



Autonomous College

(Affiliated to Mumbai University)

## **Syllabus for the S. Y. B.Sc. Course in Physics**

**(w. e. f. academic year 2021-22)**

**Course Code: RJSUPHY**

**Syllabus in Physics (Theory and Practical)**  
**as per Choice based Credit and Grading system**  
**Second Year B.Sc. 2021-2022**

The syllabus in Physics as per credit-based system (with choice) of the Second Year B.Sc. course will be implemented from the academic year 2021-2022.

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.

<b>Semester</b>	<b>Paper</b>	<b>Title</b>	<b>Credits</b>
III	RJSUPHY301	Mechanics and Thermodynamics	2
	RJSUPHY302	Vector calculus and Analog Electronics	2
	RJSUPHY303	Applied Physics-I	2
	RJSUPHY3P01 RJSUPHY3P02 RJSUPHY3P03	Practical course -3	3
<b>Total</b>			<b>9</b>
IV	RJSUPHY401	Optics	2
	RJSUPHY402	Quantum Mechanics	2
	RJSUPHY403	Applied Physics-II	2
	RJSUPHY4P01 RJSUPHY4P02 RJSUPHY4P03	Practical course - 4	3
<b>Total</b>			<b>9</b>

## SEMESTER III

### RJSUPHY301: Mechanics and Thermodynamics

**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 thermodynamics & its applications in physical situation.
- III. Learn about situations in low temperature.
- IV. Learn problem solving skills in all above areas.

#### UNIT- I

**15 Lectures**

1. Oscillations: The Simple Harmonic Oscillator (Review), Damped Harmonic Motion, Forced Oscillations and Resonance, Introduction to Two Body Oscillations.
2. Compound pendulum: Expression for period, maximum and minimum time period, centers of suspension and oscillations. reversible compound pendulum, Kater's reversible pendulum, compound pendulum and simple pendulum-a relative study.
3. 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 (more problems)

#### UNIT- II

**15 Lectures**

(Review of zeroth and first law of thermodynamics)

1. Conversion of heat into work, heat engine, Carnot's cycle: its efficiency.
2. Second law of thermodynamics, Statements, Equivalence of Kelvin and Plank statement, Carnot's theorem, Reversible and irreversible process, Absolute scale of temperature.
3. 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.

#### UNIT- III

**15 Lectures**

1. Third law of thermodynamics, Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion.
2. Steam engine, Rankine cycle, Otto engine, Efficiency of Otto cycle, Diesel cycle, Efficiency of Diesel cycle, Otto and diesel comparison (more problems)
3. 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 Vander Waal's gas, Liquefaction of helium, properties and uses of liquid Helium

#### References:

1. Resnick and Halliday: Physics – I
2. Mechanics – H. S. Hans and S. P. Puri, Tata McGraw Hill (2nd ED.)
3. Thermal Physics, AB Gupta and H. Roy, Book and Allied (P) Ltd, Reprint 2008, 2009.
4. Heat and Thermodynamics, Dittman & Zeemanskey, 7<sup>th</sup> Edition.

**Additional reference:**

1. Mechanics by K.R Symon.
2. Classical Dynamics of particles and systems by Thornton and Marian, (CENGAGE Learning)
3. Basic Thermodynamics: Evelyn Guha (Narosa Publications)
4. A treatise on heat: Meghanad Saha and B N Srivastava, 1969, India Press
5. Mechanics and Electrodynamics Rev Edn. 2005 by Brijlal and Subramanyan and Jeevan Seshan.
6. Heat thermodynamics and Statistical Physics, Brijlal, N. Subramanyam, P.S. Hemne, S.Chand, edition 2007.

**RJSUPHY302: Vector Calculus and Analog Electronics**

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

- I. Understand the basics of vector calculus and their applications in physical situations.
- II. Understand the basics of transistor biasing, operational amplifiers, their applications
- III. Understand the basic concepts of oscillators and their designing.
- IV. Develop quantitative problem-solving skill in all the topics covered.

**UNIT- I Vector Calculus**

**15 Lectures**

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.
2. Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates.

**UNIT- II Analog Electronics-I**

**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- III Analog Electronics-II**

**15 Lectures**

1. Oscillators: Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator
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 as Difference Amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator

### References:

1. Introduction to Electrodynamics 3rd Ed by D.J. Griffith
2. Schaum's outline of Theory and problems of Vector Analysis- Murray R Spiegel, Asian Student Edition
3. Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand –Multicoloured illustrative edition)
4. Electronic Devices and circuit theory – Robert L. Boylestad
5. Electronic devices and circuits – An introduction - Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)

### **RJSUPHY303: Applied Physics – I**

This paper consists of three modules (units) designed in a way so as to offer interdisciplinary & application-oriented learning.

**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.

#### **Unit - I Acoustics, Lasers and fiber optics**

**15 Lectures**

1. Acoustics of Buildings: Reverberation, Sabine's formula (without derivation) Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium.
2. Laser: Introduction, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Helium–Neon Laser, Application of Laser, Holography
3. Fibre Optics: Light propagation through Fibres, Fibre Geometry, Total Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Optical Fibres.

### References:

1. Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication.
2. Properties of matter and Acoustics – R Murugesan and K. Shivaprasad, S Chand & Co.Ltd.(2005-Ed)

#### **Unit II: Biophysics**

**15 Lectures**

1. Introduction to Biophysics, Biological fluids, Physical-chemical properties: Viscosity, Surface tension, Diffusion, Cell – a unit of life, Fundamental understanding of prokaryotic and eukaryotic cell structure and functions, Electrical properties of cell - membrane potential, Action potential, propagation of action potential, Nernst equation, Goldman equation, Voltage clamp technique.

### References:

1. Text Book of Biophysics by R N Roy
2. The Cell: A Molecular Approach by Geoffrey Cooper
3. Medical Physiology by Guyton
4. Molecular Biology of Cell by Bruce Albert
5. Elementary Biophysics- P. K. Srivastava, Narosa Publications

**Unit III: Materials – properties and applications**

**15 Lectures**

1. Introduction to Materials  
Classification of Materials based on structures (Crystalline and Amorphous, single crystal, polycrystalline and nanomaterials) and Functionality (Conducting, insulating, superconducting, reflecting, transmitting etc)
2. Types of Materials: Metals and alloys, Ceramics and Polymers, Thin Films (mention) and Nanomaterials (mention).
3. 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.  
Magnetic Properties: Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, anti-ferromagnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis

**References:**

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

**RJSUPHY3P: 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, 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 and practice the skills while performing experiments.
- II. Use the apparatus with ease.
- III. Correlate the physics theory concepts to practical application.
- IV. Understand the concept of errors/ uncertainties and their estimation.

For practical examination, the learner will be examined in three experiments (one from each group). Each experiment will be of two hours' duration. Minimum 4 from each group and in all minimum 12 experiments must be reported in journal.

All skill experiments included in the syllabus are required to be completed as a part of laboratory orientation. Evaluation in viva voce will be based on regular experiments and skill experiments.

A learner will be allowed to appear for the semester and 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.

### **Skill experiments**

1. Use of DMM
2. Use of oscilloscope
3. Travelling microscope (to find element of wire mesh)
4. Spectrometer: optical leveling and Shuster's method and determination of Angle of prism.
5. Component testing, colour code of resistors, capacitors etc.
6. Drawing of graph on semi logarithmic paper/ Using origin.
7. Estimation of uncertainties.

### **RJSUPHY3P01 (Group A)**

1. Kater's pendulum
2. Young's modulus by Koenig's method.
3. Determination of thermal conductivity of bad conductor by Lee's Method.
4. Verification of Stefan's law (electrical method)
5. Charging and discharging of capacitor.
6. Figure of merit of a mirror galvanometer.
7. Measurement of resistance of galvanometer (G by shunting)
8. Study of Coupled oscillations and resonance

### **RJSUPHY3P02 (Group B)**

1. Passive low pass filter
2. Passive band pass filters.
3. Op-amp: Inverting amplifier with different gains
4. Op-amp: Non-inverting amplifier with different gains and voltage follower
5. CE/CB amplifier: Basic Characteristics
6. CE amplifier: variation of gain with load
7. Frequency of Colpitts oscillator using Lissajous figures.
8. LCR parallel Resonance

### **RJSUPHY3P03 (Group C)**

1. Determination of  $\lambda$ (wavelength) of Laser using single slit.
2. Optical fibre: transmission of signal
3. Study of beats
4. Standardization of pH meter & acid-base titration.
5. Determination of  $\gamma$ - Flat spiral spring
6. Flat spiral spring ( $\eta$ )
7. Synthesis of materials - mini project - thin film/nano materials/bulk powders using different routes etc.
8. To measure contact potential at various parts of plants using Expeyes kit.

**References:**

1. Advanced course in Practical Physics D. Chattopadhyaya, PC Rakshit & B Saha. (6<sup>th</sup> 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 (3<sup>rd</sup> edition)
4. B.Sc. Practical Physics – C L Arora (1<sup>st</sup> Edition) -2001 S.Chand and Co Ltd.
5. Practical Physics CL Squires (3<sup>rd</sup> Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint.

## SEMESTER IV

### RJSUPHY401: Optics

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

- I. Understand the diffraction and polarization processes and applications of them in physical situations.
- II. Understand the applications of interference in design and working of interferometers.
- III. Understand the resolving power of different optical instruments.
- IV. Demonstrate quantitative problem-solving skills in all the topics covered.

#### **Unit I: Diffraction**

**15 Lectures**

1. **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.
2. **Fraunhofer Diffraction:** Introduction, Fraunhofer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhofer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima.

#### **Unit II: Polarization**

**15 Lectures**

1. Introduction, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light.
2. 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.
3. Anisotropic crystal, Calcite crystal, Optic Axis, Polarizer and Analyzer, Malus' Law, 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.
4. Retarders, Quarter wave plate, Half wave plate, Production of linearly, elliptically, circularly polarized light.
5. Analysis of polarized light, Applications of polarized light.

#### **Unit III:**

**15 Lectures**

1. **Interferometry**  
Michelson's interferometer and its applications, Fabry-Perot Interferometer and its applications
2. **Resolving power of optical instruments**  
Rayleigh's criterion, R P of telescope, prism, grating.

### References:

1. A Text Book Of Optics By: Dr.N.Subrahmanyam, Brijlal, Dr M.N. Avadhaanulu (S.Chand, 25<sup>th</sup> Revised edition 2012 Reprint 2013)
2. OPTICS (4<sup>th</sup> Edition) : Ajoy Ghatak (The McGraw Hill)
3. Optics by Eugene Hecht (Pearson Education)
4. Optics and Atomic Physics: Singh and Agarwal (Pragati Prakashan)

### **RJSUPHY402: QUANTUM PHYSICS**

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

- I. Understand the postulates of quantum mechanics and to understand its importance in explaining significant phenomena in Physics.
- II. Demonstrate quantitative problem-solving skills in all the topics covered.

**Background Reading (Review):** Origin of Quantum Mechanics:

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

#### **Unit I: The Schrodinger wave equation:**

**15 Lectures**

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

#### **Unit II: Applications of Schrodinger steady state equation- I**

**15 Lectures**

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

#### **Unit III: Applications of Schrodinger steady state equation –II**

**15 Lectures**

1. Potential barrier (Finite height and width) penetration and tunneling effect (derivation of approximate transmission probability), Application (STM and SEM).
2. Theory of alpha particle decay from radioactive nucleus.
3. Harmonic oscillator (one-dimension), correspondence principle.

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

### Reference Books:

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

### **RJSUPHY403: Applied Physics II**

**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 thermodynamics & its applications in physical situation.
- III. Learn about situations in low temperature.
- IV. Demonstrate tentative problem-solving skills in all above areas.

#### **Unit I: Digital Electronics**

**15 Lectures**

1. Background knowledge (devote one lecture at commencement):  
Binary number system , Arithmetic building blocks , Types of registers, 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, Unsigned binary numbers, Sign magnitude numbers , 2's complement, Converting to and from 2's complement representation , 2's complement arithmetic, The adder-subtractor (ignore IC specific diagrams )
2. RS Flip-Flops (only NOR gate latch, NAND gate latch) , Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop, Edge-Triggered J-K Flip-Flop, JK Master- Slave Flip-Flops, Bounce elimination switch
3. Types of registers: SISO, SIPO, PISO, PIPO [in this chapter the teacher should make all IC specific diagrams into general diagrams i.e. Ignore pin numbers and IC numbers]
4. Asynchronous counter -3 bit (ignore IC specific diagrams), Synchronous counter only mod 8, Decade Counters Mod5 and Mod10.

#### **Unit II: Communication Techniques\***

**15 Lectures**

1. Basics of Communication, Block diagram of communication system, Types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, base band and broad band communication.
2. Noise: Introduction, Internal and External noise, signal to noise ratio, noise figure, noise temperature.
3. Amplitude Modulation: Need of modulation, concept of modulation, AM waveform, Theory of AM techniques, Concept of side bands, Concept of sidebands, DSBSC, SSB technique, VSB technique, Generation of SSB and CSBSC signal, Demodulation principles. AM Receiver: TRF and super-heterodyne receiver.

4. Frequency Modulation: Definition, Mathematical representation, Frequency spectrum, Bandwidth and modulation index.
5. Digital Modulation Techniques: ASK, PSK, FSK  
Pulse Modulation Techniques: PAM, PWM, PPM, PCM.  
(To be discuss only at introductory level)
6. Antenna: Introduction, Antenna equivalent circuits, Isotropic radiator, Power gain of an antenna, Effective length and area of an antenna

**References:**

1. Digital Principles and Applications By Leach, Malvino, Saha 6<sup>th</sup> edn.
2. Digital Fundamentals by Thomas L Floyd 10<sup>th</sup> edn. (Additional Reading)
3. Modern Digital Electronics by R P Jain 4<sup>th</sup> edn. (Additional Reading)
4. Communication Electronics: Principles and applications by Louis E Frenzel 3rd edition TMH Publications.
5. Electronics Communication Systems by Kennedy

**Unit III: Introduction to Geophysics**

**15 Lectures**

1. Introduction to Geophysics its branches and relationship with other sciences.
2. Earth and solar system: Meteorites and other extra-terrestrial materials.
3. Age of Earth and various methods of determination. Planetary evolution of the Earth and its internal structure: Elastic waves and variation of physical and chemical properties in the interior of Earth.
4. Major tectonic features of the ocean oceanic and continental crust.
5. Continental drift – geological and geophysical evidence: mechanisms, objections and present status.
6. Gravity and magnetic anomalies at Mid-ocean ridges: deep sea trenches, continental shield areas and mountain chains.
7. Geomagnetism, elements of Earth's magnetism: Internal, external fields and their causes, Palaeomagnetism, Polar wandering paths and reversals, Seafloor spreading and Plate tectonics.
8. Seismic belts of the Earth: Seismicity and plate movements.
9. Geodynamics of the Indian plate.
10. Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources. Geophysical potential fields: Principles of Gravity and Magnetic methods.
11. Instrumentation, field procedures used in geophysical studies.
12. Problems.

**References:**

1. Geomagnetism: Solid Earth and Upper Atmosphere Perspectives. Nathani Basavaiah, Springer (2011).
2. Introduction to Applied Geophysics: Exploring the Shallow Subsurface. H.R. Burger, A.F. Sheehan and C.H. Jones. W.W. Norton, New York (2006).
3. Earth Science. E.J. Tarbuck, F.K. Lutgens and D. Tasa, Prentice & Hall (2005).
4. Mantle Plumes and Their Record in Earth History. K.C. Condie, Cambridge University Press, Cambridge, UK (2001)
5. The Magnetic Field of the Earth: Paleomagnetism, the Core, and the Deep Mantle. R.T. Merrill, M.W. McElhinny and P.L. McFadden, International Geophysical Series 63, Academic Press (1996).
6. Applied Geophysics (Paperback). W.M. Telford, L.P. Geldart and R.E. Sheriff, Cambridge University Press, Cambridge (1990).

**Additional References:**

1. Energy and Environment, 3rd Edition. Robert A. Ristinen and Jack P. Kraushaar, John Wiley and Sons, Inc. (2015).
2. Geomagnetism: Solid Earth and Upper Atmosphere Perspectives. Nathani Basavaiah, Springer (2011).
3. Textbook of Environmental Chemistry. BalaramPani, I.K. International Publishing House (2007).
4. A Textbook of Environmental Studies, 1/e. D.K. Asthana and Meera Asthana, S. Chand and Co. Publishing (2006).

**RJSUPHY4P: Practical course**

**Instructions:**

1. All the measurements and readings should be written with proper units in SI system only.
2. After completing all the required number of experiments in the semester and recording them.
3. Students will have to get their journal certified and produce the certified journal at the time of practical examination.
4. While evaluating practical, weight age should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
5. 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.

For practical examination the learner will be examined in the experiments (one from each group). Each experiment will be of two hour duration.

Minimum 4 from each group and in all minimum 12 experiments are required to be completed as a part of laboratory course.

Students are required to report regular experiments in the journal. Evaluation in viva voce will be based on regular 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.

**RJSUPHY4P01 (Group A)**

1. Optical lever: determination of  $\mu$
2. Cylindrical obstacle: determination of  $\lambda$
3. Fresnel's bi-prism: determination of  $\lambda$
4. Determination of Cauchy's constants.
5. R.P. of telescope.
6. Brewster's law: determination of  $\mu$
7. Determination of R.I. of liquid using laser

**RJSUPHY4P02 (Group B)**

1. Waveform generator using Op-Amp.
2. Half adder and full adder (7486, 7408, 7432)
3. Photoelectric effect.
4. Frequency response of CE amplifier
5. Op amp as a summing/difference amplifier

**RJSUPHY4P03 (Group C)**

1. R-S Flip flop
2. Study of MS-JK flip flop
3. Mod 2, 5, 10 counters
4. To study Amplitude Modulation
5. Frequency Shift Keying (FSK) using IC 555 or XR 2206
6. Determination of  $\lambda$  (wavelength) of Laser using Transmission Grating
7. Determination of sound absorption coefficient of a material
8. Binary Adder/Subtractor

**Demonstration Experiments**

1. Double refraction
2. Wave form generator using Op-amp

3. PC simulations: graph, curve fitting etc.
4. Straight edge Fresnel diffraction
5. Fibre Optics
6. DSO computational physics
7. Interferometer (Michelson's)
8. Polarimeter

**References:**

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