

"Education for Knowledge, Science and Culture"

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)



Department of Physics and Astrophysics

B.Sc. Part –

II, Semester III & IV, CBC

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Physics

Semester	Paper No.	Course Code	Course Title	No. of Credits
III	III	DSC-1001C ₁	Thermal Physics and Statistical Mechanics – I	4
	IV	DSC-1001C ₂	Waves, Oscillations and Acoustics	4
IV	V	DSC-1001D ₁	Thermal Physics and Statistical Mechanics – II	4
	VI	DSC-1001D ₂	Optics	4
III&IV	-	SEC-I	SEC Paper I	2
	-	SEC-II	SEC paper II	2

Syllabus with effect from August, 2022

VIVEKANANDCOLLEGE, KOLHAPUR (AUTONOMOUS).

CBCSSyllabuswitheffectfromJune,2022

B. Sc. Part – II Semester-

IIDSC-1001C₁PHYSICSPaper-V

Theory:36Hours

Marks-50(Credits:02)

THERMALPHYSICSAND STATISTICALMECHANICS– I

UnitI:

(18hrs)

KineticTheoryofGasesandthermometry

Mean free path, expression, approximate method 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. Thermometry: Concept of heat and temperature, temperature scales, principle of thermometry mercury thermometer, platinum resistance thermometer, thermocouple. (Principle, construction and theory)

UnitII:

Laws of Thermodynamics

(18hrs)

Thermodynamic system, thermodynamic variables, thermodynamic state, 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), change in entropy, Entropy changes in reversible & irreversible processes, Third law of thermodynamics, Entropy change in conduction of heat, diffusion of gases, physical significance of entropy, Un-attainability of absolute zero. Zero point energy.

Reference Books:

1. Heat and Thermodynamics - Brijlal and N. Subramanyam, S. Chand and company LTD
2. Textbook of heat - J.B. Rajam, S. Chand and company Ltd
3. Heat Thermodynamics and Statistical physics - J.P. Agrawal and Satya Prakash, Pragati Prakashan
4. A treatise on Heat - Meghnad Saha and B.N. Srivastava, Indian Press

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B. Sc. Part – II Semester-IIIDSC-

1001C₂PHYSICSPaper-VI

Theory:36Hours

Marks-50(Credits:02)

WAVES, OSCILLATIONS AND ACOUSTICS

UnitI (18hrs)

1. Superposition of Harmonic Oscillations

(7hrs) Linearity and superposition principle, Composition of two simple harmonic motions, 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: (4hrs)

Normal modes of vibration, normal coordinates, degrees of freedom, types of coupling, frequency of oscillatory systems, 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.

UnitII (18hrs)

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

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, concept of perfect absorber, optimum reverberation, Sabine's formula for measurement of reverberation time, Acoustic aspects of halls and auditoria.

2. Viscosity (5hrs)

Revision of viscosity, stream line flow, turbulent flow, coefficient of viscosity, critical velocity, Rate of 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 and pressure

3. Physics of flow pressure (6hrs)

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

Reference Books:

1. Elements of properties of matter - D.S. Mathur, S. Chand & Company Pvt. Ltd., New Delhi, Reprint 2016
2. The Physics of Waves and Oscillations - N.K. Bajaj, Tata McGraw-Hill Pvt. Ltd., New Delhi, Reprint 2010
3. Oscillations & Waves - Satya Prakash, Pragati Prakashan, Meerut, 3rd Edition
4. A Textbook of Sound - Khanna and Bedi, Atma Ram & Sons, Delhi
5. A textbook of sound – N Subrahmanyam Brijlal, Vikas Publishing House Pvt. Ltd., New Delhi,

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**B. Sc. Part – II Semester-
IVDSC-1001D₁PHYSICSPaper-
VII**

**Theory:36Hours
Marks-50(Credits:02)**

THERMALPHYSICSAND STATISTICALMECHANICS– II

UnitI: (18hrs)

1. ThermodynamicPotentials (10hrs)

Enthalpy,Gibbs,Helmholtz,InternalEnergyfunctions,Maxwell'sthermodynamicalrelations, Joule-Thomson effect, Clausius- Clapeyron equation, Expression for $(C_p - C_v)$, C_p/C_v ,TdSequations.

2. Theoryof Radiation (8hrs)

Thermalradiations,Blackbodyradiationanditsimportance,Blackbodyinpractice,its temperature dependence ,emissive power, absorptive power, pressure of radiation ,Experimentalstudy 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'sdisplacementlawfromPlanck'slaw.

UnitII:StatisticalMechanics (18hrs)

1. Classical statistics (10hrs)

Degrees of freedom ,momentum space, position space ,Phase space, Microstate and Macrostate, Accessible microstates, priory probability thermodynamic probability, probability distribution, Maxwell-Boltzmann distribution law, energy or speed, evaluation of constants α and β , Entropy and Thermodynamic probability, Distribution of molecular speeds.

2. Quantumstatistics (8hrs)

Need of quantum statics ,Bose-Einstein distribution law, photon gas, Planck' s radiation lawFermi-Diracdistributionlaw, freeelectroninmetal,electrongas,comparisonofM.B.,B.E.,andF.D.statistics.

Reference Books:

1. HeatandThermodynamics-BrijlalandN.Subramanyam,S. ChandandcompanyLTD
2. Textbookofheat-J.B.Rajam,S.ChandandcompanyLtd
3. Heat Thermodynamics and Statistical physics- J.P. Agrawal and Satya Prakash, PragatiPrakashan
4. A treatise on Heat- MeghnadSaha and B.N. Srivastava, Indian Press
5. Heat, Thermodynamics and statistical Physics - BrijlalandN.Subramanyam, P. Hemne, S. Chand 2008
6. Concepts of modern Physics – ArtherBeiser

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DSC-1001D₂PHYSICSPaper-VIII

Theory:36Hours

Marks-50(Credits:02)

OPTICS

UnitI (18hrs)

1. Cardinalpoints(7hrs)

Thick lens, combination of lenses (system)Cardinal points of an optical system (definitiononly),graphicalconstructionofimageusingcardinalpoints,Newton'sformula,relationbetweenfandf'foranyopticalsystem,relationbetweenlateral,axialandangularmagnifications.

2. ResolvingPowerofopticalinstruments:

(5hrs)

Resolution,Resolvingpowerof optical instruments,Rayleigh'scriterionforthelimitofresolution, Modified Rayleigh's criterion, comparison between magnification and resolution,resolvingpowerofplanediffractiongrating,resolvingpowerofaprisim.

3. Polarizationoflight:

(6hrs)

Revision of plane of vibration , plane polarization, perpendicular vibration ,parallel vibrations,polarizationbyreflectionandrefraction,Ideaofpolarization,polarizationbydoublerefraction,Huygensplanationofdoublerefractionthroughuniaxialcrystals,Nicolprism(construction, working), production and detection of circularly and elliptically polarizedlight,opticalrotation-lawsofrotationofplaneofpolarization,polarimeter.

UNIT-II

(18hrs)

1. Interference:

(10hrs)

Principle of Superposition ,Coherence and condition for interference, Division of amplitudeand division of wave front, Division of wave front – Lloyds single mirror(determination ofwavelength of light of monochromatic source),Division of amplitude-Interference in thinparallel films (reflectedlight only), Wedge shaped films, Newton's rings and its applicationfordetermination ofwavelengthandrefractiveindexoflight.

2. Diffraction:

(8 hrs)

Revision of wave fronts and diffraction , Fraunhofer diffraction - Elementary theory of planediffraction grating, Determination of wavelength of light using diffraction grating, Theory ofFresnel's half period zones, Zone plate (construction , working and its properties), Fresnel'sdiffractionatastraightedge.

Reference Books :

1. Text book of optics for B.Sc.Classes- BrijLal 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- 8th Edition,D. N. Vasudeva, Atma Ram & Sons, Delhi (1976)
4. Fundamentals of Optics- 4th Edition ,FranciesA.Jenkins and Harvey E.White, Tata McGrawHill Education Private Ltd., New Delhi 2011
5. Optics- 2nd Edition, Ajay Ghatak, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi,
6. Principles of Physics-10th Edition, Halliday and Resnick, Wiley
7. University Physics- 14th Edition, H.D. Young and R. A. Freedman, Pearson

Skill Enhancement Course (SEC) I
(Thermal Physics and Optics)
B.Sc. II(Credit 2)

1. Adjustment of spectrometer
 - a) Leveling of spectrometer
 - b) Least count of spectrometer
 - c) Schuster's method
 - d) Measurement of angle of deviation
2. Adjustment and alignment of optical bench
 - a) Adjustment of slit
 - b) Alignment of slit with eyepiece
 - c) Removal of lateral shift
 - d) Determination of fringe width
 - e) Obtain the fringe pattern using biprism, single mirror, double mirror
3. Determination of focal lengths
 - a) Convex lens
 - b) Concave lens
 - c) Plane glass
4. Study of reflection and refraction
 - a) Plane glass
 - b) Mirror
 - c) Water
5. Study of principle of thermometry
 - a) Thermometric substances
 - b) Types of thermometers
 - c) Different thermometric scales

Skill Enhancement Course (SEC) II
(General Physics, Electricity and Magnetism and Electronics)
B.Sc. II(Credit 2)

1. Determination of elastic constants of given material
 - a) Young's Modulus
 - b) Bulk Modulus
 - c) Poisson's Ratio
 - d) Modulus of rigidity
2. Study of errors in measurements
 - a) Determination of mean
 - b) Determination of deviation
 - c) Probable error
3. Study of measuring instruments
 - a) Stop watch
 - b) Traveling microscope
 - c) Vernier caliper
 - d) Screw Gauge
 - e) Spherometer etc.
4. Study of types of radiations
 - a) Ultra-violet
 - b) Visible
 - c) Infrared
 - d) Microwave etc.
5. Use of CRO to measure frequency of ac mains
6. Study of colour code and find the value of resistances
7. Study of different parts of BG
8. Determine time period of BG
9. Shouldering of electrical circuits using different components
10. Measurement of DC and AC voltage and current by digital multimeter

B.Sc. II Physics Lab Work (Practical)

Marks-100 (Credits: 08)

Group I (Thermal Physics)

1. Determination of thermal conductivity of bad conductor by lee's Method
2. Determination of thermal conductivity of good conductor by Forbe's Method.
3. Temperature of Flame
4. To determine the temperature of coefficient of resistance of platinum resistance thermometer
5. Measurement of plank's constant using black body radiation
6. Variation of thermo emf across two junctions of thermocouple with temperature
7. Verification of Stefan's 4th power law
8. Mechanical equivalent of heat 'J' by Calendar and Barne's method

Group II (Waves, Oscillation and Sound)

1. Viscosity of liquid by Poiseuille's Method
2. Viscosity of liquid by Searle's viscometer
3. Velocity of sound in air using resonating bottle
4. Velocity of sound in air using Kundt's tube
5. Study of Lissajous figures using CRO
6. To investigate the motion of coupled oscillators
7. Determination of frequency of an electrically maintained tuning fork by Melde's experiment and to verify λ^2 -T law
8. Colpitts's oscillator

Group III (Optics)

1. Goniometer I (Cardinal Points)
2. Goniometer II (Equivalent Focal Length)
3. Resolving Power of Prism
4. Determination of Cauchy's constant
5. Resolving power of grating
6. Determination of wavelength of light using Newton's ring
7. Determination of thickness of thin film using interference of wedge shaped thin film
8. Polarimeter

Group IV (Electricity and Electronics)

1. Transistor characteristics (C.E. mode)
2. Transistor as regulated power supply unit
3. Bridge rectifier with π filter circuit
4. A.C. / D.C. sensitivity of CRO
5. Calibration of bridge wire by Griffith's method
6. Constants of B.G.
7. Resistance of B.G. by half deflection method

8. High resistance by Leakage method

- There will be internal evaluation of 15 marks for each paper.
- There will be end semester theory examination of 35 marks for each paper.
- The total marks for each paper will be 50.
- There will be separate passing for internal evaluation, end semester theory examination, practical examination and Skill Enhancement Courses

Paper No.	Internal evaluation	End Semester Theory Examination	Total
V	15	35	50
VI	15	35	50
VII	15	35	50
VIII	15	35	50

- There will be practical examination of 100 marks at the end of semester IV
- Distribution of 100 marks of practical is as below

Group I	22
Group II	22
Group III	22
Group IV	22
Journal	12
Total	100

- There will be separate examination of 100 marks for Skill Enhancement Courses (SEC's) of all three subjects together of B.Sc. II at the end of semester IV (Conducted by College Examination Cell)

Nature of Question Paper (End Semester Examination)

Instructions:

- 1) All the questions are **compulsory**.
- 2). Figures to the right indicate **full** marks.
- 3) Draw neat labeled diagrams **wherever** necessary.

Time: 2 hours

Total Marks: 35

Q:1] Chose correct alternative

A] **FIVE** Multiple Choice Questions

5 Marks

B] **TWO** fill in the blanks

2 Marks

Q:2] Long Answer questions (Attempt any **TWO** out of three)

16 Marks

Q:3] Short Answer questions (Attempt any **THREE** out of five)

12 Marks