

Guidebook

Foundation Course in Physics

Institute of Physics, Sri Lanka

October 2019

1. Institutional Background

The Institute of Physics, Sri Lanka (IPSL) is a professional body which was established in the year 1980 incorporated by act of Parliament No. 12 of 1986. IPSL is the apex body of physicists in Sri Lanka who work for the development of Physics and its applications to upgrade the quality of people. Main objective of the Institute is to promote and advance the science of Physics and its applications in Sri Lanka. The Institute represents the physicist of all the branches in Physics.

2. Introduction to the Course

Foundation course in Physics is offered for those who lack academic qualifications equivalent to that of Physics in A/L. Thus, this course is particularly suited for students who lack entry requirements for the Degree programmes in Universities.

3. Objectives of the Proposed Certificate Course

Main objective of the proposed Certificate Course is to upgrade the academic qualifications equivalent to that of Physics in A/L for those who need to improve their academic qualifications equivalent to Physics in A/L.

4. Medium of Instructions

Medium of instruction of the proposed certificate course will be English/Sinhala.

5. Eligibility for Admission to the Foundation course in Physics

A person seeking admission to the Foundation course in Physics of the Institute of Physics, Sri Lanka shall be required to have:

- 5.1 six passes at G.C.E. (O/L) examination, including passes in Science and Mathematics, or,
- 5.2 secured an equivalent or higher qualification acceptable to the Council of Institute of Physics, Sri Lanka.

6. Structure of the Certificate Course

Certificate Course consists of two 5 credit course and both are compulsory for the completion of the course. Academic programme operates on Semester System with two-semesters in an academic year and end of course examinations in each semester. The duration of a semester is 20 weeks. After 16 weeks of teaching, a study leave period of 2 weeks is given followed by end of course written examination. 1 credit equals 50 notional study hours.

7. Scheme of Assessment

- 7.1 The assessment of a student in both courses, shall consist of two components, Continuous Assessment and Final Examination.
- 7.2 The overall assessment mark of a student in respect of a course shall be computed based on the summation of 30% of Continuous Assessment mark and the 70% of Final Examination mark.
- 7.3 A student who fails to obtain a C grade or higher at the overall assessment mark in respect of any course, shall be deemed to have failed that course. Such a student may repeat that course by re-registering.

A+, A, A-, B+, B, B-, C+, and C, constitute Pass grades.

Range of Marks	Grade
85 - 100	A+
70 - 84	A
65-69	A-
60-64	B+
55-59	B
50-54	B-
45-49	C+
40-44	C
35-39	C-
30-34	D+
25-29	D
00- 24	E

7. Eligibility for the Award of Certificate for the Foundation course in Physics of the Institute of Physics, Sri Lanka

To be eligible for awarding the certificate for the Foundation course in Physics of the Institute of Physics, Sri Lanka a student must obtain overall C grades or better in both the courses.

8. Course Fees

The Fees payable for the course shall be determined by the Council of the Institute of Physics Sri Lanka.

Course fee is LKR 30,000 for the year 2019.

9. Detailed Syllabus

Course Code: PHY 2501

Course Title:Physics I

Learning Outcomes: At the end of the course, the students will be able to demonstrate basic understanding on fundamental concepts of physics in measurements mechanics, Waves and Vibrations, sound, optics heat and gravitational fields and skills in relevant applications and solving problems.

Course Content:

Measurement: Investigates physical quantities using dimensions. Takes measurements accurately by selecting appropriate instruments to minimize the error. Extracts information correctly by graphical representation of experimental data.

Mechanics: Linear motion, projectiles and relative motion of bodies, resultant force and moment of force to control linear motion and rotational motion of a body, Newton's laws of motion, conditions necessary to keep a body in equilibrium, rotational motion and circular motion, mechanical energy, fluids at, Fluid-dynamics.

Oscillations and Waves: Oscillations on the basis of physics, various types of wave motions and their uses, wave properties, modes of vibration of strings and rods, vibrations in air columns by manipulating the, Doppler effect, characteristics of sound, electromagnetic waves, Human eye, Refraction, Prisms, Lens, Optical instruments, Seismic waves and Tsunami.

Thermal Physics: Temperature, Thermal expansion, Gas laws, Kinetic theory of gases, Heat exchange, Changes of state, Vapor and humidity, Thermodynamics, Transfer of heat.

Gravitational Field: Gravitational force field, Earth's gravitational field.

Recommended Reading:

* Giancoli, D. C. (2013). Physics: Principles with Applications (7th Edition), Prentice Hall.

*Nelkon, M. and Parker P., Advanced Level Physics(7th Edition), CBS Publisher.

Course Code: PHY 2502

Course Title: Physics II

Learning Outcomes: At the end of the course, the students will be able to demonstrate basic understanding on fundamental concepts of physics in fields, electricity, Magnetism, electronics, properties of matter and matter and radiation and skills in relevant applications and solving problems.

Course Content:

Electrostatic Field: Electrostatic force, Flux model, Electric potential, Electric capacity (capacitance).

Magnetic field: Magnetic force, Magnetic force field, Torque acting on a current loop, Moving coil galvanometer, Direct current motor, Dynamo, Electromagnetic induction.

Current Electricity: Fundamental concepts, Energy and power, Electromotive force, Electric circuits, Electrical measuring instruments, Potentiometer, Electromagnetic induction-

Electronics: Junction diode, Transistor, Operational amplifier, Digital electronics.

Mechanical Properties of Matter: Elasticity of solids, Viscosity, Surface tension.

Matter and Radiation: Quantum nature of radiation, Photoelectric effect, Wave nature of matter, X-rays

Recommended Reading:

* Giancoli, D. C. (2013). Physics: Principles with Applications (7th Edition), Prentice Hall.

*Nelkon, M. and Parker P., Advanced Level Physics(7th Edition), CBS Publisher.

Method of Teaching and Learning: A combination of lectures and tutorial discussions.

Assessment: Continuous assessments and end of course written examination

Continuous Assessment: One hour written test at the end of each unit.

Final Examination: Three hours written test at the end of each Course.

Academic Calender

Activity	First Semester	Second Semester
Advertising	August	January
Commence	September	February
Activity Period	16 weeks	16 weeks
Study Period	2 weeks	2 weeks
Final Exams	January	July

Course Schedule and Teaching Panel

PHY2501- Physics I

Units	Week	Topics covered	Name of Lecturer *
Measurements	1	Units and dimensions	Mr. G H Asoka
	2	Measuring instruments and Errors of measurement	Mr. G H Asoka
Mechanics	3	Scalars and vectors, Linear, projectiles and relative motion	Dr. PKDDP Pitigala
	4	Resultant force and moment of force, Newton's laws,	Dr. PKDDP Pitigala
	5	Body in equilibrium, Work, energy and power	Dr. PKDDP Pitigala
	6	Rotational motion and circular motion	Dr. PKDDP Pitigala
	7	Fluids at rest and Fluid-dynamics	Dr. PKDDP Pitigala
Oscillations and Waves	8	Simple harmonic motion, Mechanical waves, Properties of waves	Prof. V.P.S. Perera
	9	Modes of vibration of strings and air columns, Doppler effect,	Prof. V.P.S. Perera
	10	Characteristics of sound, electromagnetic waves	Prof. V.P.S. Perera
	11	Refraction of light through a prism, and thin lenses, Human eye	Prof. KPS Chandana Jayaratne
	12	Simple & Compound microscope, Astronomical telescope	Prof. KPS Chandana Jayaratne
Thermal Physics	13	Thermometry and Thermal expansion, Gas laws,	Prof. V.P.S. Perera
	14	Kinetic theory of gases, Heat exchange, Changes of state,	Prof. V.P.S. Perera
	15	Vapor and humidity, Thermodynamics, Transfer of heat	Prof. V.P.S. Perera
Gravitational Field	16	Gravitational force field, Gravitational field	Prof. V.P.S. Perera

PHY2502- Physics II

Units	Week	Topics covered	Name of Lecturer
Electrostatic Field	1	Electrostatic force, Coulomb's law, Electric field intensity	Dr. Aruna Wanninayake
	2	Electric flux, Gauss's theorem,	Dr. Aruna Wanninayake
	3	Electric potential, Electric capacitance	Dr. Aruna Wanninayake
Magnetic fields	4	Magnetic force, Fleming's left hand rule	Dr. Aruna Wanninayake
	5	Magnetic field, Biot –Savart law, Maxwell's corkscrew rule	Dr. Aruna Wanninayake
	6	Torque on a current loop, Moving coil galvanometer, Direct current motor	Dr. Aruna Wanninayake
Current Electricity	7	Fundamental concepts, Superconductivity, Ohm's law, Energy and power,	Dr. U.S. Rahubadde
	8	Electromotive force, Kirchhoff's laws, Electrical measuring instruments,	Dr. U.S. Rahubadde
	9	Electromagnetic induction, Faraday's law, Lenz's law, Fleming's right hand rule	Dr. U.S. Rahubadde
	10	Alternating current generator, Eddy currents, Back e.m.f., Transformers	Dr. U.S. Rahubadde
Electronics	11	Semiconductors, Diodes, Transistors	Dr. G.D. Illeperuma
	12	Action of a bipolar transistor, Unipolar transistor, Operational amplifier	Dr. G.D. Illeperuma
	13	Digital electronics, logic gates, Logic expressions, SR flip-flop	Dr. G.D. Illeperuma
Properties of Matter	14	Elasticity of solids, Stress-strain, Hooke's law, Viscosity, Poiseuille's equation, Stokes' law	Prof. V.P.S. Perera
	15	Surface tension, Angle of contact, surface energy, Capillary rise	Prof. V.P.S. Perera
Matter and Radiation	16	Black body radiation, Stefan's law, Photoelectric effect, Wave nature of matter, X – rays	Prof. KPS Chandana Jayaratne

Practical Schedule

	Time	Practical
Day 1	9.00 – 12.00	<ol style="list-style-type: none"> 1. Usage of the Vernier calipers 2. Usage of the micrometer screw gauge 3. Usage of the spherometer 4. Usage of the travelling microscope 5. Verification of the law of parallelogram of forces and using it to determine the mass of a body
	12.00 – 13.00	Lunch
	13.00 – 16.00	<ol style="list-style-type: none"> 6. Determination of the mass of a body using the principle of moments 7. Determination of the relative density of a liquid using the U tube 8. Determination of the relative density of a liquid using Hare's apparatus
Day 2	9.00 – 12.00	<ol style="list-style-type: none"> 9. Determination of the density of a liquid using a weighted test tube 10. Determination of the acceleration due to gravity using the simple pendulum 11. Verification of the relationship between the mass of a body suspended from a helix spring and its period of oscillation 12. Determination of the frequency of a tuning fork using the sonometer
	12.00 – 13.00	Lunch
	13.00 – 16.00	<ol style="list-style-type: none"> 13. Verification of the relationship between the frequency of a stretched string and its vibrating length using the sonometer 14. Determination of the velocity of sound using a closed resonance tube and a tuning fork and also determination of the end correction of the tube 15. Determination of the velocity of sound in air using a closed resonance tube and a set of tuning forks and also determination of the end correction of the tube 16. Determination of the refractive index of glass using the travelling microscope and a block of glass
Day 3	9.00 – 12.00	<ol style="list-style-type: none"> 17. Determination of the angle of minimum deviation of a prism by observing the variation of deviation in a ray caused by the prism 18. Determination of the refractive index of the material of a prism by the critical angle method 19. Adjustment of a spectrometer and using it for determination of the refracting angle of a prism 20. Determination of the angle of minimum deviation of a prism and the refractive index of the material of the prism using the spectrometer
	12.00 – 13.00	Lunch
	13.00 – 16.00	<ol style="list-style-type: none"> 21.1. Location of the images formed by a convex lens by the method of no-parallax and hence determination of the focal length of the lens

		<p>21.2. Location of the images formed by concave lens by the method of no-parallax and hence determination of the focal length of the lens</p> <p>22. Determination of the atmospheric pressure using the quill tube</p> <p>23. Verification of the relationship between the volume and the temperature of a gas at constant pressure</p> <p>24. To verify the relationship between the pressure and the absolute temperature of a gas at constant level</p>
Day 4	9.00 – 12.00	<p>25. Determination of the specific heat capacity of a solid substance by the method of mixtures</p> <p>26. Determination of the specific heat capacity of a liquid by the method of cooling</p> <p>27. Determination of specific latent heat of fusion of ice by the method of mixtures</p> <p>28. Determination of the specific latent heat of vaporization of water by the method of mixtures</p>
	12.00 – 13.00	Lunch
	13.00 – 16.00	<p>29. Determination of relative humidity of air using a polished calorimeter</p> <p>30. Determination of the thermal conductivity of a metal by Searle's method</p> <p>31. Determination of the internal resistance and the electromotive force of a dry cell</p> <p>32. Determination of temperature coefficient of resistance of a metal (Cu) using the Meter Bridge</p>
Day 5	9.00 – 12.00	<p>33. Comparison of electromotive forces of two cells using the potentiometer</p> <p>34. Determination of the internal resistance of a cell using the potentiometer</p> <p>35. Construction of the I-V curve for a forward biased semiconductor diode</p> <p>36. Construction of the transfer characteristic curve between I_B and I_C of a transistor in common emitter configuration</p> <p>37. Experimental investigation of the truth tables of simple fundamental logic gates and hence identification of the given gates</p>
	12.00 – 13.00	Lunch
	13.00 – 16.00	<p>38. Determination of the Young's modulus of a metal (steel) in the form of a wire</p> <p>39. Determination of the coefficient of viscosity of a liquid (water) by capillary flow method using Poiseuille's formula</p> <p>40. Determination of the surface tension of water using a microscope slide</p> <p>41. Determination of the surface tension of water by capillary rise method</p> <p>42. Determination of the surface tension of a liquid by Jaeger's method</p>