

DEPARTMENT OF PHYSICS				CLASS: I B.Sc. Physics				
Sem.	Course type	Course code	Course title	Credits	Contact hours/week	CIA	Ext	Total
I	Major Core- 2	20U1PMC2	MECHANICS	3	3	25	75	100

Course Objectives:

The students will be able to

1. Understand the fundamental ideas on conservation laws and its applications
2. Learn the basic ideas of rotational and vibrational motion of rigid bodies.
3. Expose the concepts of Gravitational fields and some idea about fluid mechanics.

Unit-I: Laws of Motion

Laws of conservation of energy – Work energy theorem – Potential energy – Conservative and non conservative forces – Linear momentum and its conservation – Collision – Elastic and inelastic collision – Newton's law of impact – Coefficient of restitution – Direct impact between two smooth spheres – Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to direct impact of two smooth spheres.

Self Study: work done by spring force, potential energy curve, Loss of K.E due to Oblique impact of two smooth spheres.

Audit: work done by gravitational force, Oblique impact of a smooth sphere on a fixed plane.

Unit-II: Dynamics of Rigid body

Moment of inertia – Theorems of perpendicular and parallel axes – M.I of a circular ring, disc, solid sphere – Compound pendulum – theory – equivalent simple pendulum – reversibility of points of oscillation and suspension.

Self study: Moment of Inertia of a hollow sphere, Determination of g and k using compound pendulum.

Audit: Moment of Inertia of a hollow cylinder.

Unit-III: Gravitation

Newton's law of gravitation – Kepler's laws of motion – G by Cavendish's method – Acceleration due to gravity. Gravitational field – Gravitational potential – Gravitational potential and field due to spherical shell – Gravitational potential and field due to a solid sphere (inside and outside).

Self study: Variation of g with altitude, depth and rotation of earth. Value of g at poles and equator.

Audit: Mass and density of earth

Unit-IV: Central Force Motion

Angular velocity, Kinetic energy of a rotating body – Angular momentum and its conservation – Torque and angular acceleration – Relation between torque and angular momentum – Expression for acceleration of a body rolling down an inclined plane without slipping – Center of mass – Motion of velocity and acceleration of centre of mass – System of variable mass – Rocket motion

Self study: acceleration of centre of mass, determination of motion of individual particle.

Audit: Satellite.

Unit-V: Statics and Hydrodynamics

Friction – Laws of friction – Angle of friction – Cone of friction – Hydrodynamics – Equation of continuity – Energy of a liquid – Euler's equation for unidirectional flow – Bernoulli's theorem – statement and proof – Applications – Venturimeter – Wings of an aeroplane – Torricelli's theorem.

Self study: Pitot's tube.

Audit: Centre of pressure, vertical rectangular lamina

Books for Study

1. D.S.Mathur and P.S. Hemne , Mechanics , 2012, S.Chand& Co.,

Unit I: 5.1, 5.2, 5.3, 5.4, 5.10, 6.1.

Unit IV: 6.2, 6.3, 6.12

2. Brijlal& N. Subramaniam , Properties of matter , 2001 , S.Chand&Co.Ltd

Unit II: 3.1, 3.2, 3.9(a), 3.10, 3.16, 3.17, 3.20, 5.11 – 5.14.

Unit III: 5.2, 5.4, 5.6, 5.9, 5.22, 5.23, 5.25, 5.26.

Unit IV: 3.3 , 3.4 , 3.5 , 3.6 , 3.28.

3. R.Murugesan , Properties of Matter, 2017 , S. Chand & Co.

Unit I – 8.1 , 8.2 , 8.4 , 8.5 , 8.6 .

Unit IV – 10.5, 10.9.

Unit V – 22.1, 22.2, 22.3, 4.1, 4.2, 4.3, 4.4.

4. Sear's and Zemansky's "University Physics with Modern Physics ", Hugh D.Young and Roger A. Freedman, 14th edition , 2017 Pearson India Education Services Pvt.Ltd.

Applications :Unit I: Examples 6.1 , 6.2 , 6.3 , 6.5 , 6.9 , 6.10 , 8.2 , 8.3 , 8.4 , 8.6 , 8.9 , 8.10
(Pages 197–206, 213–215, 262 – 278)

Unit II: Examples 9.7 , 9.9 (Pages 307–313)

Unit III : Examples 13.1 , 13.2 , 13.3 , 13.4 , 13.6 , 13.8. (Pages 422 – 437).

Unit IV: Examples 8.13 , 8.15 , 8.16 , 10.4 , 10.8 , 10.9 , 10.10 , (Pages 278 – 284 , 333 – 345 ,).

Unit V: Examples 12.6 , 12.7 , 12.8 (Pages 166–171 , 403 –409)

Books for References

1. Narayanamoorthy, Mechanics , Part I and II , National Publishing Company.
2. P. Duraipandian, LaxmiDuraipandian, MuthamizhJayapragasam, Mechanics, reprint 2018, S.Chand& Co. Ltd.
3. D. Halliday, R.Rensick and J. Walker, Fundamentals of Physics , 6th edition, 2001,Wiley Eastern Limited.
4. Paul G. Hewitt *CONCEPTUAL PHYSICS*, tenth edition, 2015 , Pearson Education, Inc. and Dorling Kindersley Publishing Inc.

Web Resources

Work energy theorem:

1. <https://www.texasgateway.org/resource/work-energy-theorem>
2. https://realizeengineering.files.wordpress.com/2013/10/5eplannod8_work-energy.pdf
3. <https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering-dynamics-fall-2011>.
4. https://realizeengineering.files.wordpress.com/2013/10/5eplannod3_workenergy.pdf

Elastic and inelastic collision:

5. https://en.wikipedia.org/wiki/Elastic_collision.
6. <http://vlab.amrita.edu/?sub=1&brch=74&sim=189&cnt=1>
7. <http://vlab.amrita.edu/?sub=1&brch=74&sim=197&cnt=1>
8. <https://sciencing.com/mechanics>

Central force:

9. <https://byjus.com/physics/central-force/>

Momentum:

10. https://realizeengineering.files.wordpress.com/2014/03/5eplannod9_impulsemomentum_methods.pdf
11. <https://www.britannica.com/science/mechanics/Rigid-bodies>
12. <https://www.real-world-physics-problems.com/physics-of-bowling.html>

Torque and acceleration:

13. <http://vlab.amrita.edu/?sub=1&brch=74&sim=1517&cnt=1>

Bernoulli's theorem:

14. <http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-3-Physics-Vol-1/Fluid-Mechanics-Real-life-applications.html5>
15. <https://realizeengineering.files.wordpress.com/2013/10/5eplannof4dynamics-of-fluid-motion1.pdf>

Course Designers:

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2. Dr. M.Revathi
3. Mr. S.Ramakrishnan

Lecture Schedule

Unit	Topics	Hours	Mode
Unit I	Laws of conservation of energy, work energy theorem, potential energy, conservative and non conservative forces	2	PPT, Chalk and talk, Quiz and assignment
	Linear momentum and its conservation, Collision, Elastic and inelastic collision, Newton's law of impact, coefficient of restitution	2	
	Direct impact between two smooth spheres, Calculation of final velocities of the spheres and problems	2	
	Oblique impact between two smooth spheres Calculation of final velocities of the spheres and problems	1	
	Loss of K.E due to direct impact of two smooth spheres and problems discussion	2	
Unit II	Rigid body, Moment of inertia	1	Chalk and talk, Quiz and assignment
	Theorems of perpendicular and parallel axes	2	
	M.I of a circular ring, disc, solid sphere and problems	2	
	Compound pendulum, theory	2	
	Equivalent simple pendulum – reversibility of points of oscillation and suspension.	2	
Unit III	Newton's law of gravitation, Kepler's laws of motion and problems	3	Chalk and talk, Quiz, assignment and seminar
	G by Boy's method	1	
	Acceleration due to gravity, Gravitational field, Gravitational potential	1	
	Gravitational potential and field due to spherical shell (inside and outside).	2	
	Gravitational potential and field due to a solid sphere (inside and outside).	2	
Unit IV	Angular velocity, Kinetic energy of a rotating body, angular momentum and its conservation	2	Chalk and talk, quiz, Group discussion
	Torque and angular acceleration, Relation between torque and angular momentum	2	
	Expression for acceleration of a body rolling down an inclined plane without slipping and problems	1	
	Center of mass, motion of velocity and acceleration of centre of mass	2	
	system of variable mass, Rocket motion	2	
Unit V	Friction, laws of friction, angle of friction and cone of friction and problems	2	PPT, Chalk and talk, Quiz and Interaction
	Hydrodynamics, Equation of continuity, Energy of a liquid	1	
	Euler's equation for unidirectional flow, Bernoulli's theorem, statement and proof	3	
	applications, Venturimeter	1	
	wings of an aeroplane, Torricelli's theorem and problem discussion	2	

Pedagogy

Chalk and talk , materials, PPT, Quiz , Assignment , Seminar , Problem solving , Group discussion , interaction and field visit.

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Use work energy theorem to physical systems.	UptoK3
CLO 2	Apply rigid body dynamics to propeller design and in biological systems.	UptoK3
CLO 3	Analyze gravitation and its effects on heavenly bodies based on the laws of Newton and Kepler.	UptoK4
CLO 4	Apply principles of conservation of momentum to real life problems involving collision, rocket propulsion, etc	UptoK3
CLO 5	Use principles of hydrodynamics to real life situations	UptoK3

Mapping of CLOs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	2	2			3
CLO2	3	2	3	3	1		3
CLO3	3	2	3	2	1		3
CLO4	3	2	2	2			3
CLO5	3	3	2	2	1		2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	3	
CLO2	3	2	2	3	2
CLO3	3	1	1	3	
CLO4	3	3	1	3	2
CLO5	3	2	2	3	

Advance application –3;Intermediate level –2; Basic level–1