adiabatic process – Work done an adiabatic expansion of gas – Equation of an adiabatic curve – Isothermal processes – Determination of g by Clement and Desorme’s method – Second law of thermodynamics – Concept of Carnot’s engine- Working efficiency of Carnot’s engine – Carnot’s refrigerator – Carnot’s Theorem and its significance.

UNIT V - CONCEPT OF ENTROPY:

Third law of thermodynamics - Concept of Entropy - Temperature entropy diagram – entropy of perfect gas - Entropy Change in entropy in a reversible process and irreversible process – temperature entropy diagram – Entropy of a perfect gas – increase of entropy in any irreversible process – Thermo dynamics functions – Maxwell’s thermodynamics relations and applications – Joule Kelvin effect theory- Claussius and Clapeyron equation - Specific Heat Relation.

TEXT BOOKS

1. Brijlal, N. Subrahmanyam and P. S. Hemne, Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
2. Richard H Dittman and Zemansky MW, Heat and Thermodynamics, 3rd Special Edition, McGraw Hill, 2008.

REFERENCES

1. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner and Margaret Bailey, Fundamentals of Engineering Thermodynamics, John Wiley and Sons, 2011.
2. D.S. Mathur, Heat and Thermodynamics, S. Chand and Company, 2006.
3. Kittel C and Kroemer H, Thermal Physics, W. H. Free man, New York, 1980.
4. Stephen Blundell and Katherine M. Blundell, Concepts in Thermal Physics, Oxford University Press, 2006.
5. Anandamoy Manna, Heat and Thermodynamics, Dorling Kindersely Pvt Ltd, 2011.

Lesson Plan

Subject Name: HEAT AND THERMODYNAMICS

Subject Code: UPY15301

Lecture Hour	Contents Description	References
UNIT I - INTRODUCTION TO HEAT		
1	Introduction to Heat and Thermodynamics	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
2	Basic Definitions	”
3	Newton’s law of cooling	”
4	heat of a liquid calendar and Barne’s continuous flow method	”
5	Two specific heats of a gas	”
6	Specific heat of a gas by Jolly’s differential steam calorimeter	”
7	Regnault’s method	”
8	Dulong and Petit’s law	”
9	Einstein’s theory of specific heat	”
10	Debye’s theory of specific heat	”
11	Variation of specific heat and atomic heat with temperature, Transference of heat	”
12	Problem Solving Session	”
13	Problem Solving Session	”
14	Problem Solving Session	”
15	Revision	”
UNIT II - TRANSMISSION OF HEAT		
16	Conduction – Coefficient of the thermal conductivity	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
17	Rectilinear flow of heat along a metal bar	”
18	Methods of radial flow of heat - Spherical shell method and	”
19	flow of heat along the wall of a cylindrical tube	”
20	Determination of thermal conductivity of rubber and bad conductor	”
21	Lee’s disc method to find thermal conductivity of bad conductor	”
22	Conduction – Radiation	”
23	Black body – Wein’s Law	”
24	Raleigh Law and its significance , Jean’s Law, Stefan’s law	”

25	Experimental Determination of Stefan's constant	”
26	Mathematical derivation of Stefan's law.	”
27	Problem Solving Session	”
28	Problem Solving Session	”
29	Problem Solving Session	”
30	Revision	”
CYCLE TEST-1		
UNIT III - KINETIC THEORY OF GASES		
31	Maxwell's law of distribution of molecular velocities	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
32	Experimental verification of molecular velocities	”
33	Equilibrium speed distribution of velocities	”
34	Mean free path of gaseous molecules	”
35	Transport phenomena	”
36	Diffusion of gases	”
37	Viscosity and thermal conduction of gases	”
38	Vander walls equation of state	”
39	Determination of Vander walls constant	”
40	Comparison of van der wall's equation with Andrews experiment	”
41	Relation between Vander Wall's constant and critical constants	”
42	Problem Solving Session	”
43	Problem Solving Session	”
44	Problem Solving Session	”
45	Revision	”
UNIT IV - LAWS OF THERMODYNAMICS		
46	First law of thermodynamics, Isothermal and Adiabatic process	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
47	Gas equation during an adiabatic process	”
48	Work done an adiabatic expansion of gas	”
49	Equation of an adiabatic curve	”
50	Isothermal processes	”
51	Determination of g by Clement and Desorme's method	”
52	Second law of thermodynamics	”
53	Concept of Carnot's engine	”
54	Working efficiency of Carnot's engine	”
55	Carnot's refrigerator	”
56	Carnot's Theorem and its significance	Richard H Dittman and Zemansky MW, Heat and Thermodynamics, 7 th Ed., McGraw Hill, 1997.
57	Problem Solving Session	Richard H Dittman and Zemansky MW, Heat and Thermodynamics, 7 th Ed., McGraw Hill, 1997.

58	Problem Solving Session	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
59	Problem Solving Session	”
60	Revision	”
CYCLE TEST-2		
UNIT V - CONCEPT OF ENTROPY		
61	Third law of thermodynamics, Concept of Entropy	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
62	Temperature entropy diagram	”
63	Entropy of perfect gas	”
64	Entropy Change in entropy in a reversible process and irreversible process	”
65	increase of entropy in any irreversible process	”
66	Thermo dynamics functions	”
67	Maxwell’s thermodynamics relations and applications	”
68	Maxwell’s thermodynamics relations and applications	”
69	Joule Kelvin effect theory	”
70	Claussius and Clapeyron equation	”
71	Specific Heat Relation	Richard H Dittman and Zemansky MW, Heat and Thermodynamics, 7 th Ed., McGraw Hill, 1997.
72	Problem Solving Session	Brijlal <i>et al.</i> , Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand and Company, 2010.
73	Problem Solving Session	”
74	Problem Solving Session	”
75	Revision	”
MODEL EXAMINATION		

Prepared By: Dr. Surya V.J.