AC/04.08.2018/RS1

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) 5^{th}ed.

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.

~*~*~*~*~*~*~*~*~*~