# 14. DETAILED SYLLABUS

## University of Kerala

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| Discipline | **PHYSICS** |
| Course Code | **UK1DSCPHY100** |
| Course Title | **FOUNDATION COURSE IN PHYSICS-I** |
| Type of Course | **DSC** |
| Semester | **I** |
| Academic Level | **100 - 199** |

| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours/Week |
|---|---|---|---|---|---|
| | 4 | 3 Hrs | - | 2 Hrs | 5 Hrs |

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| Pre-requisites | - |
| Course Summary | This course discusses basic foundation concepts in Physics. Simple mathematical tools required for understanding Physical concepts are discussed in the first module. Motion of objects is explained on the basis of Newton's laws followed by the discussion on work and energy. Study on rotational dynamics reveals the concept of angular momentum and its significance in rigid bodies. The discussion on oscillations will help to understand simple harmonic motion and its applications in pendulum. |

**BOOKS FOR STUDY**:

1. Introduction to Electrodynamics, David J Griffiths, Prentice Hall
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. Introduction to Mechanics, Daniel Kleppner and Robert Kolenkow Second Edition, Mc Graw Hill Education, 2017.
4. Mechanics, J C Upadhyaya, Ramprasad Publications
5. Principles of Physics 10th Edition, Robert Resnick, Jearl Walker, David Halliday, Wiley, 2014.

## BOOKS FOR REFERENCE:

1. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
2. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004
3. Principles of Physics: P.V. Naik, PHI,

## DETAILED SYLLABUS: THEORY

| Module | Unit | Content | Hrs | CO No |
|--------|------|---------|-----|-------|
| | | **LANGUAGE OF PHYSICS** <br> **(Book 1: Chapter 1 )** | 9 | |
| I | 1 | Vector algebra - vector operations, component form, triple products, | 3 | 1 |
| | 2 | Gradient, the operator $\nabla$, the divergence, the curl, product rules | 4 | 1 |
| | 3 | Integral calculus: line, surface and volume integrals | 1 | 1 |
| | 4 | Gauss's divergence theorem and Stokes's theorem (statements only) | 1 | 1 |
| | | **LAWS OF MOTION** <br> **(Book 2: Chapter 4 & 8)** | 9 | |
| II | 5 | Newton's first law, law of inertia - Inertial frame of reference | 2 | 2 |
| | 6 | Newton's second law- Mass and Force | 1 | 2 |
| | 7 | Mass and weight- Variation of g with location, measuring mass and weight | 2 | 3,5 |
| | 8 | Newton's third law | 1 | 2 |
| | 9 | Momentum and impulse - Newton's second law in terms of Momentum, The impulse-momentum theorem | 2 | 2 |
| III | | **DYNAMICS OF MOTION- WORK AND ENERGY** <br> **(Book 2: Chapter 6 & 7)** | 9 | |
| | 10 | Work, Kinetic energy and work - energy theorem | 1 | 2,5 |
| | 11 | Work and energy with varying forces- Straight line motion, Motion along a curve, Power | 2 | 2,5 |
| | 12 | Gravitational Potential energy, elastic Potential energy | 3 | 2 |

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|---|---|---|---|---|
| | 13 | Conservative and non-conservative forces, Law of Conservation of energy | 2 | 3,5 |
| | 14 | Force and potential energy | 1 | 2,5 |
| IV | | **DYNAMICS OF ROTATION AND ANGULAR MOMENTUM** (Book 2, Book 3 and Book 4) | 9 | |
| | 15 | Torque, Angular acceleration, Rigid body rotation about a moving axis | 4 | 2 |
| | 16 | Combined translation and rotation-energy relations, rolling without slipping. Rolling friction, work and power in rotational motion (Book2: Chapter 10) | 4 | 4,5 |
| | 17 | Angular momentum of a particle, fixed axis rotation-Moment of Inertia (ring, Disc, Stick), The Parallel axis theorem, dynamics of fixed axis rotation | 3 | 4,5 |
| V* | | **UNDERSTANDING OSCILLATIONS** (Book 6, Book 2) | 9 | |
| | 18 | Simple Harmonic motion, Energy in Simple Harmonic motion (Book6, Chapter 15) | 3 | 6 |
| | 19 | mass on a spring - oscillation of two particles connected by a spring (Book 2, Chapter 9) | 2 | 6 |
| | 20 | compound pendulum - interchange ability of suspension and oscillation points-collinear points-conditions for maximum and minimum periods (Book 2, Chapter 9) | 4 | 6 |

## DETAILED SYLLABUS: PRACTICALS

| Part A – At least 5 Experiments to be performed | | CO No |
|---|---|---|
| **Sl No** | **Name of Experiment** | |
| 1 | Compound Bar Pendulum – Symmetric | 6 |
| 2 | Compound Bar Pendulum – Asymmetric. | 6 |
| 3 | Determination of moment of inertia of fly wheel | 4, 6 |
| 4 | Helical spring- Spring constant | 2, 6 |

| 5 | Show that the period of oscillation of a simple pendulum is independent of the mass of the bob used. | 6 |
|---|---|---|
| 6 | Establish the relationship between length and period of a simple pendulum. | 6 |
| **Part B* – At least One Experiment to be performed** | | |
| 7 | Inclined plane - determine the downward force, along an inclined plane | 1, 2 |
| 8 | Concurrent forces - determination of unknown mass | 1, 2 |
| 9 | Concurrent forces - parallelogram law verification | 1, 2 |

## COURSE OUTCOMES

| No. | Upon completion of the course the graduate will be able to | Cognitive Level | PSO addressed |
|---|---|---|---|
| CO-1 | Discuss the basic mathematical tools used to manipulate vectors and associated problems | U, Ap | 1, 2, 4 |
| CO-2 | Recall Newton's laws of motion and describe basic concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion. | R, U | 1, 2 |
| CO-3 | Use the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail. | R, U | 1, 2 |
| CO-4 | Describe the concept of moment of inertia and use it to objects having different shapes | R, U, Ap | 1, 2, 7 |
| CO-5 | Solve numerical problems related to motion of objects | U, Ap | 1, 2 |
| CO-6 | Relate the concept of simple harmonic motion with periodic movement of objects | U, Ap | 1, 2, 7 |

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: FOUNDATION COURSE IN PHYSICS-I**

**Credits: 3:0:1 (Lecture:Tutorial:Practical)**

| CO No. | CO | PSO / PO | Cognitive Level | Knowledge Category | Lecture (L)/ Tutorial (T) | Practical (P) |
|---|---|---|---|---|---|---|
| CO-1 | Discuss the basic mathematical tools used to manipulate vectors and associated problems | PSO 1, 2, 4/ PO 1, 2 | U, Ap | F, C | L | P |
| CO-2 | Recall Newton's laws of motion and describe basic concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion. | PSO 1, 2/ PO 1, 2 | R, U | F, C | L | - |
| CO-3 | Use the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail. | PSO 1, 2/ PO 1, 2 | R, U | F, C | L | - |
| CO-4 | Describe the concept of moment of inertia and use it to objects having different shapes | PSO 1, 2/ PO 1, 2 | R, U, Ap | F, C, P | L | P |
| CO-5 | Solve numerical problems related to motion of objects | PSO 1, 2, 7/ PO 1, 2 | U, Ap | F, C | L | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| CO-6 | Relate the concept of simple harmonic motion with periodic movement of objects | PSO 1, 2, 7/ PO 1, 2, 3, 6 | U, Ap | F, C, P | L | P |

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

## Mapping of COs with PSOs and POs :

| | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-1 | 3 | 2 | - | 1 | - | - | - | 1 | 3 | - | - | - | - | - | - |
| CO-2 | 3 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | - | - |
| CO-3 | 3 | 2 | - | - | - | - | - | 2 | 3 | - | - | - | - | - | - |
| CO-4 | 2 | 1 | - | - | - | - | - | 1 | 2 | - | - | - | - | - | - |
| CO-5 | 2 | 3 | - | - | - | - | 1 | 2 | 3 | - | - | - | - | - | - |
| CO-6 | 2 | 2 | - | - | - | - | 2 | 3 | 2 | 1 | - | - | 2 | - | - |

## Correlation Levels:

| Level | - | 1 | 2 | 3 |
|---|---|---|---|---|
| Correlation | Nil | Slightly / Low | Moderate / Medium | Substantial / High |

## Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics :**

| CO No | Internal Exam | Assignment | Project Evaluation | End Semester Examinations |
|-------|:---:|:---:|:---:|:---:|
| CO-1 | ✓ | - | - | ✓ |
| CO-2 | ✓ | - | - | ✓ |
| CO-3 | ✓ | - | - | ✓ |
| CO-4 | ✓ | ✓ | - | ✓ |
| CO-5 | ✓ | - | - | ✓ |
| CO-6 | ✓ | ✓ | - | - |