Appendix-LXI
Resolution No. 18 [18-1(18-1-3)]

UNIVERSITY OF DELHI

B.SC. IN PHYSICAL SCIENCES

(SEMESTER-I)

based on

Undergraduate Curriculum Framework 2022 (UGCF)
(Effective from Academic Year 2022-23)

University of Delhi

B.Sc. in Physical Sciences

Semester –I
DSCs:-

Course Title	Nature of the Course	Total Credits	Components			Eligibility Criteria/ Prerequisite	Contents of the course and references may be seen at
			L	T	P		
Mechanics	Physics DSC-1	4	2	0	2		Annexure – I
	Chemistry-1 DSC-1						
	Mathematics-1 DSC-3						

GE-1: Pool A (Pool for Odd Semester)

Course Title	Nature of the Course	Total Credits	Components			Eligibility Criteria/ Prerequisite	Contents of the course and references may be seen at
			L	T	P		
Mechanics	Physics GE-01	4	3	0	1		**Same Annexures as GE Courses of B.Sc. (H) Physics**
Mathematical Physics	Physics GE-02	4	3	1	0		
Waves and Optics	Physics GE-03	4	3	0	1		
Introduction to Electronics	Physics GE-04	4	2	0	2		
Solid State Physics	Physics GE-05	4	3	1	0		
Introductory Astronomy	Physics GE-06	4	3	1	0		
Biological Physics	Physics GE-07	4	3	1	0		
Numerical Analysis and Computational Physics	Physics GE-08	4	2	0	2		
Applied Dynamics	Physics GE-09	4	3	1	0		
Quantum Information	Physics GE-10	4	3	1	0		

Contents of the course and reference are enclosed.

DISCIPLINE SPECIFIC CORE (DSC) COURSES

SEMESTER I

Course Code: PHYSICS DSC 1

Course Title: MECHANICS

Total Credits: 04 (Credits: Theory: 02, Practical: 02)

Total Hours: Theory: 30, Practical: 60

Course Objectives: This course reviews the concepts of mechanics learnt at school from a more advanced perspective and goes on to build new concepts. It begins with dynamics of a system of particles and ends with the special theory of relativity. Students will appreciate the concept of rotational motion, gravitation and oscillations. The students will be able to apply the concepts learnt to several real world problems.

Course Learning Outcomes: Upon completion of this course, students are expected to understand the following concepts.

- Laws of motion and their application to various dynamical situations.
- Conservation of momentum, angular momentum and energy. Their application to basic problems.
- Particle collision (elastic and in-elastic collisions)
- Motion of simple pendulum
- Postulates of special theory of relativity, inertial and non-inertial frame of reference and their transformation, relativistic effects on the mass and energy of a moving body.

In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier calliper and travelling microscope) student shall embark on verifying various principles and associated measurable quantities.

The pre-requisite for this course is Physics and Mathematics syllabus of class XII.

THEORY (Credit: 02; 30 Hours)

Unit 1: Review of vectors and ordinary differential equation **Hours: 4**

Gradient of a scalar field, divergence and curl of vectors field, polar and axial vectors
Second order homogeneous ordinary differential equations with constant coefficients (Operator Method Only).

Unit 2: Fundamentals of Dynamics **Hours: 7**

Dynamics of a system of particles, centre of mass, determination of centre of mass for discrete and continuous systems having spherical symmetry

Conservation of momentum and energy, Conservative and non-Conservative forces, work – energy theorem for conservative forces, force as a gradient of potential energy. Particle collision (Elastic and in-elastic collisions)

Unit 3: Rotational Dynamics and Oscillatory Motion **Hours: 8**

Angular momentum, torque, conservation of angular momentum, Moment of inertia, Theorem of parallel and perpendicular axes (statements only). Calculation of moment of inertia of discrete and continuous objects (1-D and 2-D).

Idea of simple harmonic motion, differential equation of simple harmonic motion and its solution, Motion of simple pendulum, damped harmonic oscillator

Unit 4: Gravitation **Hours: 3**

Newton's Law of Gravitation, Motion of a particle in a central force field. Kepler's Laws (statements only).

Unit 5: Special Theory of Relativity **Hours: 8**

Frames of reference, Gallilean transformations, inertial and non-inertial frames, Michelson Morley's Experiment, postulates of special theory of relativity, length contraction, time dilation, relativistic transformation of velocity, relativistic variation of mass.

References:

Essential Readings:

1) Vector Analysis – Schaum's Outline, M.R. Spiegel, S. Lipschutz, D. Spellman, 2nd Edn., 2009, McGraw- Hill Education.
2) An Introduction to Mechanics (2/e), Daniel Kleppner and Robert Kolenkow, 2014, Cambridge University Press.
3) Mechanics Berkeley Physics Course, Vol. 1, 2/e: Charles Kittel, et. al., 2017, McGraw Hill Education
4) Mechanics, D. S. Mathur, P. S. Hemne, 2012, S. Chand.
5) Intermediate Dynamics, Patrick Hamill, 2010, Jones and Bartlett Publishers.

Additional Readings:

1) Feynman Lectures, Vol. 1, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
2) University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
3) University Physics, H. D. Young, R. A. Freedman, 14/e, 2015, Pearson Education.
4) Fundamentals of Physics, Resnick, Halliday and Walker 10/e, 2013, Wiley.
5) Engineering Mechanics, Basudeb Bhattacharya, 2/e, 2015, Oxford University Press.
6) Physics for Scientists and Engineers, Randall D Knight, 3/e, 2016, Pearson Education.

PRACTICAL (Credit: 02; 60 Hours)

The teacher is expected to give basic idea and working of various apparatus and instruments related to different experiments. Students should also be given knowledge of recording and analysing experimental data.

Every student should perform at least 06 experiments from the following list.

1) Measurement of length (or diameter) using vernier calliper, screw gauge and travelling microscope.
2) Study the random error in observations.
3) Determination of height of a building using a sextant.
4) Study of motion of the spring and calculate (a) spring constant and, (b) acceleration due to gravity
5) Determination of moment of inertia of a flywheel.
6) Determination of g and velocity for a freely falling body using digital timing technique.
7) Determination of modulus of rigidity of a wire using Maxwell's needle.
8) Determination of elastic constants of a wire by Searle's method.
9) Determination of value of g using bar pendulum.
10) Determination of value of g using Kater's pendulum.

References (for Laboratory Work):

1) Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
2) Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3) Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4) A Textbook of Practical Physics, I. Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.
5) B. Sc. Practical Physics, Geeta Sanon, R. Chand and Co., 2016.