AC/04.08.2018/RS1

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE
(Autonomous)

Affiliated to
UNIVERSITY OF MUMBAI

Syllabus for

SEM I & II

Program: F.Y. B.Sc.

Course: Physics

(Credit Based Semester and Grading System with effect from the academic year 2018–2019)

Syllabus for B.Sc. Physics (Theory & Practical)

As per credit based system
First Year B.Sc.2018–2019.

The revised syllabus in Physics as per credit based system for the First Year B.Sc. Course will be implemented from the academic year 2018–2019.

Preamble:

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Objectives:

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course code	Title	Credits
	Semester I	
SIUSPHY11	Classical Mechanics, Optics & Thermodynamics	2
SIUSPHY12	Nuclear Physics & Introduction to Quantum Mechanics	2
SIUSPHYP1	Practical I	2
		Total= 06
	Semester II	
SIUSPHY21	Mathematical Physics & Classical Mechanics	2
SIUSPHY22	Electricity and Electronics	2
SIUSPHYP2	Practical II	2
		Total=06

SCHEME OF EXAMINATION:

(i) Theory:
(A) **Internal Examination: 40 marks**

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	10
3.	Active Participation in routine class instructional deliveries	10

(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:

There will not be any internal examination for practical. The SEMESTER END examination per practical course will be conducted as per the following scheme

No	Particulars	Marks
1.	Laboratory Work	80
2.	Journal	10
3.	Viva	10
	TOTAL	100

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

SEMESTER-I

Course Code	Title	Credits
SIUSPHY11	Classical Mechanics, Optics & Thermodynamics	2

Learning Outcomes:

On successful completion of this course students will be able to:

1. Understand Newton's laws and apply them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyze the forces on the object.
3. Understand the concepts of friction and the concepts of elasticity, fluid mechanics and will be able to perform calculations using them.
4. Understand the concepts of lens system and interference.
5. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
6. Demonstrate quantitative problem solving skills in all the topics covered.

UNIT I: Newton's Laws, Elasticity & Fluid Dynamics 15 lectures

1. Newton's Laws**:** Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present)
2. Elasticity: Review of Elastic constants Y, K, η and σ. Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple per unit twist in cylinder.
3. Fluid Dynamics**:** Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in air foil, Poiseuille's equation.

UNIT II: Ray Optics 15 lectures

1. Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular.
2. Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens, Ramsden and Huygens eyepiece.
3. Aberration: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration.
4. Interference: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective).

UNIT III: Thermodynamics 15 lectures

1. Behavior of real gases and real gas equation, Van der Waal equation
2. Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law,

Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems.

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

References:

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
2. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
3. Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
4. Brijlal, Subramanyam and Hemne, Heat, Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured, 2007 Ed.
5. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.

Additional References:

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.
3. R Murugeshan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
5. D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
6. C L Arora, Optics, S Chand.
7. Hans and Puri, Mechanics, 2nd Ed. Tata McGraw Hill

SEMESTER-I

Course Code	Title	Credits
SIUSPHY12	Nuclear Physics & Introduction to Quantum Mechanics	2

Learning Outcomes:

After successful completion of this course students will be able to

1. Understand nuclear properties and nuclear behaviour.
2. Understand the type isotopes and their applications.
3. Demonstrate and understand the quantum mechanical concepts.
4. Demonstrate quantitative problem solving skills in all the topics covered.

UNIT I: Nuclear Physics 15 lectures

1. Structure of Nuclei: Basic properties of nuclei, Composition, Charge, Size, Rutherford's experiment for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, Packing fraction, BE/A vs A plot, stability of nuclei (N vs Z plot) and problems.
2. Radioactivity: Radioactive disintegration, concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical Problems.
3. Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological -information from internet).

UNIT II: Nuclear Detectors & Reactions 15 lectures

1. Interaction between particles and matter, Ionization chamber, Proportional counter and GM counter, Numerical problems.
2. Nuclear Reactions: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation, problems. Fusion and fission definitions and qualitative discussion with examples.

Unit III: Introduction to Quantum Mechanics 15 lectures

1. Origin of Quantum theory, Black body (definition), Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson- Germer experiment, G. P. Thompson experiment.
2. X-Ray production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.
3. Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.

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

References:

1. SBP: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
2. Arthur Beiser, Perspectives of Modern Physics : Tata McGraw Hill
3. BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand
4. Kaplan: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House

Additional References:

1 S N Ghosal, Atomic Physics S Chand

2 S N Ghosal, Nuclear Physics 2nd ed. S Chand

Libgen

SEMESTER-I

Course Code	Title	Credits
SIUSPHYP1	Practical I	2

Leaning Outcome:

On successful completion of this course students will be able to:

1. To demonstrate their practical skills.
2. To understand and practice the skills while doing physics practical.
3. To understand the use of apparatus and their use without fear.
4. To correlate their physics theory concepts through practical.
5. Understand the concepts of errors and their estimation.

A. <u>Regular experiments:</u>

<u>PAPER 1</u>

1. Y by vibrations: To determine Young's Modulus of a material by method of vibrations
2. Torsional Oscillation: To determine modulus of rigidity η of material of wire by torsional oscillations
3. Frequency of AC mains
4. To study Thermistor characteristic Resistance vs Temperature
5. Bifilar Pendulum
6. Constant volume air thermometer
7. Capillary rise: Finding surface tension/Finding ratio of radii of capillary tubes

<u>PAPER 2</u>

1. Spectrometer: To determine angle of Prism.
2. Combination of Lenses: To determine equivalent focal length of a lens system by magnification method.
3. Moment of inertia of a Flywheel
4. LDR Characteristics
5. Newton's Rings: To determine radius of curvature of a given convex lens using Newton's rings.
6. J by Electrical Method: To determine mechanical equivalent of heat
7. To determine Coefficient of Viscosity (η) of a given liquid by Poiseulle's Method

B. <u>Skill/Demo Experiments (Any Four):</u>

1. Use of Vernier calipers, Micrometer Screw Gauge, Travelling Microscope
2. Graph Plotting : Experimental, Straight Line with intercept, Resonance Curve etc.
3. Spectrometer: Optical leveling
4. Use of DMM
5. Absolute and relative errors calculation.
6. Laser Beam Divergence

Minimum 8 experiments from the list should be completed in the first semester. Any four skill/demo experiments are to be reported in journal. ***Certified journal is a must to be eligible to appear for the semester end practical.***

The scheme of examination for the revised course in Physics at the First Year B.Sc. Semester end examination will be as follows.

Semester End Practical Examination:

There will be no internal assessment for practical.

A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement. The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for his/her skill and understanding of physics.

SEMESTER II

Course Code	Title	Credits
SIUSPHY21	**Mathematical Physics & Classical Mechanics**	2

Learning Outcomes:

On successful completion of this course students will be able to:

1. Understand the basic mathematical concepts and applications of them in physical situations.
2. Demonstrate quantitative problem solving skills in all the topics covered.

UNIT I: Vector Algebra & Vector Derivatives 15 Lectures

1. Vector Algebra: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra. Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.
2. Gradient, divergence and curl: The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl.

UNIT II: Differential Equations and its Applications 15 Lectures

1. Differential equations**:** Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, exact differentials, 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. Transient response of circuits: Series LR, CR, LCR circuits. Growth and decay of currents/charge.

UNIT III: Waves and Vibrations 15 Lectures

1. Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats).
2. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses
3. Wave Motion: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity.

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

References:

1. MS: Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
2. CH**:** Charlie Harper, Introduction to Mathematical Physics, 2009 (EEE) PHI Learning Pvt. Ltd.
3. CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
4. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

Additional References:

1. Brij Lal**,N.** Subrahmanyam **,** Jivan Seshan, Mechanics and Electrodynamics, , (S. Chand) (Revised & Enlarged ED. 2005)
2. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
3. Ken Riley**,** Michael Hobson and Stephen Bence, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).
4. H. K. Dass, Mathematical Physics, S. Chand & Co.
5. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc.

SEMESTER II

Course Code	Title	Credits
SIUSPHY22	**Electricity and Electronics**	2

UNIT I: AC Circuits: **15 lectures**

1. Alternating current theory:(Concept of L, R, and C: Review)AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series LR, CR and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor.
2. AC bridges: General AC bridge, Maxwell, de-Sauty, Wien Bridge, Hay Bridge.

UNIT II: Electronics **15 lectures**

1. Circuit theorems: (Review: Ohm's law, Kirchhoff's laws) Superposition Theorem, Thevenin's Theorem, Ideal Current Sources, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem. Numericals related to circuit analysis using the above theorems.
2. DC power supply: Half wave rectifier, Full wave rectifier, Bridge rectifier, PIV and Ripple factor of full wave rectifier, Clipper and Clampers (Basic circuits only), Capacitor Filter. Zener diode as voltage stabilizer.
3. Digital electronics: Logic gates (Review), NAND and NOR as universal building blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder

UNIT III: Electrostatics and Magnetostatics **15 lectures**

1. The Electric Field: Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution
2. Work and Energy in Electrostatics: The Work done to Move a charge, The Energy of a Point Charge Distribution
3. Magnetostatics: Magnetic Fields
4. The Biot-Savart's Law: Steady Currents, Magnetic Field of a Steady Current, Helmholtz coil and solenoid.

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

References:

1. CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
2. TT: B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
3. BN: Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.
4. VKM: V K Mehta and R Mehta Electronics Principals, Multicoloured Revised 11th Ed. Reprint in 2012 ,S Chand.
5. David J. Griffiths: Introduction to Electrodynamics, Prentice Hall India (EEE) 3rd Ed.
6. A B Bhattacharya, Electronics Principles and Applications, Central publisher.
7. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
8. Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition.

SEMESTER II

Course Code	Title	Credits
SIUSPHYP2	**Practical II**	2

Leaning Outcome:

On successful completion of this course students will be able to:

i) To understand and practice the skills while doing physics practical.
ii) To understand the use of apparatus and their use without fear.
iii) To correlate their physics theory concepts through practical.
iv) Understand the concepts of errors and their estimation.

A. Regular experiments:

PAPER 1

1.	To verify De Morgan's Theorems
2.	Square Wave generator using gates
3.	To study load regulation of a Bridge Rectifier
4.	To study NAND and NOR gates as Universal Building Blocks
5.	Transistor Characteristics: CE mode
6.	To study Zener Diode as Regulator
7.	Verification of Boolien algebra using basic gates

PAPER 2

1.	LR Circuit: To determine the value of given inductance and phase angle
2.	CR Circuit: To determine value of given capacitor and Phase angle
3.	Energy consumption in an electrical circuit
4.	LCR series Resonance: To determine resonance frequency of LCR series circuit.
5.	Thevenin's Theorem: To verify Thevenin's theorem for DC circuits
6.	Norton's Theorem: To verify Norton's Theorem for DC circuits
7.	Spectrometer: Determination of Refractive Index of material of prism

B) Skill/Demo Experiments (Any Four):

1.	Charging and discharging of a capacitor
2.	Use of Oscilloscope
3.	Lissajous Figure
4.	Phase shift measurement of an AC circuit
5.	Diffraction by single slit
6.	Transistor as switch

Minimum 8experiments from the list should be completed in the second semester. Any four skill/demo experiments are to be reported in journal. ***Certified journal is must to be eligible to appear for the semester end practical.***

The scheme of examination for the revised course in Physics at the First Year B.Sc. Semester end examination will be as follows.

Semester End Practical Examination:

There will be no internal assessment for practical.

A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement. The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for his/her skill and understanding of physics.

****