

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



**Accredited By NAAC with 'A' Grade**

**Revised Syllabus For  
Bachelor of Science  
Part-II**

**PHYSICS**

**CBCS PATTERN**

**Syllabus to be implemented from**

**June, 2019 onwards.**

**SHIVAJI UNIVERSITY KOLHAPUR**  
**B.Sc. Part-II Physics CBCS Syllabus with effect from June, 2019**  
**Semester-III**  
**PHYSICS Paper-V**  
**DSC-C1 THERMAL PHYSICS AND STATISTICAL MECHANICS – I**  
**Theory: 36 Hours**  
**Marks-50 (Credits: 02)**

**Unit I:** **(18 hrs)**

**Kinetic Theory of Gases and thermometry**

Mean free path, derivation of Maxwell's law of distribution of velocities and its experimental verification, Transport Phenomena: transport of momentum (viscosity), transport of thermal energy (conduction), Transport of mass (diffusion), Law of equipartition of energy (qualitative) and its applications to specific heat of monoatomic and diatomic gases. Principle of thermometry, types of thermometers, Scales of temperature (Celsius, Kelvin, Fahrenheit and Rankine) , Mercury thermometer, Thermoelectric thermometer ,Platinum resistance thermometer , Thermister

**Unit II:**

**Laws of Thermodynamics** **(18 hrs)**

Thermodynamic system, thermodynamic variables, equation of state, thermodynamic equilibrium, Zeroth Law of thermodynamics, Internal energy, First law of thermodynamics, conversion of heat into work, specific heats  $C_p$  &  $C_v$ , Applications of First Law (Isothermal process, Adiabatic process, Isochoric, Isobaric), relation between  $C_p$  &  $C_v$ , work done during isothermal and adiabatic processes, reversible & irreversible processes, Second law of thermodynamics, Carnot's ideal heat engine, Carnot's cycle (Working, efficiency), Carnot's theorem, Entropy (concept & significance), Entropy changes in reversible & irreversible processes, Third law of thermodynamics, Unattainability of absolute zero.

• **Reference books**

- 1) Heat and Thermodynamics- Brijlal and N.Subramanyam, S.Chand and Company Ltd.
- 2) Text book of heat- J.B. Rajam, S.Chand and company Ltd
- 3) A treatise on Heat- Meghnad Saha and B.N. Srivastava, Indian Press
- 4) Heat and Thermodynamics (8<sup>th</sup> Ed), M.W. Zemansky and R. Dittman, McGraw Hill
- 5) Heat Thermodynamics and Statistical physics- J.P. Agrawal and Satya Prakash, Pragati Prakashan
- 6) Fundamentals of heat - D.S.Mathur, S.Chand and Sons publisher

**Semester III**  
**PHYSICS Paper VI**  
**DSC-C2: WAVES AND OPTICS - I**  
**Theory: 36 Hours**  
**Marks -50 (Credits: 02)**

**Unit I** **(18 hrs)**

**1) Superposition of Harmonic Oscillations (7 hrs)**

Linearity and superposition principle, Superposition of two collinear harmonic oscillations- for oscillations having equal frequencies (Analytical and geometrical methods) and oscillations having different frequencies (Beats), Superposition of two perpendicular harmonic oscillations- for oscillations having equal frequencies (Graphical and analytical methods) and oscillations having different frequencies (Lissajous figures), Uses of Lissajous figures.

**2) Coupled Oscillations: (4 hrs)**

Frequencies of coupled oscillatory systems, normal modes and normal co-ordinates, energy of coupled oscillations, energy transfer in coupled oscillatory system.

**3) Waves Motion and Ultrasonic waves (7hrs)**

Waves Motion: Transverse waves on a string, travelling and standing waves on a string, Normal modes of a string, Group velocity and Phase velocity, Plane waves, Spherical waves.

Ultrasonic waves: Piezo-electric effect, Production of ultrasonic waves by Piezo-electric generator, Detection of ultrasonic waves, Properties ultrasonic waves, Applications of ultrasonic waves.

**Unit II** **( 18 hrs)**

**1) Sound and Acoustics of buildings: (7 hrs)**

Sound: Transducers and their characteristics, Pressure microphone, Moving coil loudspeaker, Intensity and loudness of sound, Decibels, Intensity levels, musical notes, musical scale.

Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula for measurement of reverberation time, Acoustic aspects of halls and auditoria.

**2) Viscosity(5hrs)**

Rate flow of liquid in a capillary tube - Poiseuille's formula, experimental determination of coefficient of viscosity of a liquid by Poiseuille's apparatus method, variations of viscosity of a liquid with temperature lubrication.

**3) Physics of low pressure(6hrs)**

Production and measurement of low pressure, Rotary pump, Diffusion pump, Molecular pump, Knudsen absolute gauge, Pirani gauge, Detection of leakage.

• **Reference books**

- 1) The Physics of Waves and Oscillations- N. K. Bajaj, Tata McGraw-Hill Pvt. Ltd., New Delhi, Reprint 2010
- 2) Waves and Oscillations-Subrahmanyam Brijlal, Vikas Publishing House Pvt. Ltd., New Delhi, 2<sup>nd</sup> Revised Edition
- 3) Waves and Oscillations – Dr. D. N. Tripathy, Kedarnant Ramnant Meerut , Delhi.
- 4) Elements of properties of matter-D. S. Mathur, S. Chand & company Pvt. Ltd., New Delhi, Reprint 2016
- 5) Physics for degree students- C. L. Arora and Dr. P. S. Hemne, S Chand & Company Pvt. Ltd., Second revised Edition, reprint 2014, Ram Nagar, New Delhi
- 6) A textbook of sound – N Subrahmanyam Brijlal, Vikas Publishing House Pvt. Ltd., New Delhi
- 7) A Text book of sound- Khanna and Bedi, Atma Ram & sons, Delhi
- 8) Oscillations & Waves- Satya Prakash, Pragati Prakashan, Meerut, 3<sup>rd</sup> Edition
- 9) Classical Mechanics – Gupta Kumar Sharma, Pragati Prakashan, Meerut, Reprint Introduction to Classical Mechanics- Nikhil Ranjan Ray, Vikas Publishi
- 10) Introduction to Classical Mechanics by R. G. Takwale & P. S. Puranik, McGraw Hill Education (India) Pvt,Ltd
- 11) Physics for Engineering (Vol 1)- P. K. Palanisany, Scitech Publications (India) Pvt Ltd.
- 12) University Physics –Gurbachan S. Chaddha (chapter 3), Narosa Publishing House Pvt. Ltd. Delhi
- 13) University Physics – FW Sears, MW Zemansky and HD Young, Addison Wesley

**B. Sc. Part – II Semester-IV**

**PHYSICS Paper-VII**

**DSC-D1 THERMAL PHYSICS AND STATISTICAL MECHANICS – II**

**Theory: 36 Hours**

**Marks-50 (Credits: 02)**

**Unit I**

**(18 hrs)**

**1) Thermodynamic Potentials (10 hrs)**

Enthalpy, Gibbs, Helmholtz, Internal Energy functions, Maxwell's thermodynamical relations, Joule-Thomson effect, Clausius- Clapeyron equation, Expression for  $(C_p - C_v)$ ,  $C_p/C_v$ , TdS equations.

**2) Theory of Radiation (8 hrs)**

Blackbody radiation and its importance, Experimental study of black body radiation spectrum, Concept of energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

**Unit II**

**(18 hrs)**

**1) Classical statistics (10 hrs)**

Phase space, Microstate and Macrostate, Accessible microstates, priory probability thermodynamic probability, probability distribution, Maxwell-Boltzmann distribution

law, evaluation of constants  $\alpha$  and  $\beta$ , Entropy and Thermodynamic probability, Distribution of molecular speeds.

## 2) Quantum statistics (8 hrs)

Bose-Einstein distribution law, photon gas, Fermi-Dirac distribution law, electron gas, comparison of M.B., B.E., and F.D. statistics.

### • Reference books

- 1) Heat and Thermodynamics-M.W.Zemasky and R. Dittman, McGraw Hill.
- 2) Physics for degree students B.Sc. second year- Arora, Hemne, S. Chand.
- 3) Concepts of Modern Physics- Arthur Beiser, McGraw-Hill.
- 4) Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- 5) Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa.
- 6) University Physics- Ronald Lane Reese, Thomson Brooks/Cole.
- 7) Heat Thermodynamics and Statistical Physics, N. Subramaniam, Brijlal, P. Hemne, 2008, S. Chand.

**B. Sc.Part II Semester IV**  
**PHYSICS Paper VIII**  
**DSC- D2 - WAVES AND OPTICS-II**  
**Theory: 36 Hours**  
**Marks -50 (Credits: 02)**

## Unit III

(18 hrs)

### 1. Cardinal points (7 hrs)

Cardinal points of an optical system (definitions only), graphical construction of image using cardinal points, Newton's formula, relation between  $f$  and  $f'$  for any optical system, relation between lateral, axial and angular magnifications.

### 2. Resolving Power of optical instruments: (5 hrs)

Resolution, Resolving power of optical instruments, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, comparison between magnification and resolution, resolving power of plane diffraction grating, resolving power of a prism.

### 3. Polarization of light: ( 6 hrs)

Idea of polarization, polarization by double refraction, Huygens explanation of double refraction through uniaxial crystals, Nicol prism (construction, working), production and detection of circularly and elliptically polarized light, optical rotation - laws of rotation of plane of polarization, polarimeter.

## UNIT-IV

(18 hrs)

### 1. Interference: (10 hrs)

Principle of Superposition, Coherence and condition for interference, Division of amplitude and division of wave front, Division of wave front – Lloyd's single mirror (determination of wavelength of light of monochromatic source), Division of amplitude- Interference in thin parallel films (reflected light only), Wedge shaped films, Newton's rings and its application for determination of wavelength and refractive index of light.

### 2. Diffraction: (8 hrs)

Fraunhofer diffraction- Elementary theory of plane diffraction grating, Determination of wavelength of light using diffraction grating, Theory of Fresnel's half period zones, Zone plate (construction, working and its properties), Fresnel's diffraction at a straight edge.

#### • Reference Books

1. Text book of optics for B.Sc. Classes- Brij Lal and N. Subrahmanyam, S. Chand & Company Ltd. New Delhi, 2006
2. Wave Optics- R. K. Verma, Discovery Publishing House New Delhi, 2006
3. A text book of light- 8<sup>th</sup> Edition, D. N. Vasudeva, Atma Ram & Sons, Delhi (1976)
4. Fundamentals of Optics- 4<sup>th</sup> Edition, Francis A. Jenkins and Harvey E. White, Tata McGraw-Hill Education Private Ltd., New Delhi 2011
5. Optics- 2<sup>nd</sup> Edition, Ajay Ghatak, Tata McGraw-Hill Publishing Company Ltd., New Delhi,
6. *A text book of light- D. N. Vasudeva*
7. Principles of Physics- 10<sup>th</sup> Edition, Halliday and Resnick, Wiley
8. University Physics- 14<sup>th</sup> Edition, H.D. Young and R. A. Freedman, Pearson

## ➤ B.Sc. Part II PHYSICS LAB Experiments (DSC C1, C2, D1, D2 Paper V, VI, VII, VIII) Total Marks: 100 Credits: 04

### • Group I (Thermal Physics and Statistical Mechanics I)

1. To determine the value of Stefan's Constant.
2. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
6. To study the variation of thermo e.m.f. across two junctions of a thermocouple with temperature.
7. To record and analyze the cooling temperature of hot object as a function of time using a thermocouple.
8. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

### • Group II (Thermal Physics and Statistical Mechanics II)

1. To determine the temperature coefficient of resistance using post office box.
2. To verify Stefan's fourth power law.

3. To determine specific heat of graphite.
4. To determine the ratio of specific heat of air by Kundt's tube.
5. Temperature of flame
6. To determine the coefficient of thermal conductivity of glass in the form of tube.
7. To determine the thermal conductivity of metal bar by Forbes's method.
8. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.

• **Group III( Waves and Optics I)**

1. To investigate the motion of coupled oscillators
2. To determine the frequency of an electrically maintained tuning fork by Melde's experiment and to verify  $\lambda^2 - T$  Law
3. To study Lissajous figures by using CRO
4. To determine coefficient of viscosity of water by capillary flow method (Poiseuille's method)
5. To determine velocity of sound in air by Kundt's tube and audio oscillator or Phase shift method (CRO and microphone).
6. To determine viscosity of liquid by Searle's viscometer.
7. To determine velocity of sound in air by resonating bottle.
8. To determine frequency of a crystal oscillator.

• **Group IV( Waves and Optics II)**

1. To determine the Resolving Power of a Prism.
2. To determine the Resolving Power of a Plane Diffraction Grating.
3. To determine wavelength of sodium light using diffraction due to straight edge.
4. To determine wavelength of sodium light using Newton's Rings.
5. Determine thickness of thin film using interference in wedge shaped thin film.
6. Goniometer I- To study cardinal points of optical system
7. Goniometer II- To study the equivalent focal length of optical system.
8. To study angle of specific rotation of sugar using Polarimeter.

• **Reference Books for practical**

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Pvt. Ltd., New Delhi

➤ **Scheme of Theory Examination for B. Sc. part –II**

- 1) Two theory papers for each semester.
- 2) Each paper is of two hour duration and of 50 marks.

➤ **Scheme of Practical Examination for B. Sc. Part-II**

1. The marks distribution for practical marks is as below.

Group	Allotted Marks
Group I	20
Group II	20
Group III	20
Group IV	20
Journal work Certified Journal(10 Mark) Neatness( 5 Mark) Punctuality( 5 Mark)	20
Total Marks	100
Credits	04

2. Practical examination will be conducted annually.
3. Practical examination will be conducted for two days per batch of 16 students.
4. The examination will be conducted in two sessions per day and each session will be of three hours duration.
5. Every candidate should perform one experiment each from Groups I to IV (total 4 experiments).
6. At least eighty percent practical should be completed by the student.



➤ **Nature of the Question Paper**

**Time: 2 Hours**

**Total Marks: 50**

**Instructions:**

1. All questions are compulsory
2. Figures to the right indicates full marks
3. Draw neat labeled diagrams wherever necessary.
4. Use of scientific calculator/log table is allowed

**Q.1 Select the correct alternative for the following** (10)  
(Ten questions with four alternatives carrying 1 mark each)

**Q.2 Attempt ANY TWO of the following** (20)

(A)

(B)

(C)

**Q.3 Attempt ANY FOUR of the following** (20)

(A)

(B)

(C)

(D)

(E)

(F)

**Note: Equal wattage should be given to all the units**