Ahmednagar Jilha Maratha VidyaPrasarakSamaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System (CBCS)

Bachelor of Science (B. Sc.)

Syllabus of

S. Y. B. Sc. Physics

Implemented from

Academic Year 2022 -23

Ahmednagar Jilha Maratha VidyaPrasarakSamaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies (BOS) in Physics

Sr. No.	Name	Designation
1.	Prof. (Dr.) Avinash V. Mancharkar	Chairman
2.	Dr. Ashok A. Jadhavar	Member
3.	Dr. AppasahebTorane	Academic Council Nominee
4.	Dr. Vijay M. Mayekar	Academic Council Nominee
5.	Prof. (Dr.) Arun G. Banpurkar	Vice Chancellor Nominee
6.	Prof. (Dr.) Nandu B. Chaure	Alumnus
7.	Dr. Vinay Hasabnis	Industry Expert
8.	Dr. Shrikrushna B. Gaikwad	Member (Co-opt)
9.	Mr. Dattatray K. Sonwane	Member (Co-opt)
10.	Mr. Dipak S. Shelar	Member (Co-opt)

Program Structure and Course Titles

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	F.Y.B.Sc.	I	BSC-PH 101 T	Mechanics and Properties of Matter	02
2.			BSC-PH 102 T	Physics Principles and Applications	02
3.			BSC-PH 103 P	Physics Laboratory- 1A	1.5
4.		II	BSC-PH 201 T	Heat and Thermodynamics	02
5.			BSC-PH 202 T	Electricity and Magnetism	02
6.			BSC-PH 203 P	Physics Laboratory- 1B	1.5
7.	S.Y.B.Sc.	III	BSC-PH 301 T	Mathematical Methods in Physics I	02
8.			BSC-PH 302 T (A)	Electronics I	02
9.			OR		
10.			BSC-PH 302 T (B)	Instrumentation I	
11.			BSC-PH 303 P	Physics Laboratory-2A	02
12.		IV	BSC-PH 401 T	Oscillations, Waves and Sound	02
13.			BSC-PH 402 T	Optics	02
14.			BSC-PH 403 P	Physics Laboratory-2B	02
15.	T.Y.B.Sc.	V	BSC-PH 501 T	Mathematical Methods in Physics II	02
16.			BSC-PH 502 T	Electrodynamics	02
17.			BSC-PH 503 T	Classical Mechanics	02
18.			BSC-PH 504 T	Atomic and Molecular Physics	02
19.			BSC-PH 505 T	Computational Physics	02

20.			BSC-PH 506 T (X)	Elective I	**02**
21.			BSC-PH 507 P	Physics Laboratory-3A	**02**
22.			BSC-PH 508 P	Physics Laboratory-3B	**02**
23.			BSC-PH 509 P	Project 1	**02**
24.			BSC-PH 510 T (X)	Skill Enhancement Course – I T	**02**
25.			BSC-PH 511 P (X)	Skill Enhancement Course – I P	**02**
26.			BSC-PH 601 T	Solid State Physics	**02**
27.			BSC- PH 602 T	Quantum Mechanics	**02**
28.			BSC- PH 603 T	Thermodynamics and Statistical Physics	**02**
29.			BSC- PH 604 T	Nuclear Physics	**02**
30.			BSC- PH 605 T (A)	Electronics II	**02**
31.			OR		
32.		**VI**	BSC- PH 605 T (B)	Advanced Electronics	
33.			BSC- PH 606 T (X)	Elective II	**02**
34.			BSC- PH 607 P	Physics Laboratory-4A	**02**
35.			BSC- PH 608 P	Physics Laboratory-4B	**02**
36.			BSC- PH 609 P	Project 2	**02**
37.			BSC- PH 610 T (X)	Skill Enhancement Course – II T	**02**
38.			BSC- PH 611 P (X)	Skill Enhancement Course – II P	**02**

Group I: Elective Courses

The college will offer any two Special Electives from the following list as Elective I, Elective II for T.Y.B.Sc. Semester V and Semester VI.

Sr. No.	Title	Semester	Course Code	Course Title	Credits
1.	**Elective I**	**V**	BSC-PH 506 T (A)	Astronomy and Astrophysics - I	**02**
2.			BSC-PH 506 T (B)	Elements of Material Science	**02**
3.			BSC-PH 506 T (C)	Biophysics	**02**
4.			BSC-PH 506 T (D)	Renewable Energy Studies I	**02**
5.			BSC-PH 506 T (E)	Applied Optics - I	**02**
6.	**Elective II**	**VI**	BSC-PH 606 T (A)	Astronomy and Astrophysics - II	**02**
7.			BSC-PH 606 T (B)	Medical Electronics	**02**
8.			BSC-PH 606 T (C)	Physics of Nanomaterials	**02**
9.			BSC-PH 606 T (D)	Renewable Energy Studies II	**02**
10.			BSC-PH 606 T (E)	Lasers	**02**

Group II: Skill Enhancement Course

The college will offer any two Skill Enhancement Courses from the following list as Skill Enhancement Course – I,Skill Enhancement Course – II for semester V and VI.

Sr.No.	Title	Semester	Course Code	Course Title	Credits
1.	**Skill Enhancement Course – I**	**V**	BSC-PH 510 T (A)	Biomedical Instrumentation	**02**
2.			BSC-PH 511 P (A)		**02**
3.			BSC-PH 510 T (B)	Solar Thermal System: Installation and Maintenance	**02**
4.			BSC-PH 511 P (B)		**02**
5.			BSC-PH 510 T (C)	Sensors and Transducers	**02**
6.			BSC-PH 510 P (C)		**02**
7.			BSC-PH 510 T (D)	Physics Workshop Skills	**02**
8.			BSC-PH 511 P (D)		**02**
9.	**Skill Enhancement Course – II**	**VI**	BSC- PH 610 T (A)	Solar PV System: Installation and Maintenance	**02**
10.			BSC- PH 611 P (A)		**02**
11.			BSC- PH 610 T (B)	Scientific data Analysis	**02**
12.			BSC- PH 611 P (B)		**02**
13.			BSC- PH 610 T (C)	Applications of IOT	**02**
14.			BSC- PH 611 P (C)		**02**
15.			BSC- PH 610 T (D)	Instrumentation for Agriculture	**02**
16.			BSC- PH 611 P (D)		**02**

Semester -III	Paper –I
Course Code: BSC-PH 301 T	**Title of the Course:** Mathematical Methods in Physics I
Credits: 2	**Total Hours: 30 Hrs.**

Course Objectives	Course Outcomes
1. Explain the algebra for complex numbers. 2. Explain the concept of partial differentiation and use in various cases. 3. Explain the line integrals and surface integrals. 4. Explain the concept of singular points, ordinary points, regular singular points and irregular singular points.	1. Solve various problems in complex algebra. 2. Use the concept of partial differentiation to solve numerical problems in physics. 3. Apply vector algebra studied in physics to solve various problems. 4. Understand difference between singular, ordinary, regular and irregular points.

Unit I: Complex Numbers (08 Hrs.)

Introduction to complex numbers, Rectangular, polar and exponential forms of complex numbers, Argand diagram, Algebra of complex numbers using Argand diagram, De-Moivre's Theorem (Statement only), Power, root and log of complex numbers, Trigonometric, hyperbolic and exponential functions, Applications of complex numbers to determine velocity and acceleration in curved motion, .Problems..

Unit II: Partial Differentiation (06 Hrs.)

Definition of partial differentiation, Successive differentiation, Total differentiation, Exact differential, Chain rule, Theorems of differentiation, Change of variables from Cartesian to polar co-ordinates, Conditions for maxima and minima(without proof)Problems.

Unit III: Vector Algebra and Analysis (10 Hrs.)

Introduction to scalars and vectors, dot product and cross product of two vectors and their physical significance (Revision). Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Scalar and vector fields. Differentiation of vectors with respect to

scalar, Vector differential operator and Laplacian operator, Gradient of scalar field and its physical significance, Divergence of scalar field and its physical significance, Curl of vector field and its physical significance, Vector identities, Stokes theorem (statement only) Problems.

Unit IV: Differential Equation (06 Hrs.)

Degree, order, linearity and homogeneity of differential equation, Concept of Singular points. Example of singular points ($x = 0$, $x = x_0$ and $x = \infty$) of differential equation, Problems

Suggested Readings:

1. Methods of Mathematical Physics by Laud, Takwale and Gambhir.
2. Mathematical Physics by B. D. Gupta, 4th Edition, Vikas Publishing House Pvt. Ltd, 2009.
3. Mathematical Physics by Rajput and Gupta, 3rd Edition, Vikas Publishing House Pvt. Ltd.
4. Mathematical Methods in Physical Science by Mary and Boas, Third Edition, Kaye Pace
5. Vector analysis by Spiegel, Murrey.
6. Mathematical Methods for Physicists, Arfken and Weber, 5th Edition.
7. Fundamentals of Mathematical Physics, A. B. Gupta.
8. Vector Analysis by Seymour Lipschutz and Dennis Spellman.
9. NPTEL Video: https://nptel.ac.in/courses/111/103/111103070/ Complex Number - Prof. P. A. S. Sree Krishna, Department of Mathematics, IIT Guwahati, 2013.
10. NPTEL Video: https://nptel.ac.in/courses/111/107/111107111/ Partial differential equation, Prof. P. N. Agrawal, IIT Guwahati, 2018.
11. NPTEL Video: https://nptel.ac.in/courses/111/106/111106051/ Vector analysis, Prof. K.C. Sivakumar, IIT Madras, 2015.

Semester –III	Paper -II
Course Code: BSC-PH 302 T (A)	**Title of the Course:** Electronics I
Credits: 2	**Total Hours: 30 Hrs.**

Course Objectives	Course Outcomes
1. Explain various basic electronic components and circuits. 2. Explain basic concepts, principles and theorems in electronic circuits. 3. Explain the concept of Boolean algebra, operation and working of logic gates. 4. Explain importance of operational amplifiers in various applications.	1. Apply laws of electrical circuits to different circuits. 2. Understand the concepts, laws and theorems. 3. Learn basics of number system and Boolean algebra. 4. Understand the properties and working of transistors.

Unit I: Network Theorem and Power Supply (07 Hrs.)

Krichhoff's Law, Voltage and current Divider Circuit, Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power transfer theorem (With proof in case of DC), Problems, Block diagram of power supply, unregulated and regulated power supply.

Unit II: Study of Transistor (10 Hrs.)

Bi-junction Transistor : Revision of bipolar Junction Transistor, Types, Symbol and basic action, Configuration (Common Base, Common Emitter and Common Collector), Current Gain Factors (α and β) and their relations, Input, Output and transfer Characteristic of CE Configuration, Biasing method and Voltage Divider, DC Load line (CE), Operating Point (Q- point), Transistor as a switch, Problems. Uni-Junction Transistor: Symbol, Types, Construction, Working Principle, I-V characteristics, Specifications and Parameters of Uni Junction Transistor (UJT), UJT as a relaxation Oscillator.

Unit III: Operational Amplifiers and Application (08 Hrs.)

Operational Amplifiers: Introduction, Ideal and practical Characteristics, Operational Amplifier: IC741- Block Diagram and Pin diagram, Concept of Virtual Ground, Inverting and Non-inverting operational amplifiers with concept of gain, Operational amplifier as an adder and subtractor, Operational amplifier as an Integrator and differentiator, Problems. Oscillators: Concept of Positive and negative feedback, Barkhausein Criteria for an oscillator, Construction, working and application of phase shift oscillator using IC741, Problems.

Unit IV: Number System and Logic Gates (05 Hrs.)

Number System: Binary, Binary coded Decimal (BCD), Octal, Hexadecimal, Addition and Subtraction of binary numbers and binary fractions using ones and two's complement. Basic Logic gates (OR, AND, NOT), Derived gates: NOR, NAND, EXOR, EXNOR, with symbols and truth table, Boolean Algebra, De Morgan's theorem and its verification, Problems

Suggested Readings:

1. Electronic Principles, Malvino, 7th Edition, Tata Mc-Graw Hills publication, 2007.
2. Principles of Electronics, V.K. Mehta, 12th Edition, S. Chand publication, 2020.
3. Op-amp and Linear Integrated Circuit, Ramakant Gaikwad, 4th edition, Prentice Hall of India Publication.
4. Digital Principles and Application, Malvino and Leech, 6yh edition, Tata Mc-Graw Hills publication, 2008.
5. Power supply by B.S. Sonde, McGraw-Hill Education, 1980.
6. NPTEL Video: https://nptel.ac.in/courses/117/106/117106087/ Electronic for signal processing - Prof. K. Radhakrishna Rao, Department of Electrical Engineering, IIT Madras, 2009.
7. NPTEL Video: https://nptel.ac.in/courses/108/102/108102097/ Introduction to the Course and Basic Electrical Quantity, Prof. S.C. Dutta Roy, Department of Electrical Engineering, IIT Delhi, 2015.
8. NPTEL Video: https://nptel.ac.in/courses/108/105/108105113/ Digital Circuits, Prof. Santanu Chattopathyay, IIT Kharagpur, 2018.

Semester –III	Paper -II
Course Code: BSC-PH 302 T (B)	**Title of the Course:** Instrumentation I
Credits: 2	**Total Hours: 30 Hrs.**

Course Objectives	Course Outcomes
1. Explain the functions of different instruments. 2. Explain applications of various measuring instruments. 3. Introduce the concept of transducer and different types of transducers. 4. Explain various modes of working of operational amplifiers.	1. Learn the basic functions of different instruments. 2. Use measuring instruments for the measuring various parameters. 3. Understand the functions of transducers. 4. Design experiments using sensors.

This course is for students who have taken Electronic Science as one of the subjects at F. Y. B. Sc.

Unit I: Fundamentals of measurement (07 Hrs.)

Aims of measurement, Functional elements of typical measurement system (Block diagram and its explanation), Standards of measurement and its classification. (International, primary or national, secondary and working standards). Static characteristics: Accuracy, Precision, Sensitivity, Linearity, Resolution, Drift and Hysteresis. Dynamic characteristics concepts: First and Second order instruments, Examples of first order: Resistance thermometer and thermal element, Example of 2nd order: U–tube Manometer, Errors in measurement and its classifications, Problems.

Unit II: Transducers (10 Hrs.)

Classification of Transducers and its characteristics Displacement Transducer: a) Resistive Type: Linear and Angular (Rotary) Potentiometer, Strain Gauge: Bonded and Unbonded, b) Inductive Type: Self-inductive: Variable number of turns, Variable Reluctance Mutual Inductive: LVDT, c) Piezoelectric Type: Quartz Crystal. Force Transducer: Cantilever beam, Column type devices

Temperature Measurement: Scales for temperature: Celsius, Kelvin and Fahrenheit Temperature Measurement Techniques: a) Non-electrical: Liquid filled thermometer and bimetallic thermometer, b) Electrical Methods: i) Platinum Resistance Thermometer, ii.)Thermistor: PTC and NTC with characteristics, iii) Thermocouple: Seebeck effect and Peltier effect, Types of Thermocouple.

Unit III: Measurement of Pressure (07 Hrs.)

Unit of pressure, Concept of vacuum, Absolute gauge and differential pressure, Elastic Transducer- Diaphragm, Corrugated Diaphragm, Bellows, Bourdon Tube. Electric Type- LVDT, Strain Gauge, Pressure Transducer- Calibration by dead weight tester Method, Problems.

Unit IV: Signal Conditioning and Processing (06 Hrs.)

Current to voltage, Voltage to current convertors, buffer amplifier, S/H Amplifier and Characteristics, Acquisition time, Aperture time, Drop rate, filters first order LPF and HPF with design, Instrumentation Amplifier (Using 3 op-amp)

Suggested Readings:

1. Instrumentation Device and System, Rangan, Mani and Sarma, Tata Mc Graw Hill, 2nd edition, 2017.
2. Instrumentation Measurement and Analysis, Nakra, Choudhari, Tata Mc Graw Hill India, publication, 4th edition, 2014 .
3. Op-Amps and Linear Integrated Circuits, by Ramakant A. Gayakwad, Pearson India publications, 4th Edition, 2015.
4. Process control Instrumentation Technology, C.D. Johnson, PHI publications,8th Edition, 2015.
5. Electronic instrumentation by H. S. Kalsi, 4th Edition, 2019.
6. NPTEL Video: https://nptel.ac.in/courses/112/103/112103261/ Fundamentals of measurement, Prof. Dipankar N Basu Dept. of Mechanical Engineering, IIT Guwahati, 2018.
7. NPTEL Video: https://nptel.ac.in/courses/108/105/108105064/ Transducer, Dr. Alok Barua, IIT Kharagpur,2009.

Semester –III	Paper -III
Course Code: BSC-PH 303 P	**Title of the Course:** Physics Laboratory 2A
Credits: 2	**Total Hours: 60 Hrs. (12 Practicals)**

Course Objectives	Course Outcomes
1. Explain CRO and its working. 2. Explain basic physics behind various electronic components UJT, BJT, etc. 3. Explain pin diagram and working of IC741 and its applications. 4. Give hand on skills related to Microsoft excel to plot graphs of various functions.	1. Use various instruments and equipment. 2. Understand working of components like UJT, BJT through experiments. 3. Understand pin diagram and working of IC741 4. Able to use Microsoft excel to plot graph of various experiments.

Section I- Electronics (Any 5)

Sr. No	Title of the experiment
1.	Circuit Theorems (Thevenin's, Norton's and Maximum Power Transfer Theorems).
2.	Transistor Characteristics (Input and Output characteristics of CE Configuration).
3.	Op-amp as an adder and subtractor.
4.	Use of CRO (AC/DC Voltage measurement, Frequency measurement).
5.	Single Stage Transistor Amplifier.

6.	Study of Rectifiers (Half, Full Wave and Bridge) with different filters.
7.	I-V Characteristics of UJT.
8.	UJT as Relaxation Oscillator.
9.	Zener as a Regulator (Line and Load Regulation).
10.	Op-amp as an Integrator and differentiator.
11.	Op-amp as inverting and non-inverting amplifier.
12.	Study of Phase Shift Oscillator using 741.
13.	Study of logic gates and verification of de Morgan's theorems.

Section I- Instrumentation (Any 3)

Sr. No	Title of the experiment
1.	Measure displacement using potentiometer/variable inductor/ variable capacitor.
2.	Measure force using load cell.
3.	Study of thermocouple.
4.	Determine the characteristics of PT100 (linear variable differential transformer).
5.	Determine the characteristics of LVDT (linear variable differential transformer).

6.	Measure pressure using elastic diaphragm (In Variable Capacitor / Bourdon Tube).

Section III- Use of Computer (Any 2)

Following practicals must performed using Microsoft Excel/ GNU Plot/MAXIMA/Wolfram Cloud/Origin or any other equivalent software.

Sr. No.	Title of the experiment
1.	Plotting of various trigonometric functions like sinx, cosx, tanx.
2.	Plotting of conic sections like circle, ellipse, parabola, hyperbola.
3.	Inverse, determinant of matrix, solution of linear equations.
4.	Plotting of various functions like e^{x}, e^{-x}, log(x), ln(x), x^{n}.

- Draw graphs for any 4 experiments from Section I and II using Microsoft Excel/ GNU Plot/MAXIMA/Wolfram Cloud/Origin or any other equivalent software activity equivalent to **Two** practical.
- Study tour visit report / mini project / demonstration / science exhibition participation or any other activity related to this course is equivalent to **Two** practical.

Semester –IV	Paper -I
Course Code: BSC-PH 401 T	**Title of the Course:** Oscillations, Waves and Sound
Credits: 2	**Total Lectures: 30 Hrs.**

Course Objectives	Course Outcomes
1. Explain physics & mathematics behind oscillations observed nearby us. 2. Explain mathematical equation of motion for simple harmonic, damped harmonic & forced oscillators. 3. Explain mathematical description of travelling & standing waves. 4. Explain the Doppler effect of sound.	1. Apply mathematics to solve problems in oscillations. 2. Analyze and formulate equations to understand physical content in many applications. 3. Understand the Doppler Effect. 4. Predict in qualitative terms the frequency change that will occur for a stationary & moving observer.

Unit I: Undamped Free Oscillations (06 Hrs.)

Different types of equilibria (static, dynamic, stable, unstable, and metastable equilibrium) – definitions only with examples, Definitions of linear Simple Harmonic Motion (S.H.M) and angular S.H.M., Differential equation for linear S.H.M. and it's solution, Composition of two perpendicular linear S.H.Ms. for frequency ratio 1:1 and 2:1 (analytical method), Lissajous figures (optical and electrical method) and applications, Problems.

Unit II: Damped Oscillations (06 Hrs.)

Introduction, Differential equation for damped harmonic oscillator and it's solution, discussion of different cases, Logarithmic decrement, Average energy of damped harmonic oscillator, Quality factor, Application: LCR series circuit, Problems.

Unit III: Forced Oscillations (07 Hrs.)

Introduction, Differential equation for forced oscillations and its solution , Resonance : mechanical, acoustic and electrical, Velocity and Amplitude resonance, Sharpness of resonance

and half width, Average energy of forced oscillator, Quality factor of forced oscillator, Relation between quality factor and bandwidth, Application of forced oscillations- LCR series circuit, Problems.

Unit IV: Wave Motion (05 Hrs.)

Introduction, Equation for longitudinal waves and it's solution (one dimension only), Equation for transverse waves and it's solution (one dimension only), Energy density and intensity of a wave, Qualitative discussion of seismic waves and gravitational waves, Problems.

Unit V: Sound and Doppler Effect (06 Hrs.)

Definition of sound Intensity, Loudness, Pitch, Quality and timbre, Reverberation time and reverberation of hall, Sabine's formula (without derivation), Doppler effect in sound, Expression for apparent frequency in different cases, Asymmetric nature of Doppler effect in sound, Doppler effect in light, Symmetric nature of Doppler effect in light, Applications: Radar, Speed of distant star, Rotational speed of binary star, Red Shift and Width of spectral line, Problems.

Suggested Readings:

1. Waves and Oscillations, Stephenson.
2. The Physics of Waves and Oscillations, N. K. Bajaj, 1st Edition ,Tata McGraw-Hill, publication, 2001.
3. Fundamentals of Vibrations and Waves, S. P. Puri, 1st edition, Tata McGraw-Hill publication, 1992.
4. A Text Book of Sound, Subramanyam and Brijlal, Vikas Prakashan, 2nd edition, 2018.
5. Sound – F. G. Mee. Heinemann Educational Books Ltd, 1967.
6. Waves and Oscillations - R.N. Chaudhari, 2nd edition, New Age International (p) ltd., 2010.
7. A Textbook on Oscillations, Waves and Acoustics by M. Ghosh, and D. Bhattacharya, 5th edition, S. Chand and Company Ltd, 2007.

8. NPTEL Video: http://www.nitttrc.edu.in/nptel/courses/video/115104094/L93.html Undamped Oscillation, Prof. Manoj K. Harbola, IIT Kanpur.

9. NPTEL Video: https://nptel.ac.in/courses/122/105/122105023/ Damped and undamped oscillation, Prof. S. Bharadwaj, Department of Physics and Meteorology, IIT Kharagpur, 2009.

10. NPTEL Video: https://nptel.ac.in/courses/115/106/115106119/ Forced oscillation and wave motion, Prof , M.S. Santhanam, Department of Physics IISER Pune, 2019

Semester -IV	Paper -II
Course Code: BSC-PH 402 T	**Title of the Course:** Optics
Credits: 2	**Total Hours: 30 Hrs.**

Course Objectives	Course Outcomes
1. Explain different phenomenon in light. 2. Explain different types of lenses and its uses. 3. Explain the different types of eye –piece and uses. 4. Explain different types of prism and uses. 5. Explain the phenomenon like polarization, diffraction and interference.	1. Understand fundamental laws of light like reflection, refraction. 2. Use of various types of lenses in different instruments. 3. Use of different eyepiece in spectrometer. 4. Understand the resolving power of different optical instruments. 5. Understand the diffraction, polarization, interference, and application of them.

Unit I: Geometrical optics (07Hrs.)

Introduction to lenses and sign conventions, Thin lenses: lens equation for convex lens, Lens maker equation, Concept of magnification, deviation and power of thin lens, Equivalent focal length of two thin lenses, Concept of cardinal points, Problems.

Unit II: Lens Aberrations (07 Hrs.)

Introduction, Types of aberration: Monochromatic and chromatic, Types of monochromatic aberrations and their reductions, Types of chromatic aberrations, Achromatism: lenses in contact and separated by finite distance, Problems.

Unit III: Optical Instruments (06Hrs.)

Introduction, Principle, construction and working of Simple Microscope, Compound Microscope, Ramsden's eye piece, Huygens eye piece, Problems.

Unit IV: Interference and Diffraction (06 Hrs.)

Introduction, Phase change on reflection. (Stokes treatment), Interference due to wedge shaped thin film, Newton's ring, Diffraction types: Fresnel's diffraction and Fraunhoffer's diffraction

(Double and N slit), plane diffraction grating and resolving power of prism Problems.

Unit V: Polarization (04 Hrs.)

Introduction, Brewster's law, Law of Malus, Polarization by double refraction, Polarization by double refraction by uniaxial crystal, Nicol Prism, fabrication of linear polarizer by Nicol prism, Problem.

Suggested Readings:

1. Optics by A. R. Ganesan, 4th edition, Pearson Education, E. Hetch, 2008.
2. A Textbook of Optics, N Subhramanyam, Brijlal, M. N. Avadhanulu, 23rd revised edition, S. Chand Publication, 2006.
3. Physical Optics, A.K. Ghatak, McMillan, New Delhi, 2017.
4. Optics, A.K. Ghatak, 1st edition, Graw-Hill International, 2017
5. Fundamental of Optics, F. A. Jenkins, H. E. White, 4th Edition, Mc Graw-Hill International edition, 2017.
6. Principles of Optics, D. S. Mathur, 2nd Edition, Gopal Press, Kanpur, 1996.
7. NPTEL Video: https://nptel.ac.in/courses/122/107/122107035/ , Geometrical optics, Prof. G.D. Verma, Prof. M. K. Srivastava ,Prof. B. K. Patra & Prof. Rajdeep Chatterjee, Department of physics, IIT Roorkee, 2009.
8. NPTEL Video: https://nptel.ac.in/courses/108/106/108106161/ , Lens Aberrations, Department of Electrical and Electronics Engineering, IIT Madras, 2019.

Semester -IV	Paper -III
Course Code: BSC-PH 403 P	**Title of the Course:** Physics Laboratory 2B
Credits: 2	**Total Experiments: 60 Hrs. (12 Practicals)**

Course Objectives	Course Outcomes
1. Give hand on skills to conduct the experiment in optics. 2. Explain the theoretical concept with the help of experiments. 3. Motivate and encourage students to solve real life problems through experiments. 4. Explain physics behind musical instrument and musical scales.	1. Hands on Experiments help students to learn various concepts of optics. 2. Experimentally analyzed the theory taught during lectures. 3. Experimental tools helps to develop ability to address real world problems. 4. Understand physics behind musical instrument.

Section I- Oscillations, Waves and Sound (Any 5)

Sr. No.	Title of the experiment
1.	Logarithmic decrement (in air or water).
2.	Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
3.	'g' by bar pendulum.
4.	Study of musical scales using a signal generator and musical instruments.
5.	Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.).
6.	Draw Lissajous figures on CRO and determination of unknown frequency.

7.	Determination of speed of sound by Quincke's method interferometer.
8.	Directional characteristics of Microphone.
9.	Velocity of sound by Phase shift method.
10.	Determine the frequency of an electrically maintained tuning fork by stroboscopic method.
11.	Determine the velocity of sound in air at room temperature with Kundt's Tube.

Section II- Optics (Any 5)

Sr. No.	Title of the experiment
1.	Newton's Ring: Determination of wavelength of monochromatic light source (λ).
2.	Dispersive power of glass prism.
3.	Total internal reflection using LASER beam and glass prism.
4.	Diffraction at the edge of a razor blade.
5.	Optical activity of sugar solution using polarimeter.
6.	Goniometer to determine cardinal points and focal length.
7.	Determine temperature of sodium flame.
8.	Double refracting prism.

9.	Determination of Cauchy.s constant.

- Draw graphs for any 4 experiments from Section I and II using Microsoft Excel/ GNU Plot/MAXIMA/Wolfram Cloud/Origin or any other equivalent software activity equivalent to **Two** practical.
- Study tour visit report / mini project / demonstration / science exhibition participation or any other activity related to this course is equivalent to **Two** practical.