

# DEPARTMENT OF PHYSICS, GOVERNMENT COLLEGE GURUR, BALOD, C.G.

Name of Faculty – Mr. Lekhram Hirwani  
Designation – Assistant Professor

Yearly Teaching Plan 2022 - 23


Class - B.Sc. 02<sup>nd</sup> Year  
Subject – Physics  
Subject Code - 005226


Name of Program, Class and Paper	Syllabus (Thermodynamics, Kinetic Theory and Statistical Physics)	Required Duration
<p>B.Sc. (Maths) 02<sup>nd</sup> Year Paper – I</p>	<p><b>UNIT-I</b> The laws of thermodynamics : The Zeroth law, concept of path function and point function, various Indicator diagrams, work done by and on the system, first law of thermodynamics, Internal energy as a state function, reversible and Irreversible change, Carnot theorem and the second law of thermodynamics. Different versions of the second law. Clausius theorem inequality. Entropy, Change of entropy In simple cases (i) Isothermal expansion of an Ideal gas (ii) Reversible Isochoric process (iii) Free adiabatic expansion of an ideal gas. Entropy of the universe. Principle of increase of entropy. The thermodynamic scale of temperature, its identity with the perfect gas scale. Impossibility of attaining the absolute zero, third law of thermodynamics.</p> <p><b>UNIT-II</b> Thermodynamic relationships : Thermodynamic variables, extensive and intensive, Maxwell's general relationships, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures. Blackbody radiation : Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Spectral distribution of BB radiation, Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Planck's quantum postulates, Planck's law, complete fit with experiment.</p> <p><b>UNIT-III</b> Maxwellian distribution of speeds in an Ideal gas : Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Transport phenomena in gases : Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure. Liquefaction of gases : Boyle temperature and inversion temperature. Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium. Refrigeration cycles, meaning of efficiency.</p> <p><b>UNIT-IV</b> The statistical basis of thermodynamics : Probability and thermodynamic probability, principle of equal a priori probabilities, statistical postulates. Concept of Gibbs ensemble, accessible and inaccessible states. Concept of phase space, canonical phase space, Gamma phase space and mu phase space. Equilibrium between two systems in thermal contact, probability and entropy, Boltzmann entropy relation. Boltzmann canonical distribution law and its applications, law of equipartition of energy. Transition to quantum statistics : 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator.</p> <p><b>UNIT-V</b> Indistinguishability of particles and its consequences, Bose-Einstein &amp; Fermi-Dirac conditions, Concept of partition function, Derivation of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics Through Canonical partition function. Limits of B.E. and F-D statistics to M-B statistics. Application of BE statistics to black body radiation, Application of F-D statistics to free electrons in a metal.</p>	<p><b>12 Hours (40 Min. x 18 Periods) Per Unit = 90 Periods (From August 22 to February 23)</b></p>

Name of Program, Class and Paper	Syllabus (Waves, Acoustic and Optics)	Required Duration
<p>B.Sc. (Maths) 02<sup>nd</sup> Year Paper - II</p>	<p><b>UNIT-I</b> Waves In media : Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements. Harmonics and the quality of sound; examples. Production and detection of ultrasonic and infrasonic waves and applications. Reflection, refraction and diffraction of sound : Acoustic impedance of a medium, percentage reflection &amp; refraction at a boundary, Impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.</p> <p><b>UNIT-II</b> Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations and their reductions ; spherical mirrors and schmidt corrector plates, aplanatic points, oil immersion objectives, meniscus lens. Optical Instruments : Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces. (Ramsdon and Hygen's eyepieces)</p> <p><b>UNIT-III</b> Interference of light : The principle of superpositions, two slit interference, coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer Localised fringes ; thin films. Haidinger fringes : fringes of equal inclination. Michelson Interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Twyman. Green Interferometer and its uses, Intensity distribution in multiple beam interference. Tolansky fringes, Fabry-Perot Interferometer and etalon.</p> <p><b>UNIT-IV</b> Fresnel half-period zones, plates, straight edge, rectilinear propagation, Fraunhofer diffraction : Diffraction at a slit, half-period zones, phasor diagram and Integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems. Diffraction gratings : Diffraction at N parallel slits, Intensity distribution, plane diffraction grating, reflection grating and blazed gratings, Concave grating and different mountings, resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon. Double refraction and optical rotation : Refraction in uniaxial crystals, Phase retardation plates, double image prism. Rotation of plane of polarization, origin of optical rotation in liquids and in crystals.</p> <p><b>UNIT-V</b> Laser system : Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of Laser : Ruby and, He-Ne and Semiconductor lasers. Application of lasers : Application in communication, Holography and non linear optics. (Polarization P Including higher order terms in E and generation of harmonics).</p>	<p><b>12 Hours (40 Min. x 18 Periods) Per Unit</b></p> <p><b>= 90 Periods (From August 22 to February 23)</b></p>
	<p><b>Total Duration : 120 Hours</b></p>	<p><b>180 Periods</b></p>

  
Faculty

  
HOD

  
Co-ordinator  
IQAC  
Government College Gurur  
Dist. Balod (C.G.)

  
Principal  
Government College Gurur  
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## Monthly Teaching Plan 2022 – 23

Program Name – B.Sc. (PCM)		Class – 02 <sup>nd</sup> Year		Paper – 01 <sup>st</sup> (Thermodynamics, Kinetics and Statistical Physics)		
		Paper – 02 <sup>nd</sup> (Waves, Acoustic and Optics)				
S N	Month	Curriculum Plan	No. of Periods	Teaching Method	Activity	Exam or Test
01	August 2022	<b>PAPER – I, UNIT-I</b> The laws of thermodynamics : The Zeroth law, concept of path function and point function, various indicator diagrams, work done by and on the system, first law of thermodynamics, Internal energy as a state function, reversible and irreversible change, carnot theorem and the second law of thermodynamics. Different versions of the second law. Clausius theorem inequality. Entropy, Change of entropy In simple cases (I) Isothermal expansion of an Ideal gas (II) Reversible Isochoric process (iii) Free adiabatic expansion of an Ideal gas. Entropy of the universe. Principle of increase of entropy. The thermodynamic scale of temperature, Its Identity with the perfect gas scale. Impossibility of attaining the absolute zero, third law of thermodynamics.	18	Chock & Talk PPT Chart Doubt Class Revision Class	Poster Making Student Seminar Quiz Competition	Unit Test
		<b>PAPER – II, UNIT-I</b> Waves In media: Speed of transverse waves on a uniform string, speed of longitudinal waves In a fluid, energy density and energy transmission In waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements. Harmonics and the quality of sound; examples. Production and detection of ultrasonic and Infrasonic waves and applications. Reflection, refraction and diffraction of sound : Acoustic Impedance of a medium, percentage reflection & refraction at a boundary, Impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.	18			
02	September 2022	<b>UNIT-II</b> Thermodynamic relationships: Thermodynamic variables, extensive and Intensive, Maxwell's general relationships, application to Joule-Thomson cooling and adiabatic cooling In a general system, Van der Waals gas, Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.	18	Chock & Talk PPT Demonstration Doubt Class Revision Class	Poster Making Student Seminar Group Discussion	Unit Test
		Blackbody radiation: Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Special distribution of BB radiation, Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Planck's quantum postulates, Planck's law, complete fit with experiment.	18			
		<b>PAPER – II, UNIT-II</b> Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations and their reductions ; aspherical mirrors and schmidt				



		systems. Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings, Concave grating and different mountings, resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon. Double refraction and optical rotation: Refraction in uniaxial crystals, Phase retardation plates, double image prism. Rotation of plane of polarisation, origin of optical rotation in liquids and in crystals.			Competition	
07	February 2023	<b>PAPER – II, UNIT-V</b> Laser system: Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of Laser: Ruby and He-Ne and Semiconductor lasers. Application of lasers: Application in communication, Holography and non linear optics. (Polarization P including higher order terms in E and generation of harmonics).	18	Chock & Talk PPT Demonstration Doubt Class Revision Class	Poster Making Student Seminar Group Discussion	-
07 Months		<b>Two Papers, Unit - 10</b>	180 Periods			07 Internal Exams



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