AC/14.06.2021/RS1

SIES College of Arts, Science & Commerce

RISE WITH EDUCATION

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 2021–2022)

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

As per credit based system

Program Specific Outcome

PSO1. Understand the basic concepts of and the 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 and thermodynamics, mathematical physics & biophysics

PSO3. Understand and apply the concepts of electronics in the designing of different analog & digital circuits and 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 familiarize with current and recent scientific and technological developments

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

First Year B.Sc. 2021–2022.

The revised syllabus in Physics as per credit based system for the First Year BSc .Course will be implemented from the academic year 2021–2022.

Preamble:

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

Course code	Title	Credits
	Semester I	
SIUSPHY11	**Mechanics & Properties of matter**	2
SIUSPHY12	**Electricity & Electronics**	2
SIUSPHYP1	**Practical I**	2
		Total = 06
	Semester II	
SIUSPHY21	**Optics, Modern Physics & Medical Physics**	2
SIUSPHY22	**Vector algebra, Electrostatics & Megnetostatics**	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.	Assignments/project/ viva based on the curriculum to be assessed by the teacher concerned and active participation.	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:

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 BSc Physics as per the minimum requirements.

SEMESTER-I

Paper -1

CourseCode	Title	Credits
SIUSPHY11	**Mechanics & Properties of matter**	2

Course Outcome:

CO1. Apply the basic concepts of Newtonian mechanics

CO2. Define central force and its characteristics, and study gravitational force from the point of view of central force

CO3. Apply basic ideas of pendulum to compound pendulum

CO4. Study superposition of harmonic oscillation with necessary derivations.

CO5. To Derive relation between elastic constants, torque per unit twist.
Study bending of beams with relevant derivations.

CO6. Derive equation of continuity, state and prove Bernoullie's theorem and derive Poiseullie's equation.

UNIT -I Mechanics 15 Lectures

1. Newton's notion of space, Newton's laws of motion, Limitations of Newton's laws of motion, Components of velocity and acceleration in Cartesian Coordinate system, Newtonian principle of relativity

2. Central force, its characteristics; Newton's law of gravitation, Gravitational field, Gravitational potential, Gravitational field and Gravitational potential due to a spherical shell and solid sphere , Gravitational self energy of a body, Gravitational self energy of galaxy.

UNIT -II Compound pendulum & superposition of oscillations 15 Lectures

1. S H M & Simple pendulum (review), Compound Pendulum: Expression for period, maximum and minimum time period, centres of suspension and oscillation, reversible compound pendulum. Bessel's formula, Kater's reversible pendulum, compound pendulum and simple pendulum- a comparative study.

2. Superposition of Collinear Harmonic oscillations: (review)
   Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

UNIT -III Elasticity & Fluid Mechanics 15 Lectures

1. Elastic constants, Relation between elastic constants, Twisting torque on a cylinder or wire, limiting values of Poisson's constant, Bending of beams : Bending Moment, Cantilever and beam supported at two ends and loaded at the centre.

2. Kinematics of moving fluids, Equation of continuity, Bernoulli's theorem and its application, streamline and turbulent flow, Poiseuille's equation.

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

Reference:

1. C.L Arora and Dr P.S. Hemne, Physics for degree students S.Chand Publications
2. Hans and Puri, Mechanics, 2nd Ed. Tata McGraw Hill
3. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
4. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.

Additional References:

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.

SEMESTER-I

Paper -2

Course Code	Title	Credits
SIUSPHY12	**Electricity & Electronics**	2

Course outcome:

CO1. Discuss and derive growth and decay of current in LR, CR and LCR circuit

CO2. Discuss the basic circuit laws and examine simple circuits using network theorems, application of maximum power theorem to dc circuits

CO3. Describe AC bridge concept with examples.

CO4. Understand working, sensitivity and damping of ballistic galvanometer

CO5. Categorize the digital and analog circuits. Convert from one number system to another. Understand logic gates with help of truth tables. Apply boolean laws to logic expression.

CO6. Investigate binary arithmetic with the help of logic circuits

CO7. Discuss the concept of rectification, able to calculate ripple factor and efficiency, understand voltage regulation.

UNIT I DC circuits **15 Lectures**

1. Transient response: LR growth and decay of current, CR charging and discharging, LCR growth and decay of current.

2. Ideal Constant-voltage and Constant-current Sources. Potential & current divider rule

3. Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

UNIT II: AC Circuits & B.G **15 lectures**

1. AC Circuits: Kirchhoff's laws for AC circuits, Complex reactance and impedance, Series LCR Circuit: Resonance, Power dissipation, Quality Factor and Band width. Parallel LCR Circuit.

2. AC Bridges: General AC bridge, Maxwell inductance bridge and LC bridge, de-Sauty's bridge, Wien Bridge, Hay Bridge.

3. Ballistic Galvanometer: Torque on a current loop, Ballistic Galvanometer: Current and Charge Sensitivity, Electromagnetic damping. Logarithmic damping decrement.

UNIT III: Basic Electronics **15 lectures**

1. Digital Circuits: Difference between Analog and Digital circuits. Binary numbers. Decimal to Binary and Binary to Decimal conversion. Hexadecimal numbers. NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity checker.

2. Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra.

3. Arithmetic Circuits: Binary Addition, Binary Subtraction using 2's Complement. Half and Full Adders.

4. Full-wave Bridge rectifiers, Calculation of Ripple factor and Rectification efficiency, Capacitor-filter, Zener Diode and Voltage Regulation.

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

References:

1. D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
2. B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
3. Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.
4. V K Mehta and R Mehta Electronics Principals, Multicoloured Revised 11th Ed. reprint in 2012 ,S Chand.

Additional references:

1. A B Bhattacharya, Electronics Principlesand Applications, Central publisher.
2. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
3. Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition.

SEMESTER-I

Course Code	Title	Credits
SIUSPHYP1	**Practical I**	**2**

Course Outcome:

CO 1: To demonstrate practical skills.
CO 2: To understand and practice the skills while doing physics practicals.
CO 3: Use of apparatus and their use without fear.
CO 4: Correlate their physics theory concepts through practicals.
CO 5: Concepts of errors and their estimation.

A. Regular experiments:

Paper -I

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. To determine 'g' by Bar pendulum
6. Constant volume air thermometer
7. **Y and η** by Flat Spiral Spring

Paper - II

1. LR Circuit: To determine the value of given inductance and phase angle
2. Verification of Thevenin's Theorem.
3. CR Circuit: To determine value of given capacitor and Phase angle
4. LCR Series Resonance
5. NAND & NOR Gates As Universal Building Block
6. De Morgan's Theorems
7. Load regulation of a Bridge Rectifier
8. Zener Diode As Voltage Regulator
9. Verification of Maximum power transfer theorem

B. Skill/Demo Experiments :

1. Use of Vernier calipers, Micrometer Screw Gauge, Travelling Microscope
2. Graph Plotting : Exponential, Straight Line with intercept, Resonance Curve etc.
3. Use of DMM
4. Absolute and relative errors calculation.

Minimum 8 experiments from the list (**4 experiments each from Group A and Group B)** should be completed in the second semester. All four skill/demo experiments are to be reported in the journal.

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.
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

Paper -1

Course Code	Title	Credits
SIUSPHY21	**Optics, Modern Physics & Medical Physics**	**2**

Course Outcome :

CO1. Derive lens equation and study different types of magnification

CO 2. Derive equivalent focal length and hence study the construction of different types of eye -piece

CO 3. Examine different types of inherent defects in lens

CO 4. Describe the phenomenon of interference

CO 5. Outline the origin of quantum theory

CO 6. Describe the production of X-rays and X-ray spectra

CO 7. Outline basic biophysical terminology of human body

CO 8. To understand physics of human physiology

UNIT-I Ray optics & Interference 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 lenses, cardinal points of a thick lens, Ramsden and Huygens eyepiece.
3. Aberration, Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration.
4. Interference (Review), Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective).

UNIT -II Modern Physics 15 Lectures

1. Origin of Quantum theory, Black body (definition), Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty principle. G.P Thomson 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.

UNIT-III Bio-Mechanics 15 Lecture

1. Basic Anatomical Terminology: Standard anatomical position, planes. Familiarity with terms like-Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal.
2. Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of locomotors systems: joints and movements, Stability and Equilibrium.
3. Energy house hold of the body: Energy balance in the body, Energy consumption of the body

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

Reference :

1. Optics By Brijlal & Subramanyum.
2. Concept of Modern Physics by Arthur Beiser.
3. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978).
4. Physics of the human body, Irving P. Herman, Springer (2007).

SEMESTER-II

Paper -2

Course Code	Title	Credits
SIUSPHY22	**Vector algebra and Vector derivatives, Electrostatics & Magnetostatics**	**2**

Course Outcome :

CO1. To identify basic components of Vector Algebra.

CO2 . To explain types of vector products and their applications.

CO3. To explain del operator and to illustrate its different applications.

CO4. To explain del operator and to illustrate its different applications.

CO5. To explain Gauss's law and its applications to determine electric fields

CO6. To discuss and determine the electrostatic potential and PE in different systems.

CO7. To discuss and determine the magnetic field in different systems.

CO8. To study the curl and div of magnetic field in systems and compare with electric fields

UNIT-I Vector Algebra and Vector Calculus (derivatives) 15 Lectures

1. Review of Vector Algebra: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields.
2. 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.
3. 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 Electrostatics 15 Lectures

1. Review: Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric flux, Gauss' theorem and its applications, screening of electric field by a conductor. Electric field due to a dipole. Differential form of Gauss' law.

2. Electric field is conservative. Work done in electric field is path independent. Electric potential and potential difference. Electric potential due to a point charge, electric potential due to continuous charge distribution, electric field as potential gradient, electrostatic energy stored in a medium, method of images (plane surface)

UNIT-III Magnetostatics 15 Lectures

1. Biot Savart's law, Applications of Biot Savart's law – Magnetic field on the axis of a circular coil. Helmholtz coil. Biot Savart's law and Coulomb's law (Compare and contrast).
2. Ampere's law, its application to determine B inside a solenoid and toroid and due to a straight current carrying conductor .
3. Current density, **div B** = 0. Differential form of Ampere's law, Significance of **div B** and **curl B.** Comparison between electric field and magnetic field.

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

Reference:

1. Schaum's outline of Theory and problems of Vector Analysis: Murray R Spiegel, Asian Student Edition
2. Physics for degree students C.L Arora and Dr P.S. Hemne, S.Chand publication.
3. Electricity and Magnetism : D. Chattopadhyay, P C Rakshit , 7th Ed. New Central Book agency.
4. Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
5. Introduction to Electrodynamics: David J. Griffiths (3rd Ed) Prentice Hall of India.
6. Electricity and Magnetism: NavinaWadhwani (PHI – 2010).

SEMESTER-II

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

Course Outcome:

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

A. Regular experiments:

Paper - I

1. Spectrometer: Determination of Angle of Prism
2. Spectrometer : R. I. prism
3. Combination of Lenses
4. Newton's Ring Experiment: Determination of radius of curvature of lens
5. Wedge Shaped Film
6. Newton's Ring Experiment: Determination of Refractive Index of liquid (Newton's ring)

Paper-II

1. Characteristics of LDR
2. Maxwell's L- bridge
3. Computer based experiment: Graph plotting using excel
4. Computer based experiment: Data analysis
5. Planck's constant using LED
6. Determination of B of a solenoid and its variation with distance
7. Charging and discharging of Capacitor
8. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.

B. Skill/Demo Experiments (Any Four):

1. Laser Beam Divergence.
2. Spectrometer: Optical levelling.
3. Understanding the working of a manual mercury Blood Pressure monitor and measure the Blood Pressure.
4. Use of CRO and Lissajous figures
5. Phase shift measurement of AC circuit
6. Moving coil Galvanometer

Minimum 8 experiments from the list (**4 experiments each from Group A and Group B)** should be completed in the second semester. Any four skill/demo experiments are to be reported in the journal.

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.

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