SHIVAJI UNIVERSITY, KOLHAPUR - 416 004, MAHARASHTRA
www.unishivaji.ac.in, bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर - ४१६ ००४,महाराष्ट्र
दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९३/९४

Estd. 1962
"A⁺⁺" Accredited by NAAC(2021)
With CGPA 3.52

SU/BOS/Science/481   Date: 01/07/2023

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.

Subject: Regarding syllabi of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

Sir/Madam,

  With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

	B.Sc. Part-II (Sem III & IV) as per NEP-2020		
1.	Mathematics	8.	Chemistry
2.	Statistics	9.	Sugar Technology (Entire)
3.	Physics	10.	Microbiology
4.	Astrophysics	11.	Industrial Microbiology
5.	Zoology	12.	Electronics
6.	Botany	13.	Geology
7.	Plant Protection		

  This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website **www.unishivaji.ac.in**)

  The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

  You are, therefore, requested to bring this to the notice of all students and teachers concerned.

  Thanking you,

Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

SHIVAJI UNIVERISTY, KOLHAPUR-416 004. MAHARASHTRA
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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग— २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

Estd. 1962
NAAC 'A' Grade

SU/BOS/Sci & Tech/509   Date: 12/07/2023

To,
The Principal,
 All affiliated college,
 Shivaji University, Kolhapur.

Subject: Regarding minor change in Syllabus of **B.Sc.Part-II Physics Programme as per NEP-2020** under Faculty of Science & Technology.

Ref: SU/BOS/Science/481dated 01/07/2023.

Sir/Madam,

   With reference to the subject mentioned above, I am directed to inform you that the University have accepted and granted approval to minor change in Syllabus of **B.Sc. Part-II Physics Programme as per NEP-2020** under Faculty of Science & Technology which is enclosed herewith.

   This minor change in Syllabus of will be implemented from the academic year 2023-24 i.e.

   You are therefore, requested to bring this to the notice, all students and teachers concerned.

   Thanking you,

Yours faithfully,

Dy. Registrar

Copy to :-

1	The Dean, Faculty of Science & Technology	8	Appointment Section
2	The Chairman, Respective, BOS	9	Centre for Distance Education
3	Exam Section	10	Computer Centre
4	Eligibility Section	11	Affiliation Section (U.G.)
5	O.E. I Section	12	Affiliation Section (P.G.)
6	O.E. II Section	13	P.G.Admission Section
7	O.E. III Section	14	P.G.Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR

Accredited by NAAC with 'A^{++}' Grade with CGPA 3.52

Revised Syllabus for Bachelor of Science Part II

PHYSICS

CBCS (NEP) Pattern

Syllabus to implement from June 2023.

SHIVAJI UNIVERSITY, KOLHAPUR
CBCS (NEP) Syllabus with effect from June, 2023
B.Sc. Part-II Semester-III PHYSICS Paper-V
DSC-C1 THERMAL PHYSICS AND STATISTICAL MECHANICS – I
Theory: 36 Hours
Marks-40 (Credits: 02)

Unit I: **(18 hrs)**

Laws of Thermodynamics

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.

Unit II: **(18 hrs)**

1. Transport Phenomena (09 hrs)

Molecular collisions, Mean free path and collision cross-section, Estimation of molecular diameter and mean free path, Clausius and Maxwell`s equation for mean free path (without derivation). Transport Phenomena: transport of momentum (viscosity), transport of thermal energy (conduction), Transport of mass (diffusion).

2. Thermometry (09 hrs)

Principle of thermometry, types of thermometers, Scales of temperature (Celsius, Kelvin, Fahrenheit and Rankine), Principle construction and working of a) mercury thermometer; b) platinum resistance thermometer and c) thermocouple thermometer. Thermistor.

Reference books
1) Heat and Thermodynamics, M.W. Zemansky and R. Dittman, (8th Edn) McGraw Hill.
2) Text Book of Heat- J.B. Rajam, S.Chand and Company Ltd.
3) A Treatise on Heat- MeghnadSaha and B.N. Srivastava, Indian Press.
4) Heat and Thermodynamics- Brijlal and N. Subramanyam, S.Chand and Company Ltd.
5) Heat Thermodynamics and Statistical Physics- J.P. Agrawal, Satya Prakash, Pragati Publ.
   6) Fundamentals of Heat - D.S.Mathur, S.Chand and sons.

SHIVAJI UNIVERSITY KOLHAPUR
CBCS (NEP) Syllabus with effect from June, 2023
B.Sc. Part-II Semester-III PHYSICS Paper-VI
DSC-C2 WAVES AND OPTICS – I
Theory: 36 Hours   Marks-40 (Credits: 02)

Unit I: **(18 hrs)**

1.**Superposition of Harmonic Oscillations**   (6 hr)

Linearity and superposition principle, Superposition of two collinear harmonic oscillations for oscillations having equal frequencies: Analytical method, oscillations having different frequencies (Beats), Superposition of two perpendicular harmonic oscillations: for oscillations having equal frequencies (Analytical method).Oscillations having different frequencies (Lissajous figures), Uses of Lissajous figures.

2. Coupled Oscillations   (4 hr)

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

3. Wave Motion and Ultrasonic Waves   (8 hr)

Wave 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 oscillator, Detection of ultrasonic waves, Properties of ultrasonic waves, Applications of ultrasonic waves.

Unit II: **(18 hr)**
1. Sound and Acoustics of Buildings   (7 hr)

Sound: Transducers and their characteristics, Pressure microphone, Moving coil loudspeaker, Intensity and loudness of sound, Decibels, Intensity levels, Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula for reverberation time, Acoustic aspects of halls and auditoria.

2. Viscosity   (11hr)

Rate flow of liquid in a capillary tube - Poiseuille's formula, experimental determination of coefficient of viscosity of a liquid by Poiseuille's method, effect of temperature on viscosity of a liquid, Viscosity of liquid by rotating cylinder method, Searle's viscometer, viscosity of gases by Rankine's method (qualitative treatment only), Lubrication.

Reference books:
1. The Physics of Waves and Oscillations- N. K. Bajaj, Tata McGraw-Hill Reprint 2022.
2. Physics of Degree Students- C. L. Arora and Dr. P. S. Hemne, S Chand & company
3. A Text Book of Sound- Khanna and Bedi, Atma Ram & Sons, Delhi.
4. Waves and Oscillations-N Subrahmanyam, BrijLal. Vikas 2nd edition, Reprint 2022
5. Elements of Properties of Matter-D.S. Mathur, S. Chand.
6. Electronic Instrumentation – H.S. Kalasi McHraw , Hill

SHIVAJI UNIVERSITY KOLHAPUR

CBCS (NEP) Syllabus with effect from June, 2023

B.Sc. Part-II Semester-IV PHYSICS Paper-VII

DSC-D1 THERMAL PHYSICS AND STATISTICAL MECHANICS – II

Theory: 36 Hours

Marks-40 (Credits: 02)

Unit I   **(18 hrs)**

1. Thermodynamic Potentials   (10 hrs)

Enthalpy, Gibbs function, Helmholtz function, Internal Energy, 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 displacement law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Unit II   **(18 hrs)**

1. Classical Statistics   (12 hrs)

Phase space, Microstate and Macrostate, Accessible microstates, apriori probability, thermodynamic probability, probability distribution, Maxwell-Boltzmann (MB) distribution law, evaluation of constants α and β, Entropy and Thermodynamic probability, Distribution of molecular speeds.

2. Quantum Statistics   (6 hrs)

Bose-Einstein (BE) distribution law, Fermi-Dirac (FD) distribution law, 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. Subramanyam, Brij Lal, P. Hemne, 2008, S. Chand.

B.Sc. Part-II Semester-IV PHYSICS Paper-VIII
DSC-D2   WAVES AND OPTICS -II
Theory: 36 Hours   Marks-40 (Credits: 02)

Unit - I   **(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 (RP) of optical instruments, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, comparison between magnification and resolution, RP of plane diffraction grating, RP of a prism.

3. Polarization of Light   (6 hrs)
          Idea of polarization, polarization by double refraction, Huygens explanation of double refraction through uniaxial crystal, Nicol prism (construction, working), production of circularly and elliptically polarized light, optical rotation - laws of rotation of plane of polarization, polarimeter.

Unit-II   **(18 hrs)**

1. Interference   (10 hrs)
          Principle of Superposition, Coherence and condition for interference, Division of amplitude and division of wave front, Lloyds single mirror (determination of wavelength of light of monochromatic source), 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)
          Fraunhoffer 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 straight edge.

Reference books

1)   Optics – Ajoy Ghatak, 2021, McGraw Hill.
2)   A Textbook of Optics-N. Subrahnmanyam,Brij Lal, M.N. Avadhanulu, S.Chand.
3)   A Textbook of Light- D.N. Vasudeva, Atma ram and Sons.
4)   Waves and Optics – M. N. Avadanulu , TVS Arun Murthy, S. Chand.
5)   Fundamentals of Optics – Devraj Singh PHI Learning.

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 General Physics)**

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 a bad conductor by Lee and Charlton's disc method.

4. To determine the temperature co-efficient of resistance by platinum resistance thermometer.

5. To study the variation of thermo e. m. f. across two junctions of a thermocouple with temperature. / To determine the surface tension of water by ripple method.

6. To record and analyze the cooling temperature of hot object as a function of time using a thermocouple.

7. To calibrate Resistance Temperature Device (RTD) using Null Method / Off-Balance Bridge.

8. To determine the surface tension of mercury by Quincke's method.

- **Group II (Thermal Physics and Electricity)**

1. To determine the temperature coefficient of resistance using post office box.

2. To verify the Stefan's fourth power law.

3. To determine the specific heat of graphite.

4. To determine the ratio of specific heat of air by Kundt's tube.

5. To determine Joules constant (J) by electrical method.

6. To determine the thermal coefficient of linear expansion of a metal rod.

7. To determine Mechanical equivalent of heat J by Callender and Barne's constant flow method.

8. To determine the constants of Ballistic Galvanometer (B. G.)

- **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 λ^2–T Law.

3. To study Lissajous figures 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 the viscosity of liquid by Searle's viscometer.

7. To determine the velocity of sound in air by resonating bottle.

8. To determine the 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 straight edge / Biprism.

4. To determine wavelength of sodium light using Newton's Rings.

5. To 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:

1. B.Sc. Practical Physics – Harnam Singh , P.S. Hemane, S. Chand.
2. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
5. 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 40 marks and internal evaluation of 10 Marks.

3. The theory examination will be conducted with university 80% + Internal 20% Pattern

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 Certified Journal -10 Marks Neatness -5 Marks Punctuality-5 Marks	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 Question Paper

Time: 2 Hours   **Total Marks: 40**

Instructions:

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

Q.1 Select the correct alternative for the following.

     (Eight questions with four alternatives carrying 1 mark each)   **(08)**

Q.2 Attempt ANY TWO of the following.   **(16)**

(A)

(B)

(C)

Q.3 Attempt ANY FOUR of the following.   **(16)**

(A)

(B)

(C)

(D)

(E)

(F)

 Note : Equal Weightage should be given to all the units.

Course outcome:

Paper	Course Outcome
Paper V Thermal Physics and Statistical Mechanics-I	1: Highlight different types of velocities of gas molecules. 2: Acquire Knowledge of Maxwell's distribution of gas molecules. 3: Visualize Merits and drawbacks of thermometers. 4: Apply knowledge of thermodynamic processes in design of heat engine.
Paper VI Waves and Optics –I	1: Apply superposition principle to develop mathematical model of harmonic oscillators. 2: To develop the mathematical model for coupled oscillations. 3: Understand the ultrasonic waves and their applications. 4: Use of Basic principles of sound in context of acoustics of buildings.
Paper VII Thermal Physics and Statistical Mechanics-II	1: Develop Conceptual clarity of thermodynamic functions and Clausius-Clapeyron equation. 2: Appreciate the problem associated with the black body radiation spectrum. 3: Know, how the problems can be solved by using Planck's law of radiation. 4: Acquire preliminary knowledge of classical and quantum statistical mechanics.
Paper VIII Waves and Optics-II	1: Draw ray diagrams to demonstrate Cardinal points. 2: Determine the resolving power of prism and grating by making use of Rayleigh criterion. 3: Qualitatively study phenomenon of polarization of light. 4: Apply phenomenon of interference of light for determination of its wavelength.
Practical	1: Acquire skills in setting up of optics experiments. 2: Develop the practical skills and techniques for accurate measurements. 3: Acquire observational skills 4: Determine Least counts of different measuring instruments