AC/27.04.2022/RS1

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE

(Autonomous)

Affiliated to

UNIVERSITY OFMUMBAI

Syllabus for

SEM III& IV

Program: S.Y. B.Sc.

Course: Physics

(Credit Based Semester and Grading System with effect from the academic year 2022–2023)

Syllabus for B.Sc. Physics (Theory & Practical)
As per credit based system
Second Year B.Sc.2022–2023.

The revised syllabus in Physics as per credit based system for the Second Year B.Sc. Course will be implemented from the academic year 2022–2023.

Program Specific Outcome:

PSO1. Understand the basic concepts and fundamentals of mechanics, properties of matter, current electricity and electrodynamics.

PSO2. Understand the basic of quantum mechanics, relativistic physics, nuclear physics, optics, atomic physics , solid state physics, statistical physics, thermodynamics, mathematical physics & biophysics

PSO3. Understand and apply the concepts of electronics in designing of different analog & digital circuits and also in instrumentation.

PSO4. Understand the basics of computer programming, assembly language & numerical analysis.

PSO5. Apply and verify theoretical concepts through laboratory experiments.

PSO6. Applications of theoretical concepts**.**

PSO7. To get familiarized with current and recent scientific and technological developments.

PSO8. To enrich knowledge through problem solving, hands on activities, study visits & projects.

Eligibility: Passed Semester I and Semester II as per rules of passing.

Course code	Title	Credits
Semester III		
SIUSPHY31	Mechanics	2
SIUSPHY32	Analog and Digital Electronics	2
SIUSPHY33	Mathematical physics and theory of Errors	2
SIUSPHYP3	Practical course - 3 (Group A,B,C and Skill)	3
		Total = 09
Semester IV		
SIUSPHY41	Thermodynamics	2
SIUSPHY42	Quantum Mechanics	2
SIUSPHY43	Optics and Lasers	2
SIUSPHYP4	Practical course - 4 (Group A,B,C and Demo)	3
		Total = 09

Scheme of examination:

(i) Theory:

(A) Internal Examination: 40 marks

Sr. No.	Particulars	Marks
1.	One Class Test/online examination to be conducted in the given semester.	20
2.	One assignment based on the curriculum to be assessed by the teacher concerned and active participation in routine class instructional deliveries.	20

(B) Semester End Examination: 60 marks

Each theory paper shall be of two hour duration. Each paper shall consist of FOUR questions. All questions are compulsory and will have internal option.

Q – 1 is from Unit - I

Q – 2 is from Unit - II

Q – 3 is from Unit - III

Q – 4 will consist of questions from all the THREE units with equal weightage of marks allotted to each unit.

(ii) Practicals: (Group A, B & C) There will not be any internal examination for practicals. The SEMESTER END examination per practical course will be conducted as per the following scheme

No	Particulars	Marks
1.	Laboratory Work/Industrial Visit Report/ Presentation	120
2.	Journal	15
3.	Viva	15
	TOTAL	150

A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of SYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of SYBSc Physics as per the minimum requirements.

SEMESTER-III

Course Code	Title	Credits
SIUSPHY31	Mechanics	2

Course Outcome:

CO1. To introduce concept of CM frame and Laboratory frames of reference.

CO2. To study two body collisions in CM frame and Laboratory frames of reference.

CO3. To study moving system with variable mass.

CO4. To study Angular momentum of a system of particles.

CO5. To derive basic equations for progressive waves.

CO6. To understand concepts of group velocity and phase velocity.

CO7. To study damped vibrations, forced vibrations and resonance.

CO8. To study coupled oscillations and types of coupling.

CO9. Introduction to Nonlinear dynamics leading to concept of chaos.

UNIT – I: Basic Mechanics **15 Lectures**

1 Principle of conservation of momentum, center of mass (or center of inertia), Motion of center of mass, CM frame of reference , Kinetic energy of system in its center of mass.

2 Collisions: collisions between two spheres, one dimensional head on elastic collisions, slowing down of neutrons in moderators , collision in C.M frame, relation between scattering angle in Lab and C.M frame, Kinetic energy of collision, (elastic and inelastic), system with variable mass (Rocket propulsion, conveyor belt)

3 Angular momentum: Angular momentum of a system of particle in an extended system. Law of conservation of angular momentum, angular momentum of the extended system about an arbitrary point.

UNIT – II: Waves and Oscillations **15 Lectures**

1 Wave motion (review). Differential equation of wave motion, particle velocity and wave velocity distribution of velocity and pressure in a plane progressive wave. Energy of a progressive wave.
Wave velocity and group velocity , group velocity and wave velocity in a dispersive medium.

2 Simple harmonic oscillation (review), free vibrations, undamped vibrations, damped vibrations, damped SHM in an electrical circuit, forced vibrations, resonance and sharpness of resonance, phase of resonance, Q-factor .

UNIT– III: Coupled Oscillations & Non- linear mechanics 15 Lectures

1 Coupled oscillations: Some definitions, equation of motion of stiffness coupled systems of two pendulums, types of coupling, frequency of oscillation in-phase and out of phase mode, characteristics of in-phase and out of phase mode oscillation.

2 Nonlinear mechanics: Qualitative approach to chaos, un-harmonic oscillator, numerical solution of Duffing's equation, transition to chaos: Bifurcations and strange attractors, aspects of chaotic behavior.

References:

1. Reference : Mechanics by S.L. Kakani , C. Hemrajani, S.Kakani : Viva Books Pvt Ltd.
2. Waves and oscillations by Brijlal and subramanyam : Vikas Publishing house
3. Classical Mechanics by V. D. Barger and M. G. Olsson, a Modern perspective (Mc Graw Hill International 1995 Ed.) : Art. 11.1, 11.3 to 11.5
4. Physics for Degree students by C.L. Arora and P.S.Hemne S. Chand publications

Additional reference:

1. K.R Symon, *Mechanics,* (AddisionWesely) 3rd Ed.
2. Thornton and Marion, *Classical Dynamics of particles and systems*, (CENGAGE Learning)
3. H. S. Hans and S. P. Puri, *Mechanics*, Tata McGraw Hill (2^{nd}ED.).

SEMESTER-III

Course Code	Title	Credits
SIUSPHY32	Electronics & Communication	2

Course Outcome:

CO1. To study construction and characteristics of bipolar junction transistors.

CO2. To discuss different types of transistor amplifiers and to derive expressions for their current, voltage and power gains.

CO3. To study effects of feedback in amplifiers with respect to I/P and O/P impedance, gain, stability, distortion and noise.

CO4. To study different types of transistor oscillators.

CO5. To study characteristics and applications of opamps.

CO6. To study different types of flip-flops.

CO7. To understand concept of embedded systems.

CO8. To study AM and FM in communication.

CO9. To acquire quantitative problem solving skill in all the topics covered.

UNIT I: Bi-junction Transistors and Applications 15 Lectures

1. Bipolar Junction transistors: Characteristics of CB, CE and CC, DC Load line and Q-point. Active, cut-off and saturation Regions.

2. Amplifiers: Transistor biasing and stabilization circuits. Fixed bias and Voltage-divider bias. Transistor as 2-port network. h-parameter equivalent circuit. Analysis of a single-stage CE amplifier using hybrid Model. I/P and O/P impedance. Current, voltage and power gains. Classification of class A, B & C amplifiers.

UNIT II: Transistors Oscillators and Opamp Applications 15 Lectures

1. Feedback in Amplifiers: Effects of +ve& -ve feedback on I/P and O/P impedance, gain, stability, distortion and noise.
2. Sinusoidal Oscillators: Barkhausen's criterion, RC phase-shift, Hartley & Colpitt's oscillators.
3. Op-Amp and its Applications: Characteristics of an ideal & practical op- Amp. (IC 741) open-loop and closed-loop voltage gain. Frequency response, CMRR, slew rate and concept of virtual ground. Applications of op-Amps: (i) Inverting and non-inverting amplifiers, (ii) Adder, (iii) Subtractor, (iv) Differentiator, (v) Integrator.

UNIT III: Digital Electronics and Communication: 15 Lectures

1. Sequential Circuits: SR, D, and JK F-Fs. Clocked (Level & Edge Triggered) FFs. Preset and Clear operations. Race-around conditions in JK FF. M/S JKFF.
2. Embedded system introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges & design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers.
3. Introduction to communication systems: Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. Sideband frequencies in AM wave.

References:

1. V. K. Mehta and Rohit Mehta, *Principles of Electronics* –(S. Chand – Multicolored illustrative edition)
2. Allan Mottershead, *Electronic devices and circuits* – An introduction (PHI Pvt. Ltd.– EEE – Reprint – 2013)
3. Op-amp and Linear Integrated Ciruits, Ramakant Gayakwad
4. K.V. Shibu, Introduction to Embedded Systems, Sixth Reprint 2012, Tata Mcgraw Hill.
5. Raj Kamal, "Embedded Systems" Architecture, Programming and Design, Second edition, the Mcgraw Hill

Additional References:

1. A. B. Bhattacharya, *Electronics Principles and Applications*, Central publisher.
2. Malvino and Bates, *Electronic Principles*, 7th ed., Tata McGraw Hill.
3. Malvino and Leach, *Digital Principles and Applications*, (4th Ed)(TMH).

SEMESTER-III

Course Code	Title	Credits
SIUSPHY33	Mathematical Physics & Theory Of errors	2

Course Outcome:

CO1. To understand different types of vector integrals and related fundamental theorems.

CO2. To discuss different types of curvilinear coordinates and relations among them.

CO3. To identify different types of differential equations and apply appropriate techniques to obtain their solutions.

CO4. To construct differential equations for some practical examples such as LR and CR circuits and obtain their solutions.

CO5. To understand elementary theory of errors.

UNIT I: Vector Calculus **15 Lectures**

1. LinSurface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence, The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done.
2. Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates. The ∇ operator in Cylindrical and Spherical Coordinates. Velocity and acceleration in cylindrical and spherical coordinates.

UNIT-II: Differential Equations **15 Lectures**

1. Differential equations**:** Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, exact differentials, and General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Problems depicting physical situations like LC and LR circuits, Simple Harmonic motion (spring mass system)
2. Second-order non homogeneous linear differential equations with constant coefficients: the method of successive integrations and the method of undetermined coefficients. Forced vibrations and resonance. The Laplace transform and its use in the solution of differential equations.

UNIT – III : Theory of errors **15 Lectures**

1. Theory of errors: Significant Digits – Dropping of non-significant digits, Rounding of numbers, Absolute and relative errors, relative errors and significant digits, errors of computation, Accuracy of a function.
2. Elementary theory of errors: Introduction, various kinds of errors, Different ways of measuring random errors, Uncertainty and Significant digits, fractional uncertainty and significant digits, significance of uncertainty.
3. The estimation of errors: The normal distribution, The average or mean value of measurements, the average or mean value of measurements, average errors, standard errors, probable errors, The practical determination of errors and Peter's formula (Without proof), error in single measurement, the error in the mean, reliability of measurement.

References:

1. Introduction to Electrodynamics by D.G Griffith , 3rd Edition. Prentice Hall of India.
2. CH: Charlie Harper, Introduction to Mathematical Physics, 2009 (EEE) PHI Learning Pvt. Ltd.
3. Theory of errors in Physical measurement by J.C.Pal , New central Book Agency 2008 reprint, ISBN 81-7381-108-3
4. H.K Das Mathematical Physics S.Chand & Company.
5. Jon Mathews & R.L.Walker Mathematical methods for physics, W.A Benjamin Inc.
6. A.K.Ghatak & Chua Mathematical physics, 1995 Macmillan India Ltd.

SEMESTER-III

Course Code	Title	Credits
SIUSPHYP3	Practical course -3	2

Course Outcome:

CO 1: To use breadboard for designing and testing electronic circuits.
CO 2: To practice use of different measuring instruments like CRO, BG.
CO 3: Correlate the concepts of physics with experimental outcomes.
CO 4: Concepts of errors, their estimation and significance.
CO5: To plan and execute short projects.

Group A

1. Y by bending.
2. Resonance Pendulum
3. Helmholtz resonator- determination of unknown frequency.
4. Verification of Stefan's law (electrical method).
5. Cylindrical obstacle: Determination of λ
6. Optical lever: Determination of μ
7. Surface tension of a given liquid by Jaeger's method
8. Determination of Joule constant 'J' by electrical method

Group B

1. Transistor Characteristics: CB mode
2. Norton's Theorem
3. Figure of merit of a mirror galvanometer
4. OPAMP: Inverting amplifier with different gains.
5. OPAMP: Non-inverting amplifier with different gains and voltage follower.
6. Energy consumption in an electrical circuit
7. Passive Integrator
8. Half adder and full adder (7486, 7408) using EXOR Gate

Group C

1. Determining the R.I. by air cell method
2. Surface tension of a given liquid using pipet
3. Concept of beats.
4. Research activities, Synthesis of materials - mini project - thin film/nano materials/bulk powders using different routes etc.(equivalent to 2 practical sessions).
5. Project on a topic (equivalent to 2 practical sessions)
6. Assignment & literature survey (equivalent to 2 practical sessions).

Skill experiments

1. Measurement of resistance of galvanometer (G by shunting
2. Wiring of a simple circuit using bread board.
3. Spectrometer: optical leveling and Shuster's method.
4. Travelling microscope (radius of capillary).
5. Component testing, color code of resistors, capacitors etc.
6. Drawing of graph on semi logarithmic / logarithmic scale.

References:

1. D. Chattopadhya, PC Rakshit& B Saha, Advanced course in Practical Physics, (6^{th} Edition) Book and Allied Pvt.Ltd.

2. Harnam Singh, B.Sc Practical Physics, S. Chand& Co. Ld. 2001
3. Samir Kumar Ghosh, A test book of advanced practical PHYSICS, New Central Book Agency (3rd edition)
4. CL Arora, B.Sc. Practical Physics, (1st Edition) -2001 S. Chand and Co Ltd.
5. CL Squires, Practical Physics, (3rd Edition) Cambridge University
6. DC Tayal, University Practical Physics, Himalaya Publication
7. Worsnop & Flint , Advanced Practical Physics.

Instructions:

1. All the measurements and readings should be written with proper units in SI system only.
2. After completing the required number of experiments in the semester and recording them in journal, the student will have to get their journal certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Note: Each of the activities listed below is equivalent of two experiments from **Group** C.

1. Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
2. Execute a mini project to the satisfaction of teacher in-charge of practical.
3. Participate in a study tour or visit & submit a study tour report.

For **Groups A and B**, minimum 6 experiments from each group must be reported in journal. For **Group C**, a learner must perform the equivalent of 6 practicals with at least 2 experiments performed in the lab and reported in the journal. All the skill experiments are required to be completed and reported in the journal.

For practical examination in **Group** A and **Group** B the learner will be examined in two experiments (one from each group). Each experiment will be of three hours' duration, evaluation in viva voce will be based on regular experiments and skill experiments.
Practical examination in **Group** C will be based on Project (report, presentation & viva).

A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of SYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of SYBSc Physics as per the minimum requirements.

SEMESTER-IV

Course Code	Title	Credits
SIUSPHY41	Thermodynamics	2

Course Outcome:

CO1. To understand Zeroth Law and basic concepts of Thermodynamics.
CO2. To study ideal thermodynamic engine.
CO3. To determine work done in different types of processes.
CO4. To understand concept of entropy of a system and its significance.
CO5. To derive Maxwell's Thermodynamic relations and its applications.
CO6. To study different types of heat engines and their efficiency.

UNIT I: Zeroth and first law of thermodynamics and engines 15 Lectures

1. Zeroth Law of thermodynamics, Concept of heat , Thermodynamic equilibrium, work :a path dependent function, internal energy, First law of thermodynamics, internal energy as a state function, Specific heats of a gas, isochoric process, isobaric process, adiabatic process, adiabatic equation of a perfect gas, work done during an isothermal process , work done during an adiabatic process. Slopes of a adiabatic and isothermals.
2. Reversible and irreversible process, heat engines, conversion of heat into work, Carnot's cycle: its efficiency. Carnot engine as refrigerator, coefficient of performance.

UNIT II: Second law of thermodynamics and entropy 15 Lectures

1. Second law of thermodynamics, Statements, Equivalence of Kelvin and Planck's statement, Carnot's theorem.
2. Clausius theorem, Entropy, Entropy of a cyclic process, Reversible process, Entropy change, Reversible heat transfer, Principle of increase in entropy, generalized form of first and second law, entropy change of an ideal gas, entropy of steam, entropy and unavailable energy, entropyand disorder, absolute entropy, TS diagram for Carnot engine

UNIT III: Third law of thermodynamics and Thermodynamic engines 15 Lectures

1. Third law of thermodynamics, Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion.
2. Steam engine, Rankine cycle, Otto engine, efficiency of otto cycle, diesel cycle, efficiency of diesel cycle, otto and diesel cycle comparison.

References:

1. Brijlal, N. Subramanyam, S. Hemne, *Heat, Thermodynamics and Statistical Physics*, S. Chand & Co., edition 2007.
2. A. B. Gupta and H. Roy, *Thermal Physics*, Book and Allied (P) Ltd, Reprint 2008, 2009.
3. Evelyn Guha, *Basic Thermodynamics*, Narosa Publications)
4. Meghanad Saha and BN Srivastava ,*A treatise on heat*, 1969, India Press.

SEMESTER-IV

Course Code	Title	Credits
SIUSPHY42	Quantum Mechanics	2

Course Outcome:

CO1. To understand concepts of wave function and operators.
CO2. To apply concepts of eigen values and eigen functions.
CO3. To derive time dependent and time independent (Steady State) Schrodinger equations.
CO4. To apply time independent Schrodinger equation to various problems.
CO5. To apply time independent Schrodinger equation to barrier potential problem.
CO6. To understand tunneling effect and its application to alpha particle decay.
CO7. To study Harmonic oscillator and its solution by operator method.

Background Reading (Review):

Origin of Quantum Mechanics:

1. Review of Black body radiation.
2. Review of photoelectric effect.
3. Matter waves-De Broglie hypothesis. Davisson and Germer experiment.
4. Wave particle duality.
5. Concept of wave packet, phase velocity, group velocity and relation between them.
6. Heisenberg's uncertainty principle with thought experiment, different forms of uncertainty.

UNIT –I: The Schrodinger wave equation 15 Lectures

1. Concept of wave function, Born interpretation of wave function. Concepts of operator in quantum mechanics, examples – position, momentum and energy operators, Eigenvalue equations, expectation values of operators.
2 Schrodinger equation: Postulates of quantum mechanics, analogy between wave equation and Schrodinger equation, time dependent and time independent (Steady State) Schrodinger equation, stationary state
3 Superposition principle, probability current density, equation of continuity and its physical significance.

UNIT-II: Applications of Schrodinger steady state equation-I 15 Lectures

1. Free particle, particle in infinitely deep potential well (one - dimension), particle in finitely deep potential well (one - dimension), step potential, particle in three dimension rigid box, degeneracy of energy state.

UNIT-III: Applications of Schrodinger steady state equation – II 15 Lectures

1. Potential barrier (Finite height and width) penetration and tunneling effect (derivation of approximate transmission probability),Theory of alpha particle decay from radioactive nucleus.
2. Schrödinger's equation for Harmonic oscillator, its solution by operator method, graphical representation of its energy level and wave functions, correspondence principle (Preferred reference is Beiser and Mathews).

[Note: A good number of numerical examples are expected to be covered during the prescribed lectures].

Reference Books:

1. Concepts of Modern Physics – A. Beiser (6th Ed.) Tata McGraw Hill.
2. Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
3. Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. - By R. Eisberg and R. Resnik Published by Wiley.
4. Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.
5. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.
6. Quantum Mechanics. - By L. I. Schiff.
7. Quantum Mechanics. - By Powell and Crasemann, Addison-Wesley Pub. Co.
8. Introduction to Quantum Mechanics: P. T. Mathews (TMH).

SEMESTER-IV

Course Code	Title	Credits
SIUSPHY43	Optics And Lasers	2

Course Outcome:

CO1. To understand Fresnel and Fraunhoffer diffraction.
CO2. To understand Fresnel diffraction pattern due to straight edge, narrow slit and thin wire.
CO3. To understand Fraunhoffer diffraction pattern due to double slit and plane grating.
CO4. To understand concept of polarization of light.
CO5. To derive Brewster's Law.
CO6. To know different methods of production of polarized light.
CO7. To understand uses of Quarter wave plate, Half wave plate.
CO8. To understand concept of Rayleigh's criterion of resolution.
CO9. To derive expressions for R.P. of a prism, plane transmission grating and telescope.
CO10. To study different sources and applications of LASER.

UNIT I: Diffraction **15 Lectures**

1 Review**:** Introduction, Huygens's - Fresnel theory, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction.

2 Fresnel's Diffraction*:* Fresnel's assumptions, Rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow(straight edge), Diffraction due to a narrow slit, Diffraction due to a thin wire.

3 Fraunhoffer Diffraction **:** Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima.

UNIT II: Polarization **15 Lectures**

1 Review: Introduction of Polarization, Natural light is unpolarized, unpolarized and polarized light, Brewster's law, and Polaroid sheets

2 Polarization: Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light, Polarization by reflection from dielectric surface, Polarization by refraction – pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction.

Polarizer and Analyzer, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Huygens' explanation of double refraction, Ordinary and Extra ordinary rays, Positive and Negative crystals.

Superposition of waves linearly polarized at right angles, Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Production of linearly polarized light, Production of elliptically polarized light, Production of circularly polarized light, Analysis of polarized light, Applications of polarized light.

UNITIII: Resolving Power and Lasers **15 Lectures**

1 Resolving Power: Introduction, Raleigh's criterion, resolving power of optical instruments, criterion for resolution according to Lord Rayleigh's; resolving power of telescope, resolving power of a prism, resolving power of a plane transmission grating.

2 LASERs: Introduction, transition between atomic energy states (without derivation), principle of LASER, properties of LASER, Helium –Neon LASER, Ruby LASER, applications of LASER to holography and other applications.

References:

1. Dr. N. Subrahmanyam, Brijlal, Dr. M. N. Avadhaanulu, *A Text book of Optics* (S Chand, 25th Revised Edition 2012, Reprint 2013)
2. Ajoy Ghatak, *Optics*, Tata McGraw Hill Publishing C. Ltd, 3rd Edition, 2005
3. Sanjeev Puri, *Modern Physics: Concepts and Applications*, Narosa Publications

Additional reference:

1. Eugene Hecht and A. R. Ganesan, *Optics*, (Pearson, 4th Edition)

SEMESTER-IV

Course Code	Title	Credits
SIUSPHYP4	Practical Course -4	2

Course Outcome:

CO1: Data Analysis using PC (Least square fitting).

CO2: To use of spectroscopic techniques in experiments.

CO3: To use PC simulations to demonstrate various experiments.

CO4: Correlate the concepts of physics with experimental outcomes.

CO5: Concepts of errors and their estimation.

CO6: To get exposure to novel experimental techniques used in industries and research institutes.

Group A

1. Biprism
2. R.P. of a telescope.
3. Laser beam profile
4. Viscosity of a liquid: Poiseuille's Method
5. Moment of inertia of a Flywheel
6. Grating-Determination of wavelength
7. LCR parallel resonance.
8. Determination of absolute capacitance using BG

Group B

1. Schmitt Trigger using OPAMP (inverting)
2. Passive high pass/ Low Pass filter.
3. Passive band pass filter.
4. De' Sauty's bridge.
5. OPAMP difference amplifier & Voltage follower.
6. OPAMP Integrator.
7. CE amplifier: variation of gain with load.
8. Data Analysis using PC (Least square fitting).

Group C

1. Brewster's law: determination of μ
2. Velocity of sound using CRO.
3. Standardization of pH meter & acid-base titration.
4. Understanding UV visible spectra of protein/Nucleic Acids.
5. Project on a topic (equivalent to 2 practical sessions).
6. Visit to research institutes (equivalent to 2 practical sessions).
7. Assignment & literature survey (equivalent to 2 practical sessions).
8. Plotting and analysis of detector data (from University /research institutions).

Demonstration experiments

1. Error analysis of a given experiment.
2. Waveform generator using Op-amp.
3. PC simulations: graph, curve fitting etc.
4. Straight edge Fresnel diffraction.
5. CE amplifier frequency response.
6. Lissajous Figures using CRO.

References:

1. D. Chattopadhya, PC Rakshit& B Saha, *Advanced course in Practical Physics*, (6^{th} Edition) Book and Allied Pvt.Ltd.
2. Harnam Singh, *B.Sc Practical Physics*, S. Chand & Co. Ld. 2001.
3. Samir Kumar Ghosh, *A test book of advanced practical Physics*, New Central Book Agency (3^{rd} edition).
4. CL Arora, *B.Sc. Practical Physics*, (1^{st} Edition) -2001 S. Chand and Co Ltd.
5. CL Squires, *Practical Physics*, (3^{rd} Edition) Cambridge University.
6. DC Tayal, *University Practical Physics*, Himalaya Publication.
7. Worsnop & Flint, *Advanced Practical Physics.*

Instructions:

1. All the measurements and readings should be written with proper units in SI system only.
2. After completing the required number of experiments in the semester and recording them in journal, the student will have to get their journals certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of performing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Note: Each of the activities listed below is equivalent of two experiments from **Group** C.

1. Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.

2. Execute a mini project to the satisfaction of teacher in-charge of practical.
3. Participate in a study tour or visit & submit a study tour report.

For **Groups A and B**, minimum 6 experiments from each group must be reported in journal. For **Group C**, a learner must perform the equivalent of 6 practicals with at least 2 experiments performed in the lab and reported in the journal. All the skill experiments are required to be completed and reported in the journal.

For practical examination in **Group** A and **Group** B the learner will be examined in two experiments (one from each group). Each experiment will be of three hours duration, evaluation in viva voce will be based on regular experiments and skill experiments.

Practical examination in **Group** C will be based on Project (report, presentation & viva).

A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of SYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of SYBSc Physics as per the minimum requirements.

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