DEBRA THANA S.K.S. MAHAVIDYALAYA

(Autonomous)

Debra, Paschim Medinipur, West Bengal

Department Of Physics

Proposed Curriculum & Syllabus (draft)

(w.e.f. Academic Year 2024-2025)

Based on

Curriculum & Credit Framework for Undergraduate Programmes (CCFUP), 2024 & NEP, 2020

BACHELOR OF SCIENCE IN PHYSICAL SCIENCES with PHYSICS

(*Under CCFUP, 2024*)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. in Physical Sc. with Physics	2nd	III	**SEMESTER-III**							
			Major-A2	PHSPMJ02	**T: Waves and Optics; P: Practical** *(To be studied by students taken* **PHYSICS** *as Discipline- A)*	4	3-0-1	15	60	75
			Major-A3	PHSPMJ03	**T: Thermal Physics; P: Practical** *(To be studied by students taken* **PHYSICS** *as Discipline- A)*	4	3-0-1	15	60	75
			SEC	SEC03	**SEC 03: Basics of Computer and Graph Plotting.** *(To be studied by students taken* **PHYSICS** *as Discipline- C)*	3	0-0-3	10	40	50
			AEC	AEC03	Communicative English-2 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC03	Multidisciplinary Course-3 (***to be chosen from the list***)	3	3-0-0	10	40	50
			Minor-3 (Disc.-C3)	PHSMIN03	**T: Thermal Physics; P: Practical** *(To be studied by students taken PHYSICS as Discipline- C)*	4	3-0-1	15	60	75
					Semester-III Total	20				375
		IV	**SEMESTER-IV**							
			Major-B2		**T: Waves and Optics; P: Practical** *(To be studied by students taken* **PHYSICS** *as Discipline- B)*	4	3-0-1	15	60	75
			Major-B3		**T: Thermal Physics; P: Practical** *(To be studied by students taken* **PHYSICS** *as Discipline- B)*	4	3-0-1	15	60	75
			Major (Elective) -1	PHSMJE-01	**T: Advanced Mathematical Methods OR Classical Mechanics with Special Theory of Relativity** *(To be studied by students taken PHYSICS as Discipline- A)*	4	3-1-0	15	60	75
			AEC	AEC04	MIL-2 (***common for all programmes***)	2	2-0-0	10	40	50
			Minor -4 (Disc.-C4)	PHSMIN04	**T: Waves and Optics; P: Practical** *(To be studied by students taken PHYSICS as Discipline- C)*	4	3-0-1	15	60	75
			Summer Intern.	IA	Internship / Apprenticeship- **activities to be decided by the Colleges following the guidelines to be given later**	4	0-0-4	-	-	50
					Semester-IV Total	22				400
					TOTAL of YEAR-2	42	-	-	-	775

MJP = Major Programme (Multidisciplinary), MI = Minor, A/B = Choice of Major Discipline; C= Choice of Minor Discipline; SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language

MAJOR (MJ)

MJ A2/B2: Waves and Optics Credits 04

MJ A2/B2T: Waves and Optics Credits 03 [40L]

Course contents:

1. Oscillations: Differential equation of simple harmonic oscillations and its solution, Calculation of kinetic energy, potential energy, total energy and their time and space average values, Damped oscillations, Forced oscillations: Transient and steady states; Resonance, amplitude and velocity resonance, sharpness of resonance, power dissipation and Quality Factor. [8L]

2. Superposition of harmonic oscillations: Superposition of two collinear harmonic oscillations having equal frequencies and different frequencies (beats), Superposition of two perpendicular harmonic oscillations, Lissajous figures. [4L]

3. Wave motion: Plane progressive waves, Wave equation for progressive waves, Particle and wave velocities, Speed of transverse vibrations in a stretched string, standing (stationary) waves in a string, Phase and Group velocities, Doppler Effect and Doppler shift. [4L]

4. Geometrical optics: Fermat's principle, Laws of reflection and refraction at a plane surface from Fermat's principle, refraction at a spherical surface, lens formula and lens maker's formula, Combination of thin lenses in contact and in separation, equivalent focal length, Dispersion and dispersive power, Spherical and chromatic aberration. [6L]

5. Interference: Huygens' principle, explanation of the laws of reflection and refraction, Coherent sources, Division of wavefront and division of amplitude, Young's double slit experiment (YDSE), Intensity distribution, conditions of interference, Interference in thin films, Parallel and wedge shaped films: Fringes of equal inclination (Haidinger fringes- Idea only), Fringes of equal thickness (Fizeau fringes- Idea only), Newton's rings: Measurement of wavelength and refractive index. [6L]

6. Diffraction: Fresnel diffraction: Fresnel's half-period zones for plane waves, Theory of Zone Plate: Multiple foci of Zone Plate, Fraunhoffer diffraction: Single and double slits. Concept of diffraction grating with its diffraction pattern. Rayleigh criterion and idea of grating's resolving power. [6L]

7. Polarization: Description of linear, circular and elliptical polarization, Malus law, Birefringence, Uniaxial crystals, Double refraction and polarization by double refraction, Ordinary and extraordinary refractive indices, Retardation plates (idea only): Quarter-wave and Half-wave plates, Rotatory polarization, Biot's laws for rotatory polarization, Specific rotation. [6L]

Suggested readings:

- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Advanced Acoustics, D. P. Roychowdhury, Promothesh Banerjee and Raghunandan Misra, The New Book Stall.
- Waves and Oscillations, N. K. Bajaj, 2017, Tata McGraw-Hill.
- A textbook of Optics, N. Subramanyam, B. Lal and M. N. Avadhanulu, 2006, S. Chand Publishing.

- A Text Book on Light, B. Ghosh & K.G. Mazumdar, Shreedhar Publishers.

MJ A2 /B2 P: Practical **Credits 01**

List of Practical:

1. Measurement of focal length of a concave lens by combination method.
2. Familiarization with Schuster`s method and determination of angle of prism.
3. Determination of refractive index of material of a prism using sodium source.
4. To determine the frequency of an electric tuning fork by Melde's experiment.
5. Determination of wavelength of sodium light/radius of a plano-convex lens using Newton's Rings.
6. To study the specific rotation of optically active solution using polarimeter.
7. To determine dispersive power and resolving power of a plane diffraction grating.

Recommended Reading:

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Laboratory Manual of Physics, Vol. 1 & 2 Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
- Practical Physics, G. L. Squires, 2015, 4th Edition, Cambridge University Press
- B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited
- Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
- Advanced Practical Physics Vol 1 & 2, B. Ghosh, K. G. Majumder, Sreedhar Publisher
- Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
- B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited

MJ A3/B3: **Thermal Physics** **Credits 04**

MJ A3/B3T: **Thermal Physics** **Credits 03 [35L]**

Course contents:

1. Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of molecular velocities and its experimental verification, Mean free path (zeroth order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Degrees of freedom, Law of equi-partition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. [6L]

2. Laws of Thermodynamics: Zeroth Law of thermodynamics and concept of temperature, First law of thermodynamics and internal energy, conversion of heat into work, Various thermodynamic processes, Applications of First law: General relation between C_P and C_V, Work done in isothermal and adiabatic processes, compressibility and expansion coefficient, Reversible and irreversible processes, Second law of thermodynamics, concept of entropy, Carnot's cycle and Carnot's theorem, entropy changes in reversible & irreversible processes, entropy-temperature diagrams, Third law of thermodynamics and its implication. [10L]

3. Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and internal energy functions, Maxwell's relations and applications, Expression for (C_P - C_V), C_P/C_V, TdS equations and their importance, Joule-Thomson Effect, Adiabatic demagnetisation (idea only), Clausius-Clapeyron Equation. [6L]

4. Theory of Radiation: Blackbody radiation, spectral distribution, concept of energy density, Derivation of Planck's law, Deduction of four laws (Wien's distribution law, Rayleigh - Jeans Law, Stefan Boltzmann Law and Wien's displacement law) from Planck's law. [6L]

5. Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Quantum statistics: Fermi-Dirac distribution, Application to electron gas, Bose-Einstein distribution, Application to photon gas, comparison of three statistics. [7L]

Recommended Reading:

- A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M. W. Zemansky and R. Dittman, 1981, McGraw Hill
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears and G. L. Salinger. 1988, Narosa.
- Thermal Physics, A. B. Gupta and H. P. Roy, Books & Allied (P) Ltd.
- Thermal Physics, A. Kumar and S. P. Taneja, 2014, R. Chand Publications.

MJ A3 /B3 P: Practical **Credits 01**

List of Practical:

1. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
2. Verification of Stefan-Boltzmann law using tungsten bulb and to determine Stefan's Constant.
3. To determine the temperature co-efficient of resistance of platinum by platinum resistance thermometer.
4. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
5. Determination of the temperature coefficient of resistance by Carey Foster's method.
6. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
7. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.

Recommended Reading:

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Laboratory Manual of Physics, Vol. 1 & 2 Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
- Practical Physics, G. L. Squires, 2015, 4th Edition, Cambridge University Press
- B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited
- Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
- Advanced Practical Physics Vol 1 & 2, B. Ghosh, K. G. Majumder, Sreedhar Publisher
- Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
- B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited

Major Elective -1 (MDP)

MJ (Elective)-1A: Advanced Mathematical Methods Credits 04
MJ (Elective)-1T: Advanced Mathematical Methods Credits 03 [45L]

1. Matrices
(a) Addition and multiplication of matrices. Null matrices. Diagonal, scalar and unit matrices. Transpose of a matrix. Symmetric and skew-symmetric matrices. Conjugate of a matrix. Hermitian and skew-Hermitian matrices. Singular and non-singular matrices. Orthogonal and unitary matrices. Trace of a matrix. (b) Eigenvalues and eigenvectors (non-degenerate). Properties of Hermitian matrices. Cayley-Hamilton theorem. **[18L]**

2. Partial Differential Equations
Solutions to Laplace's equation using separation of variables for cartesian coordinates, Wave equation and its solution for vibrational modes of a stretched string. Simple problems. **[4L]**

3. Basics of Probability
Random experiments, sample space, events. Definitions of Probability. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications. **[5L]**

4. Some special integrals
Beta and Gamma functions and relation between them. Expression of integrals in terms of Gamma functions. Error function (probability integral). **[4L]**

5. Fourier Series
Periodic functions. Orthogonality of sine and cosine functions, Dirichlet conditions (statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Simple problems. **[7L]**

6. Fourier Transforms
Fourier integral theorem. Fourier Transform. Examples. Fourier transform of box and gaussian functions. **[7L]**

MJ (Elect. A/B)-1Tu: Advanced Mathematical Methods Credits 1

Tutorial
Students must be given at least Two assignments with list of relevant problems. On the basis of regularity of submission and evaluation of assignment by the respective teacher, credits should be awarded to the students.

Recommended reading:

- Introduction to Mathematical Physics, Charlie Harper, 1978, PHI Learning Pvt. Ltd.
- Mathematical methods in the Physical Sciences, M. L. Boas, 2005, Wiley.
- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press.
- Mathematical Physics, P.K. Chattopadhyay, 2014, New Academic Science.
- Mathematical Physics, H. K. Dass & Rama Verma, 2014, S Chand.
- Fundamentals of Mathematical Physics, A B Gupta, 2024, Books & Allied.

OR

MJ (Elective)-1B **Classical Mechanics with Special Theory of Relativity** **Credits 04**

MJ (Elective)-1T **Classical Mechanics with Special Theory of Relativity** **Credits 03 [45L]**

Course contents:

1. Introduction to Tensor analysis: [5L]

Definition of Cartesian tensors in 3 dimensions. Transformation properties. Contravariant and Covariant tensors. Inner Product. Contraction of rank of tensors.

2. Lagrangian formulation: (16L)

A. Lagrange's equation: Degrees of freedom; constraints, holonomic, non-holonomic, scleronomous and rheonomous constraints; generalised coordinates; Virtual displacement and virtual work, principle of virtual work; D' Alembert's principle; Lagrange's equation for holonomic systems (from D' Alembert's principle) – for conservative systems and for systems with velocity dependent potentials, application of Lagrange's equation in simple cases. (12L)

B. Small oscillations: Theory of small oscillations (up to calculation of eigen frequencies and relative amplitudes), simple applications: spring mass systems, diatomic molecules. (4L)

3. Hamiltonian formulation (17L):

A. Hamilton's equations: Generalised momentum, cyclic coordinates and its relation with conservation principles, definition of Hamiltonian, Hamilton's equation, Legendre transformation and derivation of Hamilton's equation by Legendre transformation; kinetic energy in terms of generalised velocities and generalised coordinates, Hamiltonian and total energy for systems with schleronomous-rheonomic constraints, Application of Hamiltonian Formulation to simple cases.

B. Hamilton's principle: Variational principle, Euler-Lagrange equation; Hamilton's principle, Derivation of Lagrange's equation from Hamilton's principle, Application to brachistochrone problem. (4L)

C. Canonical transformations: Generating function, Conditions for transformation to be canonical, Simple problems. (3L)

D. Poisson bracket: Fundamental properties of Poisson bracket, equations of motion in Poisson bracket form, Poisson bracket and integrals of motion, Poisson bracket of angular momentum components, Poisson bracket and canonical transformation. (3L)

4. Special theory of relativity [7L]:

Results of Michelson-Morley Experiment (derivation not required). Postulates of special theory of relativity. Transformation equations. Length contraction and time dilation, Velocity addition theorem, Variation of mass with velocity and mass-energy equivalence. Relativistic Kinematics using four-vector approach.

MJ (Elect. A/B)-1Tu: **Classical Mechanics with Special Theory of Relativity** **Credits 1**

Tutorial

Students must be given at least Two assignments with list of relevant problems. On the basis of regularity of submission and evaluation of assignment by the respective teacher, credits should be awarded to the students.

Suggested Reading:

Classical Mechanics-

1. Classical Mechanics, N. C. Rana and P. S. Joag, McGraw Hill Education
2. Classical Mechanics, H. Goldstein, Pearson Education, 3Ed.
3. Classical Mechanics, A. B. Gupta, 2022, Books and Allied Pvt. Ltd.
4. Classical Mechanics, J. C. Upadhyay, 2019 Himalaya Publishing House
5. Classical Mechanics, A. K. Raychaudhuri, 1983 Oxford Univ. Press
6. Introduction to Classical Mechanics, R. G. Takwale, P. S. Puranik, 2017, McGraw Hill Education
7. Classical Mechanics: Systems of Particles and Hamiltonian Dynamics, Walter Greiner, Springer
8. Classical Mechanics: Point Particles and Relativity, Walter Greiner, Springer
9. Introduction to Special Relativity, Robert Resnick, 2005, Wiley
10. The Special Theory of Relativity, Sriranjan Banerjee and Asit Banerji, 2012, Prentice Hall India Learning Private Limited.
11. Special Theory of Relativity; a chapter of Electricity and Magnetism, D. Chattopadhyay, P. C. Rakshit, New Central Book Agency
12. The Special Theory of Relativity: A Mathematical Approach, Farook Rahaman, Springer
13. Mechanics Through Problems Including Special Theory Of Relativity, D. Roy, A. Dasgupta, 2022, Techno World.
14. Classical Mechanics: Problems with solutions by Konstantin K Likharev, 2018, IOP Expanding Physics.
15. Solved Problems in Classical Mechanics: Analytical and Numerical Solutions with Comments by O.L. de Lange, J. Pierrus, 2010, Oxford Univ. Press.

MINOR (MI)

PHSMIN03: Thermal Physics Credits 04

PHSMIN03T: Thermal Physics Credits 03 [35L]

Course contents:

1.Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of molecular velocities and its experimental verification, Mean free path (zeroth order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Degrees of freedom, Law of equi-partition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. [6L]

2.Laws of Thermodynamics: Zeroth Law of thermodynamics and concept of temperature, First law of thermodynamics and internal energy, conversion of heat into work, Various thermodynamic processes, Applications of First law: General relation between C_P and C_V, Work done in isothermal and adiabatic processes, compressibility and expansion coefficient, Reversible and irreversible processes, Second law of thermodynamics, concept of entropy, Carnot's cycle and Carnot's theorem, entropy changes in reversible & irreversible processes, entropy-temperature diagrams, Third law of thermodynamics and its implication. [10L]

3.Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and internal energy functions, Maxwell's relations and applications, Expression for (C_P - C_V), C_P/C_V, TdS equations and their importance, Joule-Thomson Effect, Adiabatic demagnetisation (idea only), Clausius-Clapeyron Equation. [6L]

4.Theory of Radiation: Blackbody radiation, spectral distribution, concept of energy density, Derivation of Planck's law, Deduction of four laws (Wien's distribution law, Rayleigh - Jeans Law, Stefan Boltzmann Law and Wien's displacement law) from Planck's law. [6L]

5.Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Quantum statistics: Fermi-Dirac distribution, Application to electron gas, Bose-Einstein distribution, Application to photon gas, comparison of three statistics. [7L]

Recommended Reading:

- A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M. W. Zemansky and R. Dittman, 1981, McGraw Hill
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears and G. L. Salinger. 1988, Narosa.
- Thermal Physics, A. B. Gupta and H. P. Roy, Books & Allied (P) Ltd.
- Thermal Physics, A. Kumar and S. P. Taneja, 2014, R. Chand Publications.

PHSMIN03P: **Credits 01**

List of Practical:

1.To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
2.Verification of Stefan-Boltzmann law using tungsten bulb and to determine Stefan's Constant.
3.To determine the temperature co-efficient of resistance of platinum by platinum resistance thermometer.
4.To study the variation of thermo emf across two junctions of a thermocouple with temperature.
5.Determination of the temperature coefficient of resistance by Carey Foster's method.
6.To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
7.To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.

Recommended Reading:

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Laboratory Manual of Physics, Vol. 1 & 2 Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
- Practical Physics, G. L. Squires, 2015, 4th Edition, Cambridge University Press
- B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited
- Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
- Advanced Practical Physics Vol 1 & 2, B. Ghosh, K. G. Majumder, Sreedhar Publisher
- Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
- B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited

PHSMIN04: Waves and Optics Credits 04

PHSMIN04T: Waves and Optics Credits 03 [40L]

Course contents:

1.Oscillations: Differential equation of simple harmonic oscillations and its solution, Calculation of kinetic energy, potential energy, total energy and their time and space average values, Damped oscillations, Forced oscillations: Transient and steady states; Resonance, amplitude and velocity resonance, sharpness of resonance, power dissipation and Quality Factor. [8L]

2.Superposition of harmonic oscillations: Superposition of two collinear harmonic oscillations having equal frequencies and different frequencies (beats), Superposition of two perpendicular harmonic oscillations, Lissajous figures. [4L]

3.Wave motion: Plane progressive waves, Wave equation for progressive waves, Particle and wave velocities, Speed of transverse vibrations in a stretched string, standing (stationary) waves in a string, Phase and Group velocities, Doppler Effect and Doppler shift. [4L]

4.Geometrical optics: Fermat's principle, Laws of reflection and refraction at a plane surface from Fermat's principle, refraction at a spherical surface, lens formula and lens maker's formula, Combination of thin lenses in contact and in separation, equivalent focal length, Dispersion and dispersive power, Spherical and chromatic aberration. [6L]

5.Interference: Huygens' principle, explanation of the laws of reflection and refraction, Coherent sources, Division of wavefront and division of amplitude, Young's double slit experiment (YDSE), Intensity distribution, conditions of interference, Interference in thin films, Parallel and wedge shaped films: Fringes of equal inclination (Haidinger fringes- Idea only), Fringes of equal thickness (Fizeau fringes- Idea only), Newton's rings: Measurement of wavelength and refractive index. [6L]

6.Diffraction: Fresnel diffraction: Fresnel's half-period zones for plane waves, Theory of Zone Plate: Multiple foci of Zone Plate, Fraunhoffer diffraction: Single and double slits. Concept of diffraction grating with its diffraction pattern. Rayleigh criterion and idea of grating's resolving power. [6L]

7.Polarization: Description of linear, circular and elliptical polarization, Malus law, Birefringence, Uniaxial crystals, Double refraction and polarization by double refraction, Ordinary and extraordinary refractive indices, Retardation plates (idea only): Quarter-wave and Half-wave plates, Rotatory polarization, Biot's laws for rotatory polarization, Specific rotation. [6L]

Suggested readings:

- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Advanced Acoustics, D. P. Roychowdhury, Promothesh Banerjee and Raghunandan Misra, The New Book Stall.
- Waves and Oscillations, N. K. Bajaj, 2017, Tata McGraw-Hill.
- A textbook of Optics, N. Subramanyam, B. Lal and M. N. Avadhanulu, 2006, S. Chand Publishing.

- A Text Book on Light, B. Ghosh & K.G. Mazumdar, Shreedhar Publishers.

PHSMIN04P: **Credits 01**

List of Practical:

1.Measurement of focal length of a concave lens by combination method.
2.Familiarization with Schuster`s method and determination of angle of prism.
3.Determination of refractive index of material of a prism using sodium source.
4.To determine the frequency of an electric tuning fork by Melde's experiment.
5. To determine dispersive power and resolving power of a plane diffraction grating.
6.Determination of wavelength of sodium light/radius of a plano-convex lens using Newton's Rings.
7.To study the specific rotation of optically active solution using polarimeter.

Recommended Reading:

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Laboratory Manual of Physics, Vol. 1 & 2 Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
- Practical Physics, G. L. Squires, 2015, 4th Edition, Cambridge University Press
- B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited
- Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
- Advanced Practical Physics Vol 1 & 2, B. Ghosh, K. G. Majumder, Sreedhar Publisher
- Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
- B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited

SKILL ENHANCEMENT COURSE (SEC)

(To be studied by students taken Physics as Discipline- C)

SEC 03: Basics of Computer and Graph Plotting. **Credits 03**

SEC03P: Basics of Computer and Graph Plotting.
Introduction and Overview: Introduction to computer and Basic data types Introduction to computer- Characteristics and Basic Applications of Computer, Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Memory, concepts of Hardware and Software.
Basic Word Processing: Introduction to Word Processing, Opening Word Processing Package, Opening and closing documents, Using a Document/Help Wizard, Text Creation and Manipulation, Formatting the Text, Handling Multiple Documents, Table Manipulation, Printing, saving documents in different formats.
Spreadsheets and Basic Data Analysis: Spread Sheet, Elements of Electronics Spread Sheet,

Application/usage of Electronic Spread Sheet, Manipulation of cells, Formulas and functions; Spread sheets for Small accountings maintaining invoices/budgets, basic practical data analysis works

Basic Presentations: Basics- Difference between presentation and document, Using Power Point, Creation of Presentation, Preparation of Slides, Selection of type of Slides, Importing text from word documents, Providing aesthetics- Slide Designs, Slide Manipulation and Slide Show, Presentation of the Slides.

Introduction to plotting graphs: Basic 2D and 3D graph plotting - plotting functions and data files, fitting data using gnuplot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface and contour plots, exporting plots. Graph plotting using Origin software.

Introduction to Image analysis software: Overview of image analysis software (e.g., ImageJ).

Basics of image processing techniques. Projectile Motion Analysis. Frictional Forces and Surface Analysis.

Introduction to Video tracking software: Overview of video tracking and it's application.

Introduction to popular video tracking software. Tracking of simple mechanical systems (e.g., pendulum, projectile motion). Analyzing motion trajectories and velocity profiles.

Suggested Readings:

1. C.S. French "Data Processing and Information Technology", BPB Publications 1998
2. P.K Sinha, Computer Fundamentals, BPB Publications, 1992
3. Guy Hart-Davis "The ABCs of Microsoft Office 97 Professional edition", BPB Publications, 1998
4. Karl Schwartz, "Microsoft Windows 98 Training Guide", 1998
5. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
6. Elementary Numerical Analysis, K.E. Atkinson, 3 rd Edn . , 2007, Wiley India Edition.