University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK2DSCPHY102**				
Course Title	**OPTICS AND THERMODYNAMICS**				
Type of Course	**MINOR**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. Students should know the fundamentals of ray optics such as reflection, refraction and total internal reflection. 2. Students should be aware of wavefront, Huygen's Principle and coherent sources. 3. Students should be familiar with Thermal equilibrium, Zeroth law and first law of thermodynamics 4. Students should know the basics mathematics of permutations, combinations, logarithm, and Sterling's approximation				
Course Summary	1. Introduces theory of different optical phenomena. 2. Aims to provide the basic concepts of thermodynamics, the first and the second law of thermodynamics, heat engine, entropy, and the change in entropy during reversible and irreversible processes. 3. Gain the basic knowledge about the fundamentals of Statistcal Mechanics. 4. Provides a platform to observe and analyse different optical phenomena through practical sessions.				

BOOKS FOR STUDY:

1. Optics, Dr. N Subrahmanyam Brijlal, Dr M N Avadhanulu, S Chand and Company Ltd (2020).

2. Heat and Thermodynamics and Statistical Mechanics: Brijlal and Subramaniam, P S Hemne, S. Chand &Co (2021).

BOOKS FOR REFERENCES

1. Optics, Ajoy Ghatak, McGraw Hill, New Delhi (2020).

2. Heat and Thermodynamics: M. Zemansky, McGraw Hill, New Delhi (2007).

3. Physics, Principles with Applications, Douglas C. Giancoli, Pearson Education Limited, 7th Edition (2016).

4. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, McGraw Hill Education (India) Private Limited (2017).

5. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.

6. Heat and Thermodynamics: D. S. Mathur, S. Chand & Sons, New Delhi (1995)

7. College Physics 2e, Paul Peter Urone, Roger Hinrichs, Openstax, 2022.

8. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.

9. Statistical Mechanics, Sathyaprakash, Kedar Nath Ram Nath, Delhi, Edn (2021).

10. Thermal and Statistical Mechanics: S. K. Roy, New Age International- 2001

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**GEOMETRIC OPTICS** **(Book 1)**	**7**	
	1	Light – Electromagnetic theory and Quantum theory, Dual nature	1	1
	2	Reflection – Laws, Refraction – Laws	2	1
	3	Refractive index, optical path,	1	1
	4	Dispersion	1	1
	5	Fermat's principle, Rectilinear propagation of light	2	1
II		**WAVE OPTICS (Book 1)**	**15**	
	1	Interference - Principle of superposition.	2	1

	2	Young's double slit experiment, bright and dark fringes, fringe width	2	1
	3	Interference in thin films – due to reflected light, Colours in thin films, Applications.	2	1
	4	Newton's rings	2	1
	5	Diffraction - Fresnel and Fraunhofer Diffraction	2	1
	6	Diffraction from a Single slit, Double slit (Qualitative), Plane transmission grating (Qualitative).	3	1
	7	Polarisation – polarised and unpolarised light	2	1
III		**THERMODYNAMICS (Book 2)**	**9**	
	1	Thermodynamic Systems, Thermodynamic Equilibrium, Work done during volume changes, Internal energy and first law of Thermodynamics	2	2
	2	Thermodynamic processes –Quasistatic, Isothermal, Adiabatic, reversible, and irreversible, Cyclic process, Isobaric and Isochoric (Basic ideas)	3	2
	3	Carnot's Ideal Heat engine	2	2
	4	Second law of thermodynamics – Clausius and Kelvin - Planck statements, Refrigerator	2	2
IV		**ENTROPY (Book 2)**	**5**	
	1	Change of entropy – Reversible process, irreversible processes and physical concept	2	2
	2	T -S diagram	2	2
	3	Principle of increase of entropy - Heat Death of universe	1	2
V*		**STATISTICAL MECHANICS (Book 2)**	**9**	
	1	Statistical Basis – Probability, Principle of equal A priory	2	3
	2	Macrostates and Microstates, Phase space	2	3
	3	Statistical Ensembles – Microcanonical, Canonical, Grand Canonical	2	3

	4	Need of Quantum statistics, Maxwell - Boltzmann statistics, Bose - Einstein statistics, Fermi - Dirac statistics – Comparative study only	3	3

DETAILED SYLLABUS: PRACTICALS

Part A - At least **FIVE** experiments to be performed		CO No
Sl No	**Experiment**	
1	Liquid Lens – Optical constants of given lens (Mercury Given)	4
2	Liquid Lens – Optical constants of given lens (Water Given)	4
3	Liquid lens – Refractive Index of given liquid (Mercury Given)	4
4	Liquid lens – Refractive Index of given liquid (Water Given)	4
5	Spectrometer – A, D and n of a solid prism	4
6	Spectrometer – Dispersive power and Cauchy's constants	4
7	Spectrometer – Grating normal Incidence	4
8	Spectrometer – Hollow Prism Refractive Index of given liquid	4
9	Spectrometer – i-d Curve	4
10	Newton's Rings – Reflected system	4
11	To determine angular spread of He-Ne laser using plane diffraction grating	4
12	Determine Refractive Index of a Glass Slab using a Travelling Microscope	4
Part B - At least **ONE** experiment to be performed		
13	Air wedge – Diameter of a wire	4
14	To determine the wavelength of a laser source using diffraction of a single slit	4
15	To determine the wavelength of a laser source using diffraction of double slits	4
16	Lee's Disc – Determination of thermal conductivity of a bad conductor	4