AC – 11/07/2022
Item No. 6.15 (R)

UNIVERSITY OF MUMBAI

Revised Syllabus for
F.Y.B.Sc.
(Physics)

Semester: I & II
(CBCS)

(With effect from the academic year 2022-23)

UNIVERSITY OF MUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course	F.Y.B.Sc. (Physics)
2	Eligibility for Admission	
3	Passing Marks	
4	Ordinances / Regulations (if any)	
5	No. of Years / Semesters	06 Semesters
6	Level	UG
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic Year	From Academic Year: 2022-2023

Date: Signature:

Name Dr. Anuradha Majumdar
Chairman of BOS of Physics Dean, Science and Technology

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

As per Choice Based and Credit System
First Year B.Sc 2022-2023

The revised syllabus in Physics as per Choice Based and Credit System for the First Year B.Sc Course will be implemented from the academic year 2022-2023.

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	
USPH101	Classical Physics	02
USPH102	Modern Physics	02
USPHPI	Practical I	02
		Total = 06
	Semester II	
USPH201	Optics I	02
USPH202	Electricity and Electronics	02
USPHPII	Practical II	02
		Total = 06

Scheme of Examination:

- Each theory paper of each semester will have 20% Internal Assessment (IA) and 80% External Assessment (EA). All external examinations will be held at the end of each semester and will be conducted by the University as per existing norms
- 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 (one from each group) 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 its skill and understanding of physics.

SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
USPH101	**Classical Physics**	2	

Learning Objectives:

1. Understand Newton's laws and applications in daily life.
2. Understand the concepts of friction
3. Understand Work and Energy Equivalence
4. Understand the concepts of Elasticity, Viscosity and Fluid dynamics
5. Understand behavior of real gases in relation to their thermo dynamical response.

Learning Outcomes:

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

1. Apply Newton's laws for the calculations of the motion of simple systems.
2. Use Work and Energy equivalence and its applications through suitable numerical.
3. Use Elasticity, Viscosity and Fluid dynamics in daily life.
4. Understand Real gases and validity of the laws of thermodynamics.
5. Demonstrate quantitative problem solving skills in all the topics covered

Unit I **15 Lectures**

1. Newton's Laws of Motion: 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)
HCV: 5.1 to 5.5

2. Friction: Advantages & disadvantages of friction in daily life, Friction as the component of Contact force, Kinetic Friction, Static friction, laws of friction, Understanding friction at Atomic level.
HCV: 6.1 to 6.5

3. Work and Energy: Kinetic Energy, Work and Work-energy theorem, Potential Energy, Conservative and Non Conservative Forces, Different forms of Energy: Mass Energy Equivalence
Worked out Examples
HCV**:** 8.1, 8.2, 8.5, 8.6, 8.11

Unit II **15 Lectures**

1. Elasticity: An introduction to Elasticity, Stress, Strain, Hooke's Law and Moduli of Elasticity and relation between them
HCV**:** 14.2, 14.3, 14.4, 14.5

2. Viscosity: An introduction to Viscosity, Flow through a Narrow Tube: Poiseuille's Equation, Stokes' Law, Terminal velocity, Measuring Coefficient of Viscosity by Stokes' method, Critical velocity and Reynolds number. Worked out Examples
HCV: 14.15, 14.16, 14.17, 14.18, 14.19, 14.20

3. Fluid Mechanics: Streamline and Turbulent flow, Equation of Continuity, Bernoulli's equation, Applications of Bernoulli's equation. Worked out Examples
HCV: 13.8, 13.10, 13.11, 13.12

Unit III **15 lectures**

1. Behavior of real gases: An introduction, Van der Waals equation of state
BSH: 2.8

2. Laws of Thermodynamics: Thermodynamic Systems, Zeroth law of thermodynamics, Concept of heat, Thermodynamic Equilibrium, Work: A Path dependent function, Internal energy, First law of Thermodynamics, Internal Energy as a state function, Specific heat of gases, Applications of First Law of thermodynamics, The indicator diagram, Work done during Isothermal and Adiabatic processes
BSH: 4.1 to 4.13

3. Heat engine: Definition of Efficiency of heat engine, Carnot's Ideal heat engine, and Numerical examples
BSH: 4.21, 4.22, 4.23

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

Main References:

1. HCV: H. C. Verma, Concepts of Physics – Part I, (Second Reprint of 2020) Bharati Bhavan Publishers and Distributers
2. BSH: BrijLal, Subrahmanyam and Hemne, Heat Thermodynamics and Statistical Physics, S. Chand , Revised, Multi-coloured, (Reprint 2019)

Additional References:

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley & Sons.
2. D.S Mathur, P.S Hemne, Mechanics, 2012, S. Chand
3. M. W Zemansky and R. H Dittman, Heat and Thermodynamics, McGraw Hill.
4. Thornton and Marion, Classical Dynamics (5th Ed.)
5. D. S Mathur, Element of Properties of Matter, S. Chand & Co.
6. R. Murugeshan and K. Shivprasath, Properties of Matter and Acoustics, S. Chand.
7. D. K Chakrabarti, Theory and Experiments on Thermal Physics,(2006 Ed.), Central books.
8. Hans and Puri, Mechanics, (2nd Ed.) Tata McGraw Hill

SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
USPH102	**Modern Physics**	2	

Learning Objectives:

1. To grasp and understand the basic concepts of Modern Physics

Learning Outcomes:

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

1. Understand nuclear properties, nuclear behavior and various types of nuclear reactions
2. Understand the concept of radioactivity, its applications and different types of equilibria in radioactive elements
3. Understand various types of nuclear detectors and their applications
4. Demonstrate and understand the quantum mechanical concepts.
5. Demonstrate quantitative problem solving skills in all the topics covered.

Unit I **15 Lectures**

1. Basic properties of nuclei: Composition, Charge, Size, density, Spin and Magnetic dipole moment, Rutherford's experiment and estimation of nuclear size , mass defect and binding energy, BE/A vs A plot and its interpretation, stability of nuclei (N vs Z plot)

Problems

AB: 11.1, 11.2, 11.3, 11.4

SBP: 4.1.2

2. Radioactivity: Review of properties of α, β and γ-rays.

Law of Radioactive decay, half-life and mean life (derivation required), units of radioactivity, statistical nature of radioactivity, successive radioactive disintegration- A to B to C (stable) type, natural radioactive series, radioactive equilibriums, artificial radioactivity, determination of the age of the Earth, Carbon dating, radioisotopes and its applications, radiation hazards.

Problems

SBP: 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.11, 2.12, 2.13

DCT: 2.13 Page No.86 and 87

AB: 12.1 Page No. 422,423

Additional Reference: https://dae.gov.in/node/191

Unit II **15 Lectures**

1. Radiation Detectors: Interaction between particles and matter, plot of variation of ionization current with applied voltage, Gas filled radiation detectors- Ionization chamber (qualitative), Proportional Counter and GM Counter

Problems

SBP: 1.I.1, 1.I.2, 1.I.3 (i, ii)

SNG: Figure: 7.3 (exclude mode of operation), 7.4

2. Nuclear Reactions: Introduction, types of nuclear reactions, conservation laws (mass, energy and charge), concept of compound and direct reaction, Q value equation and solution of the Q equation, threshold energy

Problems

SBP: 3.1, 3.2, 3.3, 3.4, 3.5

Unit III **15 Lectures**

Review (Photoelectric effect, Black body, Black Body spectrum, Wien's displacement law)

1. Origin of Quantum theory: Matter waves: De Broglie waves, Concept of wave packet, phase velocity, group velocity and relation between them, wave particle duality, Davisson-Germer experiment, Heisenberg's Uncertainty Principle

AB: 3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 3.9

2.X-Rays: Production and properties, X-Ray spectra, X-Ray Diffraction, Bragg's Law, Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift, Black holes

AB: 2.5, 2.6, 2.7, 2.8, 2.9

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

Main References:

1. AB: Arthur Beiser, Concepts of Modern Physics, 6th Edition

2. SBP: S.B. Patel, Nuclear Physics: An Introduction, New Age International Publishers, 2nd Edition

3. SNG: S.N, Ghoshal, Nuclear Physics

4. DCT: D.C. Tayal, Nuclear Physics, Himalaya Publishing House, 5th Edition

Additional References:

1. S.L Kakani and Shubhra Kakani, Nuclear and Particle Physics, Viva Books, 2nd Edition

2. Kenneth S. Krane, Modern Physics, 4th Edition, Wiley.

4. Ronald Gautreau, Schaum's Outline of Modern Physics, Second Edition, McGraw Hill

Besides reference books, Standard websites are expected to be referred

SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	**I**	**Physics**
Course Code	Title	Credits	
USPHP1	**Practical I**	2	

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 in journal, student will have to get their journal certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning Outcome:

1. On successful completion of this course students will be able to:
2. Understand & practice the skills while performing experiments.
3. Understand the use of apparatus and their use without fear & hesitation.
4. Correlate the physics theory concepts to practical application.
5. Understand the concept of errors and their estimation**.**

Note: Exemption of two experiments from section A and / or B and / or C may be given if student carries out any one of the following activity.

- Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study tour or visit & submit a study tour report.
- For practical examinations, the learner will be examined in two experiments (one from each group).
- Each experiment will be of three lecture hours' duration.

- A Minimum 4 from each group and in all minimum 8 experiments must be reported in 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 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 I as per the minimum requirements.

A. Regular Experiment:

Sr No	Name of the Experiment
	GROUP A
1	Torsional Oscillation: To determine modulus of rigidity η of a material of wire by Torsional oscillations
2	Bifilar Pendulum: Determination of moment of inertia of rectangular and cylindrical bar about an axis passing through its centre of gravity
3	Moment of inertial of Flywheel
4	Constant volume air thermometer
5	Frequency of AC Mains: To determine frequency of AC mains (Sonometer wire)
6	LDR Characteristics: To study the dependence of LDR resistance on intensity of light
	GROUP B
7	Study of Logic gates & To verify De Morgan's Theorems
8	To study EX-OR Gate and verify its truth table
9	To study half adder and full adder and verify their truth table Ex-OR Gate
10	To study load regulation of a Bridge Rectifier
11	To study Zener Diode as Regulator
12	Study of LASER Beam Divergence

GROUP C:Skill Experiment	
1	Use of Vernier Callipers, Micrometer Screw Gauge and Travelling Microscope
2	Graph plotting (Plot BE/A verses A graph for 30 atoms, Plot Packing Fraction graph for 30 atoms)
3	Spectrometer: Schuster's Method
4	To determine the Resistance & Capacitance using Color code/Number & verify using Multimeter (Analog/Digital)
5	Use of digital multimeter
6	Absolute and relative error calculation

Note: Minimum **8** experiments (Four From each group) and **4** Skill experiments should be completed and reported in the journal, in the first semester. **Certified Journal is a must,** to be eligible to appear for the semester end practical examination.

SEMESTER-II

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
USPH201	**Optics I**	2	

Learning Objectives:
To acquire knowledge of fundamental optics

Learning Outcomes:
After successful completion of the course, the student will be able to:

1. Understand the concept of lens, lens defects and their minimization.
2. Significance of combination of lenses implied to eyepiece of optical instrument.
3. Understand interference of light with few well known daily life examples.
4. Understand Lasers and Optical fibers, their applications in day to day life.

UI Geometrical Optics (15 lectures)

1. Lenses and Lens Maker's Equation: Introduction to lenses, Terminology and sign conventions, Introduction to Thin lenses and Lens equation for single convex lens, Lens maker's equation: Positions of the Principal Foci and Newton's Lens equation.
SBA: 4.1, 4.2, 4.3, 4.7, 4.8, 4.9, 4.10, 4.10.1, 4.11

2. Magnification by a lens and power of lens: Lateral, Longitudinal and Angular magnification, Deviation by a thin lens and its power, Necessity to combine the lenses & equivalent focal length & power of two thin lenses, Concept of cardinal points and their significance
SBA: 4.12, 4.12.1, 4.12.2, 4.12.3, 4.15, 4.16, 4.17, 4.17.1, 4.17.2, 4.17.3, 4.17.4, 5.2

3. Introduction to Aberration in lenses: Spherical aberration & reduction, chromatic aberration & reduction (Qualitative)
SBA: 9.2, 9.5, 9.5.1, 9.10
Suitable numerical with appropriate difficulty level.

U2 Introduction to Optical Instruments and Interference in Thin Films (15 lectures)

1. **Optical Instruments and Eyepieces**: Human Eye as an optical instrument, Camera and Lenses of Camera, Simple Microscope & Compound Microscope, Concept of eyepiece & its significance: Huygens Eyepiece and Ramsden Eyepiece (Principle, Construction, Expression for Equivalent Focal Length, Merits and Demerits), Comparison of Huygens Eyepiece and Ramsden Eyepiece, Gauss Eyepiece, Refracting Astronomical Telescope (Construction and Working), Reflecting Telescope (Qualitative)

SBA: 10.2, 10.3, 10.3.1, 10.5, 10.8, 10.10, 10.11, 10.12, 10.13, 10.14, 10.15, 10.15.1, 10.16

2. **Interference in Thin Films**: Interference due to reflected and transmitted light in plane thin films, Conditions for Maxima and Minima, Interference pattern in wedge-shaped film & Newton's rings

SBA: 15.1, 15.2, 15.2.1, 15.2.2, 15.5, 15.6

Suitable numerical with appropriate difficulty level.

U3 Lasers and Fiber Optics (15 lectures)

1. **An Introduction to LASERS**: Absorption and Emission, Spontaneous and Stimulated Emission, Components of laser, Ruby laser, He-Ne Laser, Laser Beam Characteristics, Applications of Laser

SBA: 22.1, 22.4.1, 22.4.2, 22.8, 22.8.1, 22.8.2, 22.8.3, 22.14.1, 22.14.3, 22.16, 22.19

2. **An Introduction to Optical Fiber**: Total Internal Reflection, Propagation of light through an Optical fiber, Numerical Aperture, Classification of Optical fibers, Single Mode Step Index Fiber, Multimode Step Index Fiber, Graded Index Fiber, Optical Fiber applications (Optical fiber based communication system & Optical Fiber based Temperature sensor)

SBA: 24.2, 24.3, 24.4, 24.6, 24.10, 24.11.1, 24.11.2, 24.11.3, 24.21, 24.23.1

Main Reference:

SBA: Dr. N. Subrahmanyam, Brijlal, and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012(Reprint 2016), S. Chand and Company Pvt. Ltd.

Additional References:

1. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International

2. Ajoy Ghatak, Optics, 6th Edition, Mc Graw Hill Education (India) Private Limited

SEMESTER II

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
USPH202	**Electricity and Electronics**	2	

Learning Outcomes:

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

1. Understand the basic concepts of Alternating current theory, AC bridges and Circuit Theorems
2. Understand the basics of Analog and Digital Electronics and apply them in real life situations
3. Demonstrate quantitative problem solving skills in all the topics covered

Unit I: Electricity **15 lectures**

1. **Alternating current theory**: (Review: Concept of L, R, and C)

AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits, Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q- Factor.

TT: 11.29, 11.30, 11.32, 12.5, 12.6, 13.1, 13.7, 13.9, 13.10, 13.11, 13.12, 13.13, 13.14, 13.17, 13.19, 14.2

2. **AC bridges**: General AC Bridge, Maxwell's Inductance Bridge, Maxwell's L/C Bridge, De Sauty Bridge, Wien Bridge.
(Bridge diagram, balancing condition derivation, applications)

TT: 16.1, 16.2, 16.3, 16.9, 16.11

3. **Circuit Theorems**: (Review: Ohm's law, Kirchhoff's laws) Ideal Current and Voltage Sources, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.
Problems related to circuit analysis using the above theorems.

TT: 2.15, 2.16, 2.18, 2.25, 2.30

Unit II: Analog Electronics **15 lectures**

1.**DC Power Supply**: Block diagram of a dc power supply – concept of a transformer,(Review: Half wave rectifier, Full wave rectifier) Bridge rectifier, PIV, Efficiency and Ripple factor of full wave rectifier, Capacitor Filter, Need for voltage regulation - Zener diode as voltage stabilizer, Clipper and Clampers (Basic diode based circuits only).

BN: 1.15, 2.6, 2.7, 2.8, 2.9, 2.10, 15.2, 15.3
AD: 4.2, 22.1

2. **Transistor dc Biasing**: (Review: transistor structure and characteristics), Definition of gains α, β (dc and ac) and relation between them, load line analysis, operating point, cut-off and saturation points, Inherent Variations of transistor Parameters, Stabilization, Necessity of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor or fixed bias, Emitter Bias and Voltage Divider Bias Methods(Qualitative Analysis only, No mathematical derivation) , Stability factor for Potential Divider Bias.

Transistor as a switch: circuit and working, Transistor as an Amplifier: CE, CB and CC modes, Practical circuit of an amplifier and its operation and phase reversal.

BN: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.2, 4.17, 4.18(Transistor Switch)

Unit III: Digital Electronics **15 lectures**

1. **Number Systems** – Binary number system: Binary to decimal and Decimal to binary conversion, Hexadecimal number system: Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion.

LMS: 5.1 to **5.5**

2. **Derived Gates** (Review: Basic Logic gates),NAND and NOR as Universal Building blocks, Ex-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications – Parity generator and checker, Half adder and Full adder.

LMS: 2.1, 2.2

Tokheim: 3.6, 3.8, 10.2, 10.3

3. **Boolean Algebra**: Boolean theorems, De-Morgan theorems, Sum of Product (SOP) and Product of sum (POS) methods, Simplification of logical expressions.

LMS: 3.1, 3.2, 3.7, 3.8

References:

1. TT: B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology Vol. I, S. Chand Publication

2. BN: R. L. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory - 10th Edition, Pearson

3. LMS: Leach, Malvino, Saha, Digital Principles and Applications – 6th Edition.Tata McGraw Hill

5. Tokheim: Digital Electronics, Principles and Applications, 6th Edition, McGraw Hill Edition.

6. AD: Albert Malvino, David Bates, Electronic Principles, 8th Edition, Tata McGraw Hill

SEMESTER-II

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	**II**	**Physics**
Course Code	Title	Credits	
USPHP2	**Practical II**	2	

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 in journal, student will have to get their journal certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning Outcome:

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

1. Understand & practice the skills while performing experiments.
2. Understand the use of apparatus and their use without fear & hesitation.
3. Correlate the physics theory concepts to practical application.
4. Understand the concept of errors and their estimation.

Note: Exemption of two experiments from section A and / or B and / or C may be given if student carries out any one of the following activity.

- Collect the information of at least five Physicists with their work or any three events on physics, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study tour or visit & submit a study tour report.
- For practical examinations, the learner will be examined in two experiments (one from each group).

- Each experiment will be of three lecture hours' duration.
- A Minimum 4 from each group and in all minimum 8 experiments must be reported in 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 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 II as per the minimum requirements.

A. Regular Experiment:

Sr No	Name of the Experiments
	GROUP A
1	Young's Modulus of a wire material by method of vibrations
2	Spectrometer: To determine of angle of Prism
3	Spectrometer: To determine refractive index of prism material
4	Combination of Lenses: To determine equivalent focal length of a lens system by magnification method
5	Newton’s Rings: To determine radius of curvature of a given convex lens using Newton's rings.
6	Determination of diameter of thin wire using Wedge Shaped Film
	GROUP B
7	To study NAND/NOR gates as Universal Building Blocks
8	LR Circuit: To determine the value of given inductance and phase angle
9	CR Circuit: To determine value of given capacitor and Phase angle
10	Transistor configurations : CB/CE/CC (study of input-output characteristics)

11	LCR series Resonance: To determine resonance frequency of LCR series circuit
12	To study Thermistor characteristics: Resistance vs. Temperature
GROUP C: DEMONSTRATION EXPERIMENT	
1	Radius of ball bearings (single pan balance)
2	Use of Oscilloscope: Wave forms at output of half wave , bridge rectifiers with and without Capacitor filter, Ripple
3	Use of PC for graph plotting
4	I-V Characteristics of LED
5	Testing of components (Resistors , Diode , Transistor , capacitor)
6	Study of I-V characteristics of solar cell

Note: Minimum **8** experiments (Four From each group) and **4** Demo experiments should be completed and reported in the journal, in the first semester. **Certified Journal is a must,** to be eligible to appear for the semester end practical examination.