SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE
(Autonomous)

Affiliated to
UNIVERSITY OFMUMBAI

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)

Syllabusfor B.Sc. Physics(Theory&Practical)

Aspercreditbasedsystem
FirstYearB.Sc.2018–2019.

TherevisedsyllabusinPhysicsasper creditbasedsystemfortheFirstYearB.Sc.Course willbeimplementedfromtheacademicyear2018–2019.

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

CourseCode	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 analyzetheforces 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 toanalyze athermodynamic process.
6. Demonstrate quantitative problem solving skills in all the topics covered.

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

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 airfoil, Poiseuille's equation.

UNITII: Ray Optics 15lectures

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, Ramsdenand 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:Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe 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. BharatiBhavan Publishers.
3. Brijlal,Subramanyam andAvadhanulu 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

CourseCode	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 15lectures

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: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe prescribed lectures

References:

1. SBP: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
2. Arthur Beiser, Perspectives ofModernPhysics : 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

SEMESTER-I

CourseCode	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. Regularexperiments:

PAPER 1

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

PAPER 2

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. Skill/Demo Experiments (Any Four):

1. Use of Verniercalipers, 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 8experimentsfrom the listshouldbecompletedinthe first semester. Any four skill/demo experimentsaretobereportedinjournal. ***Certifiedjournalis a must tobeeligibletoappearforthe semester endpractical.***

Theschemeofexaminationfortherevisedcoursein Physicsat theFirstYearB.Sc.Semester endexaminationwillbeasfollows.

SemesterEnd Practical Examination:

There will be no internal assessment for practical.

Acandidatewillbeallowedtoappearforthesemester end practical examinationonlyifthecandidatesubmits acertified journalatthetimeofpracticalexaminationofthe semesteroracertificatefrom theHeadoftheDepartment /Institute totheeffectthat thecandidate hascompleted the practicalcourseofthatsemesterofF.Y.B.Sc.Physicsasperthe minimumrequirement. 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

CourseCode	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.

UNITII: 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: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe 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. BrijLal**,N.** Subrahmanyam **,** JivanSeshan, Mechanics and Electrodynamics, , (S. Chand) (Revised & Enlarged ED. 2005)
2. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
3. Ken Riley**,** MichaelHobsonand StephenBence, 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

CourseCode	Title	Credits
SIUSPHY22	**Electricity and Electronics**	2

UNITI: 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'slaws)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, PIVand 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 ofa Point Charge Distribution
3. Magnetostatics: Magnetic Fields
4. TheBiot-Savart's Law: Steady Currents,Magnetic Field of a Steady Current, Helmholtz coil and solenoid.

Note: Agoodnumberofnumericalexamplesareexpectedtobecoveredduringthe 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, MulticolouredRevised 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 Principlesand 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

CourseCode	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 8experimentsfrom the listshouldbecompletedinthesecondsemester. Any fourskill/demo experimentsaretobereportedinjournal.***Certifiedjournalis musttobeeligibletoappearforthe semester endpractical.***

Theschemeofexaminationfortherevisedcoursein Physicsat theFirstYearB.Sc.Semesterendexaminationwillbeasfollows.

SemesterEnd 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.

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SIES College of Arts, Science & Commerce

RISE WITH EDUCATION

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE

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Syllabus for

SEM III& IV

Program: S.Y. B.Sc.

Course: Physics

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

Title: Syllabus for the B.Sc. Course in Physics(fromacademic year 2018-19) for Semester III & IV

Course Code:**SIUSPHY3**

Preamble:

This is a revised part of the undergraduate programme (Six Semesters) in Physics, to be taught in Semester III & IV from the academic year 2018-19 onwards.
Developing Curriculum that is progressive and purposeful to create positive improvement in the education system is the logic behind this revision.
Across the Six courses in Semesters 3 and 4, **Five**courses are devoted to core Physics, catering to Mechanics, Mathematical Physics, Optics,Electronics& communication,Thermodynamicsand Quantum Mechanics. These have been tailored to fit in with the existing FYBSc syllabus (SEM I and SEM II) in terms of continuity and to ensure delivery of quality content to the learner.
One paper of applied science is included in the fourth semester.
The 'practical' component in the applied course will be seen as a combination of laboratory sessions , a visit to a Research Institute/Industry, mini project, an assignment on a relevant topic etc.
For the various units, experts will guide as **'Resource Persons'** and their laboratories/ departments could serve as **Resource Centers**. Faculty members/Teachers can avail of their expertise to train themselves in the delivery of these courses whenever required.

Objective:
Upon completion of the course, students should have acquired the following knowledge and skills:

1. A thorough quantitative and conceptual understanding of the core areas of physics, including mechanics, , thermodynamics, quantum mechanics, electronics at a level compatible with graduate programs in physics at peer institutions.
2. The ability to analyze and interpret quantitative results, both in the core areas of physics and interdisciplinary areas.
3. The ability to use contemporary experimental apparatus and analysis tools to acquire, analyze and interpret scientific data.
4. The ability to apply the principles of physics to solve new and unfamiliar problems.
5. The ability to communicate scientific results effectively in presentations or posters.

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

Revised Syllabus in Physics (Theory and Practical)

As per credit basedGrading system

Second year B.Sc. 2018-2019

The revised syllabus in Physics as per credit based system (with choice) of theSecond Year B.Sc.course will be implemented from the academic year 2018-2019.

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.

Semester	Paper	Title	Credits
III	SIUSPHY31	Mathematical physics and Mechanics	2
III	SIUSPHY33	Optics and lasers	2
III	SIUSPHY32	Electronics& Communication	2
III	SIUSPHYP3	Practical course -3 (Group A,B,C and Skill)	3
		Total	**9**
IV	SIUSPHY41	Thermodynamics	2
IV	SIUSPHY42	Quantum Mechanics	2
IV	SIUSPHY43	Applied Physics-I	2
IV	SIUSPHYP4	Practical course -4 (Group A,B,C and Demo)	3
		Total	**9**

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	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**:(PAPERI, II&III) There will not be any internal examination for practical.

The SEMESTER END examination per practical course (For Paper I, II) will be conducted as per the following scheme

Sr.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 SYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of S Y BSc Physics as per the minimum requirements.

Proposed syllabus of SYBSc(2018-19)

SIUSPHY31: MECHANICS & MATHEMATICAL PHYSICS

Learning Outcomes:

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

i) Understand the concepts of mechanics & properties of matter & to apply them to problems.

ii) Comprehend the basic concepts of mechanics& mathematical physics and its applications.

iii) Demonstrate tentative problem solving skills in all above areas.

UNIT – I: Vector Calculus: 15Lectures

1 Line, Surface 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

3 Dirac delta function

UNIT – II: Mechanics 15 Lectures

1 Compound Pendulum: Expression for period, maximum and minimum time period, centers of suspension and oscillation, reversible compound pendulum. Kater's reversible pendulum, compound pendulum and simple pendulum- a relative study.

2 Oscillations**,** The Simple Harmonic Oscillator, Relation between Simple Harmonic Motion and Uniform Circular Motion, Two Body Oscillations,
Damped Harmonic Motion, Forced Oscillations and Resonance.

UNIT– III: Mechanics of System of particles 15 Lectures

1 Center of Mass , Motion of the Center of Mass , Linear momentum of a Particle
Linear momentum of a System of Particles , Linear momentum w.r.t. CM coordinate (i.e. shift of origin from Lab to CM), Conservation of Linear Momentum , Some Applications of the Momentum Principle , System of Variable Mass
Torque Acting on a Particle; Angular Momentum of a Particle; Angular Momentum of System of Particles;Total angular momentum w.r.t. CM coordinate. Conservation of Angular Momentum

2 Collisions: Introduction, types of collisions, laboratory and centre of mass systems, relationship between displacements and velocities, relationship between angles.

References:

Resnick and Halliday: Physics – I

Introduction to Electrodynamics (3rd Ed), David Griffiths

Mechanics – H. S. Hans and S. P. Puri, Tata McGraw Hill (2ndED.)

Additional reference:

1. KRS: Mechanics by K.R Symon.
2. Classical Dynamics of particles and systems by Thornton and Marian, (CENGAGE Learning)
3. Mechanics and Electrodynamics Rev Edn. 2005 by Brijlal and Subramanyanand JeevanSeshan.

SIUSPHY32:ELECTRONICS &COMMUNICATION

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

1) Understand the basics of transistor biasing, op-amp and their applications.
2) Understand the basic concepts of oscillator.
3) Understanding working of digital circuits.

UNIT I: Analog Electronics 1 15 Lectures

1 Transistor Biasing, Inherent Variations of Transistor Parameters, Stabilization, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias.

2 General amplifier characteristics: Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance, general theory of feedback, reasons for negative feedback, loop gain.

3 Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width.

UNIT II: Analog Electronics2 15 Lectures

1 Oscillators: Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator.(All oscillator mentioned transistorized)

2 Operational Amplifiers: Introduction, Schematic symbol of OPAMP, Output voltage from

OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator

UNIT III: Digital Electronics: 15 Lectures

Background knowledge (devote one lecture at commencement):

1 Binary number system , Arithmetic building blocks , Types of registers

2 Digital IC signal levels, Binary to Decimal, Decimal to binary, hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition.

3 RS Flip-Flops (only NOR gate latch, NAND gate latch) , Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop

4 OPAMP Astable multivibrator, Monostable multivibrator and OPAMP Schmitt trigger.

5 Basics of Communication

6 Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication,

7 Electromagnetic spectrum, base band and broad band communication.

8 Noise: Concept and types signal to noise ratio, noise figure, noise temperature.

References:

Principles of Electronics – V. K. Mehta and Rohit Mehta, (S. Chand – Multicolored illustrative edition)

Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)

SIUSPHY33: OPTICS& LASERS

Learning Outcomes:

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

1) Understand the basic concepts of optics and its applications in physical situations.
2) Understand the basic laws of optics and be able to perform calculations using them.
3) Demonstrate quantitative problem solving skill in all the topics covered.

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 narrow 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.

UNITII: 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 **LASER**: 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:

A Text book of Optics by Dr. N Subrahmanyam, Brijlal, Dr M N Avadhaanulu (S Chand, 25th Revised Edition 2012, Reprint 2013)
Optics by AjoyGhatak
Modern Physics: Concepts and Applications---Sanjeev Puri, Narosa Publications

Additional reference:

Optics by Eugene Hecht and A R Ganesan (Pearson, 4th Edition)

SIUSPHYP3: Practical course -3

Instructions:

i) All the measurements and readings should be written with proper units in SI system only.
ii) After completing all 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.
iii) While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
iv) Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning outcomes:

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

i) Understand &practice the skills while performing experiments.
ii) Understand the use of apparatus and their use without fear& hesitation.
iii) Correlate the physics theory concepts to practical application.
iv) Understand the concept of errors and their estimation.

Note: Exemption of two experiments from **Group**C may be given if student carries out any one of the following activity.

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 practical examination in **Group** A and **Group** B the learner will be examined in twoexperiments (one from each group). Each experiment will be of three hours'duration, Minimum 6 from each group and in all minimum 12 experiments must be reported in journal.
Practical examination in **Group** C will be based on industrial visit (report and viva) /Project and presentation. However a learner must perform at least two experiments and report in the journal.
All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments.

A learner will be allowed to appear for the semester end practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester III as per the minimum requirements.

Group A

1. Y by bending.
2. Helmholtz resonator- determination of unknown frequency.
3. Verification of Stefan's law (electrical method)
4. Charging and discharging of capacitor.
5. LCR parallel resonance.
6. Figure of merit of a mirror galvanometer.
7. Determination of absolute capacitance using BG
8. Measurement of resistance of galvanometer (G by shunting)
9. R.P of telescope.
10. Biprism

Group B

1. Passive low pass filter.
2. Passive high pass filter.
3. Passive band pass filter.
4. OPAMP: Inverting amplifier with different gains
5. OPAMP: Non-inverting amplifier with different gains and voltage follower
6. CE amplifier: variation of gain with load
7. Phase shift oscillator
8. Transistor Wien bridge oscillator
9. Transistor Colpitt's oscillator
10. Passive differentiator

Group C

1. Laser experiments: straight edge, single slit, grating
2. Optical fibre: transmission of signal
3. Concept of beats
4. Coupled oscillations and resonance
5. Synthesis of materials - mini project - thin film/nano materials/bulk powders using different routes etc.(equivalent to 2 practical sessions)
6. Visit to research institutes (equivalent to 2 practical sessions).
7. Assignment & literature survey (equivalent to 2 practical sessions).

Skill experiments

1. Soldering technique
2. Wiring of a simple circuit using bread board

3. Use of oscilloscope
4. Travelling microscope (radius of capillary)
5. Spectrometer: mean μ of yellow doublet of mercury source.
6. Spectrometer: optical leveling and Shuster's method
7. Component testing, color code of resistors, capacitors etc.
8. Drawing of graph on semi logarithmic / logarithmic scale.

References:

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

SIUSPHY41: THERMODYNAMICS

Learning Outcomes:

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

1) Understand the basicconcepts of thermodynamics, engines and their analysis and to understand its importance in explaining significant phenomena in Physics.

2) Demonstrate quantitative problem solving skills in all the topics covered.

UNIT –I **15 Lectures**

(Review of zeroth and first law of thermodynamics)

I Reversible and irreversible process, heat engines, Conversion of heat into work, Carnot's cycle: its efficiency.Carnot engine as refrigerator, Coefficient of performance.

II Steam engine, Rankine cycle, Otto engine, Efficiency of Otto cycle, Diesel cycle, Efficiency of Diesel cycle, Otto and Diesel comparison

UNIT –II **15 Lectures**

I Second law of thermodynamics, Statements, Equivalence of Kelvin and Planck's statement, Carnot's theorem, Absolute scale of temperature.

II 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, entropy and disorder, absolute entropy.
TS diagram for Carnot engine

UNIT –III **15 Lectures**

I Third law of thermodynamics, Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion.

II Low temp Physics: Different methods of liquefaction of gases, methods of freezing, Cooling by evaporation, cooling by adiabatic expansion
Joule - Thompson effect, JT effect of Van der Waal's gas, properties and uses of liquid Helium

References:

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

SIUSPHY42: QUANTUM MECHANICS

Learning Outcomes:

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

3) Understand the postulates of quantum mechanics and to understand its importance in explaining significant phenomena in Physics.

4) Demonstrate quantitative problem solving skills in all the topics covered.

Background Reading (Review):

Origin of Quantum Mechanics:
1. Review of Black body radiation, b) Review of photoelectric effect.
2. Matter waves-De Broglie hypothesis. Davisson and Germer experiment.
3. 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 15Lectures

1. Concept of wave function, Born interpretation of wave function.
2. Concepts of operator in quantum mechanics, examples – position, momentum and energy operators.
3. Eigenvalue equations, expectation values of operators.
4. Schrodinger equation.
5. Postulates of Quantum Mechanics.
6. Analogy between Wave equation and Schrodinger equation.
7. Time dependent and time independent (Steady State) Schrodinger equation, Stationary State
8. Superposition principle.
9. Probability current density, Equation of continuity and its physical significance.

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

1. Free particle.
2. Particle in infinitely deep potential well (one - dimension).
3. Particle in finitely deep potential well (one - dimension).
4. Step potential.
5. Particle in three dimension rigid box, degeneracy of energy state.

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

1. Potential barrier (Finite height and width) penetration and tunneling effect (derivation of approximate transmission probability)
2. Theory of alpha particle decay from radioactive nucleus.

[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.
5. Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.
6. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.
7. Quantum Mechanics. - By L. I. Schiff.
8. Quantum Mechanics. - By Powell and Crasemann, Addison-Wesley Pub. Co.

SIUSPHY43: APPLIED PHYSICS

Learning Outcomes:

On completion of this, it is expected that

i) Students will be exposed to contextual real life situations.
ii) Students will appreciate the role of Physics in 'interdisciplinary areas related to materials, Bio Physics, Acoustics etc.
iii) The learner will understand the scope of the subject in Industry & Research.
iv) Experimental learning opportunities will faster creative thinking & a spirit of inquiry.

UNIT1: Acoustics &Ultrasonics 15 Lectures

1 Acoustics of Buildings

Reverberation, Sabine's formula with derivation, Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium.

2 Ultrasonics

Piezoelectric effect, Production of Ultrasonic waves: Piezoelectric Crystal Method, Magnetostriction Method;Detection, Properties and applications of Ultrasonic Waves

References:

Properties of matter and Acoustics – R Murugeshan and K. Shivaprasath, S Chand &Co.Ltd. (2005-Ed)

UNITII: Biophysics 15 Lectures

Introduction, definition, History & scope of biophysics, biological fluids, physico-chemical properties, viscosity, surface tension, pH, osmosis, osmotic pressure. Diffusion, Ficks' laws of diffusion, dialysis, Cell is unit of life, fundamental understanding prokaryotic and eukaryotic cell structure and function, eukaryotic cell membrane, Fundamentals of transport process through biological membrane, membrane channels. electrical properties of cell, Action potential, propagation of action potential, methods of measurement of action potential, Nernst equation, Golman equation, The Hodgkin-Huxely model of action potential, voltage clamp technique, Patch clamp technique, cell impedance and capacitance.

References:

1. Cellular and Molecular Biology: Concept and Experiment by Gerald Karp
2. The Cell: A Molecular Approach by Geoffery Cooper
3. Introductory Biophysics: Perspective on living state by James Claycomb
4. Medical Physiology by Guyton
5. Molecular Biology of Cell by Bruce Albert
6. Text Book of Biophysics by R N Roy

UNITIII: Materials – properties and applications 15 Lectures

1Introduction to Materials

Classification of Materials based on structures (Crystalline and Amorphous, single crystal, polycrystalline and nanomaterials) and Functionality (Conducting, insulating, superconducting, reflecting, transmitting etc)

Types of Materials: Metals and alloys, Ceramics, Polymers and Composites, Thin Films, Nanomaterials; Some Physical and Chemical methods of materials synthesis

2 Properties of materials

Electrical Properties: Review of energy band diagram for materials - conductors, semiconductors and insulators, Electrical conductivity in metals, semiconductors and insulators (dielectrics), effect of temperature on conductivity

Optical Properties: Reflection, refraction, absorption and transmission of electromagnetic radiation in solids.

Magnetic Properties: Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferro-magnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis

3 Applications

Optical materials: LEDs, OLEDs, LCDs, Flat Panel Displays, optical fibersDielectric materials: Piezoelectric, ferroelectric and pyroelectric materials

Magnetic Materials: Soft magnets (Transformer steels), Hard magnets for permanent magnets, Magnetic Recording and Storage

References:

1. Electronic Properties of Materials, Rolf E Hummel
2. Materials Science and Engineering: A First Course by V. Raghavan

SIUSPHYP4: Practical course -4

Instructions:

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

Learning Outcomes:

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

i) Understand &practice the skills while performing experiments.
ii) Understand the use of apparatus and their use without fear & hesitation.
iii) Correlate their physics theory concepts to practical application.
iv) Understand the concept of errors and their estimation.

Note: Exemption of two experiments from **Group**C may be given if student carries out any one of the following activity.

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 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, Minimum 6 from each group and in all minimum 12 experiments must be reported in journal.
Practical examination in **Group** C will be based on industrial visit (report and viva) /Project and presentation. However a learner must perform at least two experiments and report in the journal.
All the skill/demo experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill/demo experiments.

A learner will be allowed to appear for the semester end practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester IV as per the minimum requirements.

Group A

1. Optical lever: determination of μ
2. Cylindrical obstacle: determination of λ
3. Single slit diffraction using Sodium Lamp
4. Conversion of PMMC to voltmeter
5. R.P. of grating
6. Brewster's law: determination of μ
7. Bar pendulum
8. Laser beam profile
9. De' Sauty's bridge
10. Wedge shaped film

Group B

1. Schmitt Trigger using OPAMP (inverting)
2. Half adder and full adder (7486, 7408)using EXOR Gate
3. Study of MS-JK flip flop
4. Study of RS flip-flop using NAND and NOR gates
5. OPAMP difference amplifier
6. Passive integrator
7. OPAMP Astable multivibrator
8. OPAMP Monostable multivibrator
9. Phase shift oscillator (OPAMP/Transistor)
10. Clipper circuit

Group C

1. Velocity of sound using CRO.
2. Standardization of pH meter & acid-base titration.
3. Determination of Isoelectric point of Amino Acids/protein.

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

SIES College of Arts, Science & Commerce

RISE WITH EDUCATION

SIES COLLEGE OF ARTS, SCIENCE ANDCOMMERCE

(Autonomous)

Affiliated to

UNIVERSITY OFMUMBAI

Syllabus for

SEM V & VI

Program: T.Y. B.Sc.

Course: Physics

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

T.Y.B.Sc. Physics Syllabus: Credit Based Semester and Grading System
To be implemented from the Academic year 2018-2019

SEMESTER V Theory

COURSE	UNIT	TOPICS	CREDITS	L/WEEK
SIUSPHY51	I	Mathematical methods in Physics	2.5	4
	II	Mathematical methods in Physics		
	III	Thermal and Statistical Physics		
	IV	Thermal and Statistical Physics		
SIUSPHY52	I	Solid State Physics	2.5	4
	II	Solid State Physics		
	III	Solid State Physics		
	IV	Solid State Physics		
SIUSPHY53	I	Atomic and Molecular Physics	2.5	4
	II	Atomic and Molecular Physics		
	III	Atomic and Molecular Physics		
	IV	Atomic and Molecular Physics		
SIUSPHY54	I	Electrodynamics	2.5	4
	II	Electrodynamics		
	III	Electrodynamics		
	IV	Electrodynamics		

Practicals

SIUSPHYP51	Practicals of Course SIUSPHY51 + Course SIUSPHY52	3	8
SIUSPHYP52	Practicals of Course SIUSPHY53 + Course SIUSPHY54	3	8

Scheme of examination:

Theory:

(A) **Internal Examination: 40 mark**

S.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

i) Each theory paper shall be of two hour duration.

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal option.

Q – I is from Unit - I,

Q – II is from Unit - II,

Q - III is from Unit - III,

Q - IV is from Unit - IV

Q - V will consist of questions from all the FOUR 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,

Sr. No.	**Particulars of External Practical Examination**	**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 TYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of TYBSc Physics as per the minimum requirements.

iii) Visits to industry, national research laboratories, and scientific exhibitions should be encouraged.

SEMESTER V

Theory Course - SIUSPHY51: Mathematical, Thermal and Statistical Physics

UNIT I: Probability **15 lectures**

Review of basic concepts: sample space, events, independent events, conditional probability, probability theorems, permutations and combinations, discrete and continuous random variables, binomial distribution, joint distributions and covariance, the normal distribution, the Poisson distribution, statistics and experimental measurements, Chebyshev's inequality, law of large numbers, central limit theorem.

UNIT II: Differential Equations and Transforms **15 lectures**

1. Second-order nonhomogeneous 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.

2. Fourier transforms: Introduction, formal development of the complex Fourier transform, cosine and sine transforms, the transforms of derivatives (with proofs), solutions of partial differential equations (wave and heat equation) using Fourier transforms.

UNIT III: Thermal and Statistical Physics 15 lectures

1. Description of a system : Why statistical approach, Particle-states, System-states, Microstates and Macro states of a system, Equilibrium and Fluctuations, Irreversibility, The equiprobability postulate, Statistical ensemble, Number of states accessible to a system, Phase space, Reversible processes.
2. Thermal and Adiabatic Interactions :
   Thermal interaction, Canonical distribution, Energy fluctuations, Entropy of a system in a heat bath, Helmholtz free energy, Adiabatic interaction and enthalpy, General interaction and the first law of thermodynamics, Infinitesimal general interaction, Gibbs free energy, Phase transitions.

UNIT IV: Thermal and Statistical Physics 15 lectures

1. Statistical Mechanics :
   Phase space, The probability of a distribution, The most probable distribution, Maxwell-Boltzmann statistics, Molecular speeds.
2. Quantum Statistics :
   Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results, Transition between states.

References:

UNIT I:

MB Chapter 15

UNIT II:

CH – Sections 5.2.4, 8.2.1, 8.2.2, 8.2.4

MB – Sections 8.6, 8.8 and 8.9

UNIT III:

LG: 1.1 to 1.11

LG: 2.1, 2.3 to 2.11

UNIT - IV

AB: 15.1 to 15.5

AB: 16.1 to 16.7

References:

1. **MB:** Mathematical Methods in the Physical sciences:- Mary L. Boas Wiley India3rded.
2. **LG:** Statistical and Thermal Physics- : S. Lokanathan and R. S. Gambhir. an introduction (Prentice Hall of India : 2008)
3. **AB:** Perspectives of Modern Physics: Arthur Beiser. (Mc Graw Hill International)

Additional References:

1. Mathematical Physics: A K Ghatak, Chua – 1995Macmillian India Ltd.
2. Mathematical Method of Physics: Riley, Hobson and Bence. Cambridge (Indian edition).
3. Mathematical Physics: H. K. Dass, S. Chand & Co.
4. Mathematical Methods of Physics: Jon Mathews & R. L. Walker, W A Benjamin inc.
5. A Treatise on heat:Saha and Srivastava. (Indian press, Allahabad)
6. Fundamentals of Statistical and Thermal Physics (Mc Graw - Hill): F. Reif

SEMESTER V

Theory Course - SIUSPHY52: Solid State Physics

UNITI: Crystal Physics **15 lectures**

Lattice points and space lattice, The basis and crystal structure, Unit Cells and lattice parameters, Primitive Cells, Crystal Systems, Crystal Symmetry, Bravais space lattices, Metallic crystal structures, relation between the density of crystal material and lattice constant in a cubic lattice, Directions, Planes, Miller Indices, Important planes in simple cubic structure, separation between lattice planes in a cubic crystal, Reciprocal Lattice(Omit Vector-algebraic discussion), X-ray Diffraction

UNIT II: Electrical properties of metals **15 lectures**

1. Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path
2. Quantum theory of free electrons, Fermi Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, The Fermi distribution function, Heat capacity of the Electron gas, Mean energy of electron gas at 0 K, Electrical conductivity from quantum mechanical considerations.
3. Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Distinction between metals, insulators and intrinsic semiconductors.

UNIT III: Conduction in Semiconductors **15 lectures**

1. Electrons and Holes in an Intrinsic Semiconductor, Conductivity, Carrier concentrations in an intrinsic semiconductor, Donor and Acceptor impurities, Charge densities in a semiconductor, Fermi level in extrinsic semiconductors, Diffusion, Carrier lifetime, The continuity equation, Hall Effect
2. Semiconductor-diode Characteristics : Qualitative theory of the p-n junction, p- n junction as a diode, Band structure of an open-circuit p-n junction

UNIT IV: Diode, magnetism and superconductivity **15 lectures**

1. The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance.
2. Magnetic Properties of matter: Diamagnetism and Paramagnetism, The origin of permanent magnetic dipoles, Diamagnetism and Larmor precession, The static paramagnetic susceptibility
3. Superconductivity : A survey, Mechanism of Superconductors, Effects of magnetic field, Critical Currents, The Meissner effect, The penetration depth, Type I and Type II Superconductors.

References:

UNIT I

SOP: Chapter 4: II, III, IV, V, VI, VII, XIV, XV, XVI, XVIII, XX, XXII, XXV, XXVI
Chapter 6: II, III, IV

UNIT II

SOP: Chapter 6: V, XIV,XV, XVI, XVII, XVIII,XX.
Chapter 6: XXXVII, XXXVIII, XXXIX,XXXX, XXXXI

UNIT III

MH: 4.1 to 4.10 and 5.1, 5.2, 5.3

UNIT IV

MH: 5.4 to 5.8
D: 18.1 to 18.4
SOP: Chapter 8: II, III, IV, VI, VII, XII, XIII

References:

1. SOP: Solid State Physics: S. O. Pillai, New Age International. 6thed.
2. SOP: Modern Physics and Solid State Physics : Problems and solutions New Age International.
3. MH: Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.
4. D: Solid State Physics : A. J. Dekker, Prentice Hall

SEMESTER V

Theory Course - SIUSPHY53: Atomic and Molecular Physics

UNIT-I Harmonic Oscillator and Hydrogen atom 15 Lectures

1. Schrödinger's equation for Harmonic oscillator, its solution by operator method. Graphical representation of its energy level and wave functions.
2. Hydrogen atom: Schrödinger's equation for Hydrogen atom, Separation of variables, Quantum Numbers: Total quantum number, Orbital quantum number, Magnetic quantum number. Angular momentum, Electron probability density (Radial part).

UNIT II Electron spin and spin orbit coupling 15 Lectures

1. Electron Spin: The Stern-Gerlach experiment, Pauli's Exclusion Principle Symmetric and Antisymmetric wave functions.
2. Spin orbit coupling, Hund's Rule, Total angular momentum, Vector atom model, L-S and j-j coupling. Origin of spectral lines, Selection rules.

UNIT III Effect of Magnetic field on atoms 15 Lectures

1. Effect of Magnetic field on atoms, The normal Zeeman effect and its explanation (Classical and Quantum), The Lande′ g factor, Anomalous Zeeman effect.
2. Paschen-Back effect, Paschen-Back effect of principal series doublet, Selection rules for Paschen-Back effect.

UNIT IV Molecular Physics 15 lectures

1. Molecular Spectra (Diatomic Molecules): Rotational energy levels, Rotational spectra, Vibrational energy levels, Vibrational-Rotational spectra.

   Electronic Spectra of Diatomic molecules: The Born-Oppenheimer approximation, Intensity of vibrational-electronic spectra: The Franck-Condon principle.
2. Raman Effect: Quantum Theory of Raman effect, Classical theory of Raman effect, Pure Rotational Raman spectra: Linear molecules, symmetric top molecules, Asymmetric top molecules, Vibrational Raman spectra : Raman activity of vibrations.

References:

UNIT – I.

1. M: 5.2, AB: 8.7,
2. AB: 8.7, 9.1 to 9.9.

UNIT - II

1. AB: 10.1, 10.3.
2. AB: 10.2, 10.6, 10.7, 10.8, 10.9, 11.1 and 11.2.

UNIT – III:

1. SA: 9.14, 9.15, 9.16, 9.17.
2. W: 10.7, 10.8, 10.9

UNIT – IV:

1. AB: 14.1, 14.3, 14.5, 14.7 BM: 6.11, 6.1.3.
2. BM: 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1.

References:

1. AB: Perspectives of Modern Physics: Arthur Beiser McGraw Hill.
2. SA: Introduction to Atomic & Nuclear Physics: H. Semat & J. R. Albright (5th Ed.) Chapman& Hal
3. W: Introduction to Atomic Spectra: H. E. White. McGraw Hill.
4. BM: Fundamentals of Molecular Spectroscopy: C. N. Banwell & E. M. McCash (TMH).(4th Ed.)
5. M: Introduction to Quantum Mechanics: P. T. Mathews (TMH).

SEMESTER V

Theory Course - SIUSPHY54: Electrodynamics

UNIT I: Electrostatics 15 lectures

1. Field lines, Flux and Gauss' law, The divergence of **E**, Applications of Gauss' law, The curl of **E**.
   Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution. , Review of conductors
2. First Uniqueness theorem, The classic image problem- Infinite conducting plane and conducting sphere.

UNIT II: Polarization and Magnetostatics 15 lectures

1. Dielectrics, Induced Dipoles, Alignment of polar molecules, Polarization, Bound charges and their physical interpretation, Gauss' law in presence of dielectrics, A deceptive parallel, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems.
2. Straight-line currents, The Divergence and Curl of **B**, Applications of Ampere's Law in the case of a long straight wire and a long solenoid, Comparison of Magneto-statics and Electrostatics.

UNIT III: Magnetism and Varying Fields 15 lectures

1. Diamagnets, Paramagnets Ferro magnets, Magnetization, Bound currents and their physical interpretation, Ampere's law in magnetized materials, Magnetic susceptibility and permeability.
2. Energy in magnetic fields, Electrodynamics before Maxwell, Maxwell's correction to Ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations in matter, Boundary conditions.

UNIT IV: Electromagnetic waves 15 lectures

1. The continuity equation, Poynting's theorem, Newton's third law in electrodynamics.
2. The wave equation for **E** and **B**, Monochromatic Plane waves, Energy and momentum in electromagnetic waves, Propagation in linear media, Reflection and transmission of EM waves at normal incidence.

References:

UNIT – I

1. DG: 2.2.1 to 2.2.4, 2.3.1 to 2.3.4,(2.5.1 to 2.5.4 for review)
2. DG: 3.1.5, 3.2.1 to 3.2.3. 3.2.4

UNIT - II

1. DG: 4.1.1 to 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.3.
2. DG: 5.3.1 to 5.3.4.

UNIT – III

1. DG: 6.1.1, 6.1.4, 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1.
2. DG: 7.2.4, 7.3.1 to 7.3.6

UNIT - IV

1. DG: 8.1.1, 8.1.2., 8.2.1.
2. DG: 9.2.1 to 9.2.3, 9.3.1 to 9.3.2.

References:

DG: Introduction to Electrodynamics: David J. Griffiths (3rd Ed) Prentice Hall of India.
Additional References:
1. Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
2. Engineering Electrodynamics: William Hayt Jr. & John H. Buck (TMH).
3. Electricity and Magnetism: NavinaWadhwani (PHI – 2010).

SEMESTER V

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of demonstration and skill experiments. During the teaching and examination of Physics laboratory work, simple modifications of experimental parameters may be attempted. Attention should be given to basic skills of experimentation which include:

i) Understanding relevant concepts.
ii) Planning of the experiments.
iii) Layout and adjustments of the equipments.
iv) Recording of observations and plotting of graphs.
v) Calculation of results and estimation of possible errors in the observation of results.

i) Regular Physics Experiments: A minimum of 8 experiments from each of the course are to be performed and reported in the journal.

ii) Skill Experiments: All the skills are compulsory and must be reported in the journal. Skills will be tested during the examination through viva or Practicals

The certified journal must contain a minimum of 16 regular experiments (8 from each group), with all Skills in semester V. A separate index and certificate in journal is must for each semester course.
There will be two turns of three hours each for the examination of practical courses.

SEMESTER V

Practical Course: SIUSPHYP51

1	Determination of 'g' by Kater's pendulum.
2	Y by Koenig's method
3	Stefan's constant σ
4	Thermal conductivity of bad conductor by Lee's disc
5	Goniometer
6	R.I of liquid using laser
7	Rydberg's constant
8	Edser's A pattern/step slit
9	Flat spiral spring: Determination of Young's Modulus
10	Determination of e/m

Practical Course: SIUSPHYP52

1	Mutual inductance by BG
2	Hysteresis by magnetometer
3	Maxwell's bridge
4	Energy Band gap of Semi conductor
5	Schmitt Trigger using OPAMP (Non Inverting)
6	Low pass (first order active filter)
7	Wien bridge oscillator (OPAMP)
8	Counters mod 2,5 10
9	LM-317 as voltage regulator
10	LM 317 as current regulator

Skills:

1	Estimation of errors.
2	Soldering advanced circuit
3	Bread board circuit using IC's.
4	Optical Leveling of Spectrometer
5	Mounting of Grating for normal incidence
6	Use of electronic balance : radius of small ball bearing
7	Dual trace CRO: Phase shift measurement.
8	BG: C1 /C2 by comparing θ1 / θ2.

References :

1. Advanced course in Practical Physics : D. Chattopadhya, PC. Rakshit & B. Saha (8th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001.
3. A Text book of Practical Physics : Samir Kumar Ghosh New Central Book Agency (4rd edition).
4. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics: C. L. Squires – (3rd Edition) Cambridge University Press.
6. University Practical Physics: D C Tayal. Himalaya Publication.
7. Advanced Practical Physics:Worsnop & Flint.

T.Y.B.Sc
Physics Syllabus:
Credit Based Semester and Grading System
To be implemented from the Academic year 2018-2019

SEMESTER VI Theory

COURSE	UNIT	TOPICS	CREDITS	L/WEEK
SIUSPHY61	I	Classical Mechanics	2.5	4
	II	Classical Mechanics		
	III	Classical Mechanics		
	IV	Nonlinear Mechanics		
SIUSPHY62	I	Electronics	2.5	4
	II	Electronics		
	III	Electronics		
	IV	Electronics		
SIUSPHY63	I	Nuclear Physics	2.5	4
	II	Nuclear Physics		
	III	Nuclear Physics		
	IV	Nuclear Physics		
SIUSPHY64	I	Relativity	2.5	4
	II	Relativity		
	III	Relativity		
	IV	Relativity		

Practicals

SIUSPHYP61	Practicals of Course : Group A and Group B	3	8
SIUSPHYP62	Practicals of Course : Group A and Group B	3	8

Scheme of examination:

Theory:

(A) **Internal Examination: 40 mark**

S. 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

i) Each theory paper shall be of two hour duration.

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal option.

Q – I is from Unit - I

Q – II is from Unit - II

Q - III is from Unit - III

Q - IV is from Unit - IV

Q - V will consist of questions from all the FOUR 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,

Sr.No.	Particulars of External Practical Examination	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 TY BSc Physics or a certificate from the Head of theDepartment to the effect that the candidate has completed the practical course of TY BSc Physics as per the minimum requirements.

iii) Visits to industry, national research laboratories, and scientific exhibitions should be encouraged.

SEMESTER VI

Theory Course: SIUSPHY61: Classical Mechanics

UNIT I: Central Force **15 lectures**

1. Motion under a central force, The central force inversely proportional to the square of the distance, Elliptical orbits. The Kepler's problem. Hyperbolic Orbits : The Rutherford problem – Scattering cross section.
2. Moving origin of co-ordinates, Rotating co-ordinate systems, Laws of motion on the rotating earth, Foucault pendulum, Larmor's theorem (with proof).

UNIT II: Lagrange's equations **15 lectures**

Lagrange's equations: D'Alembert's principle, Generalized coordinates, Lagrange's equations using D'Alembert's principle, Examples, Systems subject to constraints, Examples of systems subject to constraints, Constants of motion and ignorable coordinates.

UNIT III: Fluid Motion and Rigid body rotation **15 lectures**

1. Kinematics of moving fluids, Equation of motion for an ideal fluid, Conservation laws for fluid motion, Steady flow.
2. The rotation of a Rigid body: Motion of a rigid body in space, Euler's equations of motion for a rigid body, Euler's angles, Heavy symmetrical top (without nutation).

UNIT IV: Non Linear Mechanics **15 lectures**

Nonlinear mechanics: Qualitative approach to chaos, The anharmonic oscillator, Numerical solution of Duffing's equation, Transition to chaos: Bifurcations and strange attractors, Aspects of chaotic behavior.

References:

UNIT – I

1. KRS: Art. 3.13 to 3.16
2. KRS: Art. 7.1 to 7.5

UNIT – II

1. KRS: Art. 9.1 to 9.6 G:1.4

UNIT - III

1. KRS: Art. 8.6 to 8.9
2. KRS: Art. 11.1, 11.2, 11.4, 11.5, BO: 6.7

UNIT - IV

1. BO: Art. 11.1, 11.3 to 11.5

References:

1. KRS: Mechanics: Keith R. Symon. (Addision Wesely) 3rd Ed.
2. BO: Classical Mechanics- : V. D. Barger and M. G. Olsson. a Modern perspective (Mc Graw Hill International 1995 Ed.)
3. G: Classical Mechanics: Herbert Goldstein, (Narosa 2nd Ed.)

Additional References:

1. Classical Mechanics: Herbert Goldstein (Narosa 2nd Ed.)
2. An Introduction to Mechanics: Daniel Kleppner & Robert Kolenkow Tata Mc Graw Hill (Indian Ed. 2007)
3. Chaotic Dynamics- an introduction. : Baker and Gollup.

SEMESTER VI

Theory Course: SIUSPHY62: Electronics

UNIT I: 15 lectures

1. Field effect transistors: JFET: Basic ideas, Drain curve, The transconductance curve, Biasing in the ohmic region and the active region, Trans- conductance, JFET common source amplifier, JFET analog switch, multiplexer, voltagecontrolled resistor, Current sourcing.
2. MOSFET: Depletion and enhancement mode, MOSFET operation and characteristics, digital switching.
3. Thyristors: SCR – Working, Equivalent circuit, important terms, I-V Characteristics, SCR as a switch, half wave rectifier and full wave rectifier. TRIAC: Construction, Operation, I-V Characteristics, Applications.
   DIAC: Construction, Operation, Characteristics and applications.

UNIT II: 15 Lectures

1. Regulated DC power supply: Supply characteristics, series voltage regulator, Short circuit protection (current limit and fold back) Monolithic linear IC voltage Regulators. (LM 78XX, LM 79XX, LM 317).
2. Differential Amplifier using transistor: The Differential Amplifier, DC and AC analysis of a differential amplifier, Input characteristic-effect of input bias, offset current and input offset voltage on output, common mode gain, CMRR.
3. Transistor Multivibrators: Astable, Monostable and Bistable Multivibrators, Schmitt trigger.

UNIT III: 15 Lectures

1. Op Amp Applications: Log amplifier, Instrumentation amplifiers, Voltage controlled current sources (grounded load), First order Active filters, Astable using OP AMP, square wave and triangular wave generator using OP AMP, Wien-bridge oscillator using OP AMP.
2. 555 Timer: Review Block diagram, Monostable and Astable operation Voltage Controlled Oscillator, Pulse Width modulator, Triggered linear ramp generator.

UNIT –IV: 15 Lectures

1. Logic families: Standard TTL NAND, TTL NOR, Open collector gates, Three state TTL devices, MOS inverters, CMOS NAND and NOR gates, CMOS characteristics.
2. Applications of JK flip flop: Types of registers, 4-bit shift register (serial in-serial out), Asynchronous counters, 4-bit up-down counter, MOD-3, MOD-5, Decade counter, Shift counter.
3. Electronic communication techniques: Radio broadcasting, Transmission and reception, Modulation, Amplitude modulation(AM), Modulation factor, Analysis of amplitude modulated wave, Side band frequencies in AM wave, Transistor amplitude modulator, Power in AM wave, Limitations of AM

References:

Unit -I:

1. MB: Art. 13.1 to 13.9
2. MB: 14.1, 14.2, 14.4, 14.6.
3. VKM: Art. 20.1 to 20.10, 21.1 to 21.6, 21.8, 21.9, 21.10.

UNIT – II:

1. MB: Art 24.1, 24.3, 24.4.
2. MB: Art 17.1 to 17.5.

KVR: Art. 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1.

UNIT – III:

1. MB: Art. 20.5, 20.8, 21.4, 22.7, 22.8, 23.2. MH: 16.14.
2. MB: Art. 23.8, 23.9.

UNIT – IV:

1. ML: Art. 6.2, 6.4, 6.6, 6.7, 7.2 to 7.4.
2. ML: Art 10.1, 10.2, 11.1, 11.3 to 11.5, 11.7
3. VKM: Art. 16.1 to 16.11

References:

1. MB: Electronic Principles: A. P. Malvino and D.J. Bates, (7th Ed.) – (TMH).
2. VKM: Principles of Electronics: V. K. Mehta and Rohit Mehta. S. ChandPublications. (11th Ed.)
3. KVR: Functional Electronics: K .V. Ramanan (TMH).
4. AM: Electronic Devices and Circuits: Allen Mottershed, PHI learning 2013 Ed
5. ML: Digital Principles and Applications: Malvino and Leach (4th Ed)(TMH).
6. MH: Integrated Electronics: Millman and Halkias, Mc Graw Hill International.

SEMESTER VI

Theory Course: SIUSPHY63 Nuclear Physics

UNIT I: Alpha & Beta Decay 15 lectures

1. Alpha Decay: Velocity, energy, and Absorption of alpha particles: Range, Ionization and stopping power, Nuclear energy levels. Range of alpha particles, alpha particle spectrum, Fine structure, long range alpha particles, Alpha decay paradox: Barrier penetration (Gamow's theory of alpha decay and Geiger-Nuttal law),
2. Beta decay: Introduction, Velocity and energy of beta particles, Energy levels and decay schemes, Continuous beta ray spectrum-Difficulties encountered to understand it, Pauli's neutrino hypothesis, Detection of neutrino, Energetics of beta decay.

UNIT II: Gamma Decay & Nuclear Models **15 lectures**

1. Gamma decay: Introduction, Internal conversion, nuclear isomerism, Mossbauer Effect
2 Nuclear Models: Liquid drop model, Weizsacher's semi-empirical mass formula, Mass parabolas - Prediction of stability against beta decay for members of an isobaric family, Stability limits against spontaneous fission.
   Shell model(Qualitative) ,Magic numbers in the nucleus

UNIT III: Particle Accelerators & Energy Generation **15 lectures**

1. Particle Accelerators: Van de Graaff Generator, Cyclotron, Synchrotron, Betatron and Idea of Large Hadron Collider
2. Nuclear energy: Introduction, Asymmetric fission - Mass yield, Emission of delayed neutrons, Nuclear release in fission, Nature of fission fragments, Energy released in the fission of U235, Fission of lighter nuclei, Fission chain reaction, Neutron cycle in a thermal nuclear reactor (Four Factor Formula), Nuclear reactors, Natural fusionPossibility of controlled fusion

UNIT IV: Meson Theory & Elementary Particles **15 lectures**

1. Meson theory of Nuclear Force: A qualitative discussion
2. Elementary particles: Introduction, Classification of elementary particles, Particle Interactions, Conservation laws (linear &angular momentum ,energy, charge, baryon number & lepton number),particles and anti particles(Electrons and positrons, Protons and anti-protons, Neutrons and anti- neutrons, Neutrinos and anti-neutrinos), Photons, Mesons, Quark model(Qualitative).

References:

UNIT I

1 K: 13. 1, 13.2, 13.5. , P: 4. II. 1, 4. II. 2, 4. II. 3, 1.II.3

2. K: 14.1, 14.7 P: 4. III. 1, 4. III. 2, 4. III. 3, 4. III. 5 G: 5.5.

UNIT II

1. P 4. IV. 1, 4. IV. 3, 4. IV. 4, 9.4.

2. P: 5.1, 5.3, 5.4, 5.5. AB: 11.6-pages (460,461)

UNIT III

1. P: 1.I.4 (i), 1.I.4 (ii), 1.I.4 (iii), 1.I.4 (iv), AB 15.7

2. P: 6.1, 6.3 to 6.9, 9.6, 9.7

UNIT IV

1. P:8.6

2. T: 18.1, 18.2, 18.3, 18.4, 18.5 to 18.9 AB: 13.5

References:

1. AB: Concepts of Modern Physics: Arthur Beiser, Shobhit Mahajan, S Rai Choudhury (6th Ed.) (TMH).
2. P: Nuclear Physics: S.B. Patel (Wiley Eastern Ltd.).
3. K: Nuclear Physics: Irving Kaplan (2nd Ed.) (Addison Wesley).
4. G: Nuclear Physics: S. N. Ghoshal (S. Chand & Co.)
5. T: Nuclear Physics: D. C. Tayal (Himalayan Publishing House) 5thed.

Additional References

1. Modern Physics: Kenneth Krane (2nd Ed.) John Wiley & Sons.
2. Atomic & Nuclear Physics: A B Gupta & Dipak Ghosh Books & Allied (P) Ltd.
3. Introduction to Elementary Particles: David Griffiths, Second Revised Edition,Wiley- VCH
4. Nuclear Radiation Detectors by S. S. Kapoor and S. N. Ramamootry

SEMESTER VI

Theory Course – SIUSPHY64: Special Theory of Relativity

UNIT I: Special Theory of Relativity & Relativistic Kinematics 15 lectures

1. Experimental background of special theory of relativity and relativistic kinematics : Galilean transformations, Newtonian relativity, Electromagnetism and Newtonian relativity. Attempts to locate absolute frame: Michelson- Morley experiment, Attempts to preserve the concept of a preferred ether frame: Lorentz Fitzgerald contraction and ether drag hypothesis, Attempt to modify electrodynamics, postulates of the special theory of relativity.
2. Relativistic Kinematics: Simultaneity, Derivation of Lorentz transformation equations Some consequences of the Lorentz transformation equations: length contraction, time dilation and meson experiment, The observer in relativity

UNIT II: Relativistic Kinematics 15 lectures

1. Relativistic Kinematics (continued): The relativistic addition of velocities and acceleration transformation equations, Aberration and Doppler effect in relativity, The common sense of special relativity.
2. The Geometric Representation of Space-Time: Space-Time Diagrams, Simultaneity, Length contraction and Time dilation, The time order and space separation of events, The twin paradox

UNIT III: Relativistic Dynamics 15 lectures

1. Relativistic Dynamics: Mechanics and Relativity, The need to redefine momentum, Relativistic momentum, Alternative views of mass in relativity, The relativistic force law and the dynamics of a single particle, The equivalence of mass and energy, The transformation properties of momentum, energy and mass.

UNIT IV: Relativity and Electromagnetism **15 Lectures**

1. Relativity and Electromagnetism: Introduction, The interdependence of Electric and Magnetic fields, The Transformation for E and B, The field of a uniformly moving point charge, Force and fields near a current-carrying wire, Force between moving charges, the invariance of Maxwell's equations.
2. The principle of equivalence and general relativity Gravitational red shift.

References:

UNIT I:

RR: 1.1 to 1.6,1.8, 1.9, 2.1, to 2.5

UNIT II:

RR 2.6 to 2.8, Supplementary topics A1,A2,A3, B1 ,B2 , B3

UNIT III:

RR 3.1 to 3.7

UNIT IV:

RR 4.1 to 4.7

Supplementary topic C1, C2, C3, C4

References

1. RR : Introduction to Special Relativity : Robert Resnick (Wiley Student Edition)
2. Special theory of Relativity : A. P. French

SEMESTER VI

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of demonstration and skill experiments. During the teaching and examination of Physics laboratory work, simple modifications of experimental parameters may be attempted. Attention should be given to basic skills of experimentation which include:

1) Understanding relevant concepts.
2) Planning of the experiments.
3) Layout and adjustments of the equipments.
4) Recording of observations and plotting of graphs.
5) Calculation of results and estimation of possible errors in the observation of results.

i) Regular Physics Experiments: A minimum of 8 experiments from each of the practical course are to be performed and reported in the journal.

ii) Demo Experiments: The demonstration experiments are to be performed by the teacher in the laboratory and students should be encouraged to participate and take observation wherever possible.

Demonstration experiments are designed to bring about interest and excitement in Physics. Students are required to enter details of these'demo' experiments in their journal.

The certified journal must contain a minimum of 16 regular experiments (8 from each practical course), with minimum 6 demonstration experiments in semester VI. A separate index and certificate in journal is must for each semester course.
There will be two turns of three hours each for the examination of practical course.

Practical Course – SIUSPHYP61

1	Quincke's method for surface tension of Mercury
2	Double refraction
3	FET characteristics
4	UJT characteristics
5	UJT as relaxation oscillator
6	SCR characteristics
7	Photodiode characteristics
8	Phototransistor characteristics
9	Diameter of Lycopodium powder
10	Frequency response of Common Source FET Amplifier

Practical Course – SIUSPHPY62

1	M/C using B.G.
2	Transistorized Astable multivibrator
3	Transistorized Bistable multivibrator
4	Transistorized Monostable multivibrator
5	Log amplifier using OPAMP
6	Hall effect
7	555 timer as ramp generator.
8	Diode as a temperature sensor
9	Shift register
10	555 monostable/astable

Demonstration Experiments:

1	Data sheet reading for diodes, Transistor, Op amp and Optoelectronic devices.
2	Circuit designing – single stage amplifier, Transistor Multivibrator etc. and testing on breadboard.
3	Equation solver
4	Amplitude Modulation
5	Frequency Modulation
6	Michelson's interferometer.
7	Iodine absorption spectra.
8	Standing waves in liquid using Ultrasonic waves.
9	PC simulation of 8085.
10	Use of PC / μP to control real world parameters.
11	Seven segment display.
12	GM counter

References:

1. Advanced course in Practical Physics: D. Chattopadhya, PC. Rakshit & B. Saha (8th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics: Harnam Singh S. Chand & Co. Ltd. – 2001.
3. A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4rd edition).
4. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001S. Chand & Co. Ltd.
5. Practical Physics: C. L. Squires – (3rd Edition) Cambridge University Press.
6. University Practical Physics: D C Tayal. Himalaya Publication.
7. Advanced Practical Physics: Worsnop & Flint.

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