SYLLABUS

for

Semester I and II

Program: B. Sc.

Course: Physics

Effective from

Academic Year

2024-25

Board of Studies in Physics

Undergraduate and Post graduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Prof. Sadanand Sutar	Chairperson	Sir P. T. Sarvajanik College of Science
All Faculty Members of the Department			
1	Prof. Vireshkumar Thakkar	Associate Professor	Sir P. T. Sarvajanik College of Science
2	Dr. Nisha Patel	Assistant Professor	Sir P. T. Sarvajanik College of Science
3	Dr. Dhiraj Shah	Assistant Professor	Sir P. T. Sarvajanik College of Science
4	Prof. Kileen Mahajan	Associate Professor	Sir P. T. Sarvajanik College of Science
5	Prof. Bhupesh Lad	Associate Professor	Sir P. T. Sarvajanik College of Science
6	Dr. Naveen Kumar Singh	Adhyapak Sahayak	Sir P. T. Sarvajanik College of Science
7	Dr. Jenishkumar Patel	Adhyapak Sahayak	Sir P. T. Sarvajanik College of Science
8	Prof. Pradipkumar Dholakia	Assistant Professor	Sir P. T. Sarvajanik College of Science
Subject Expert nominated by Vice-Chancellor			
1	Dr. Arvind Bajaj	Nominated Member	V. S. Patel College of Arts & Science, College Campus, Morarji Desai Marg, Bilimora
Subject experts			
1	Prof. Smita L. Survase	Nominated Member	K. J. Somaiya College of Commerce and Science (Autonomous), Mumbai
2	Prof. Mahesh Shetti	Nominated Member	Wilson College (Autonomous), Mumbai
Representative from Industry/corporate sector/allied area			

1	Mr. Gopal Singh Panwar	Nominated Member	Officer, Human Resources, L & T Defence IC, Hazira, Surat
Meritorious Alumnus			
1	Mr. Darshankumar Jagdishbhai Gabani	Nominated Member	R & D Division, Lucan Techno, Katargam, Surat
Expert from other than the parent University			
1	Prof. Chetan Limbachia	Nominated Member	Head, Department of Applied Physics, M. S. University, Vadodara

Acknowledgement

At the outset, I would like to thank our, Principal Dr. Pruthul Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies, for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Physics for the long and arduous work they have put in during the compiling of the restructured syllabus.

Prof. S. A. Sutar

(Chairperson, Board of Studies in Physics)

Graduate Attributes:

After the successful completion of modules in different courses of B. Sc. PHYSICS, the learner will be able to:

GA 1: Apply Physics concepts and acquired skill sets to novel and unknown problems in order to establish an effective approach or strategy for dealing with them.

GA 2: Explore and derive quantitative data in the realms of Physics.

GA 3: Collect, analyse, and interpret scientific data in the realms of Physics using modern experimental apparatus and research methods.

GA 4: Develop Psycho-motive, analytical, observation skills through lab work

GA 5: Approach any real-life problem with proper assumption, logic and constraints.

GA 6: Prepare for jobs, career development, and lifelong learning in Physics, by using acquired ICT skills, Physics practical skills, and mathematical skills.

Programme Specific Outcomes:

PO 1: Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

PO 2: Problem solving: Execute a solution process using the first principles of science to solve problems related to respective discipline.

PO 3: Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in their discipline.

PO 4: Ethics: Apply the professional ethics and norms in the respective discipline.

PO 5: Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.

PO 6: Communication: Communicate effectively with the stake holders and give and receive clear instructions.

Content

Sr. No	Semester	Course number	Course Code	Course title
1	I	CC I	PHYMJ-S1P1-3CR24	MJ COURSE-I
2		CC II	PHYMJ-S1P2-3CR24	MJ COURSE-II
3		CC PRACTICAL I	PHYMJ-S1PR1-1CR24	MJ LAB COURSE-I
4		CC PRACTICAL II	PHYMJ-S1PR2-1CR24	MJ LAB COURSE-II
5		EC I	PHYMN-S1P1-2CR24	MN COURSE-I
6		EC PRACTICAL I	PHYMN-S1PR1-1CR24	MN LAB COURSE-I
7		EC PRACTICAL II	PHYMN-S1PR2-1CR24	MN LAB COURSE-II
8		MDC I	PHYMDC-S1P1-2CR24	MDC COURSE-1
9		MDC PRACTICAL I	PHYMDC-S1PR1-1CR24	MDC LAB COURSE-I
10		MDC PRACTICAL II	PHYMDC-S1PR1-1CR24	MDC LAB COURSE-II
11		SEC I	PHYSEC-S1P1-1CR24	SEC COURSE-I
12		SEC PRACTICAL I	PHYSEC-S1PR1-1CR24	SEC LAB COURSE-I
1	II	CC III	PHYMJ-S2P3-3CR24	MJ COURSE-III
2		CC IV	PHYMJ-S2P4-3CR24	MJ COURSE-IV
3		CC PRACTICAL III	PHYMJ-S2PR3-1CR24	MJ LAB COURSE-III
4		CC PRACTICAL IV	PHYMJ-S2PR4-1CR24	MJ LAB COURSE-IV
5		EC II	PHYMN-S2P2-2CR24	MN COURSE-II
6		EC PRACTICAL III	PHYMN-S2PR3-1CR24	MN LAB COURSE-III
7		EC PRACTICAL IV	PHYMN-S2PR4-1CR24	MN LAB COURSE-IV
8		MDC II	PHYMDC-S2P2-2CR24	MDC COURSE-II
9		MDC PRACTICAL III	PHYMDC-S2PR3-1CR24	MDC LAB COURSE-III
10		MDC PRACTICAL IV	PHYMDC-S2PR4-1CR24	MDC LAB COURSE-IV
11		SEC II	PHYSEC-S2P2-1CR24	SEC COURSE-II
12		SEC PRACTICAL II	PHYSEC-S2PR2-1CR24	SEC LAB COURSE-II

SEM-I

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MJ COURSE-I

COURSE CODE: PHYMJ-S1P1-3CR24 [CREDITS - 03]

CC I	Course Code: PHYMJ-S1P1-3CR24	
Course Learning Outcomes		
At the end of this course, learners will be able to • apply the concepts of vector algebra and vector calculus • analyse different motions • explain SHMs and their combinations • analyse Lissajous figures • classify various elastic properties of solids • interpret various moduli of elasticity.		
Unit I	**Vector Analysis**	**[15L]**
Learning Objective This unit is intended to • familiarize the students with the concepts of scalar product and vector product of two and three vectors • make them learn vector differentiation and integration • discuss gradient, divergence and curl of different point functions • train them solve problems of Physics using products of vectors • let them study the line, surface and volume integrals and associated theorems.		
Learning Outcomes: At the end of this unit, learners will be able to • apply the concepts of scalar product and vector product of vectors in solving problems • use differentiation, gradient, divergence and curl of the point functions in different cases • interpret the line, surface and volume integrals and apply them to understand various theorems in vector calculus.		
1.1	Review of dot or scalar product, Cross or vector product Triple product (2.4), reciprocal sets of vectors (2.5)	**[3L]**
1.2	Ordinary derivatives of vectors, space curves (3.2), continuity and differentiability, differentiation formulae (3.3), Partial derivatives of vectors (3.4), differential geometry (3.5). The vector differential operator del (4.1), the gradient (4.2), the divergence (4.3), the curl (4.4), formulae involving del (4.5), invariance (4.6).	**[6L]**
1.3	Ordinary integrals of vectors (5.2), line integrals (5.3), surface integrals (5.4), volume integrals (5.5). The divergence theorem of Gauss, Stokes' theorem, Green's theorem in the plane (statements only) (6.2).	**[6L]**

Text book:
Vector Analysis by Murray Spiegel, Schaum's Outline, 2nd Ed., McGraw-Hill, 2009.

Unit II	Combinations of SHMs	[15L]

Learning Objective:
This unit is intended to

- introduce different harmonic motions to the students
- make them analyse such motions and get the inferences
- train them to describe the combinations of SHMs and Lissajous figures.

Learning Outcomes:
At the end of this unit, learners will be able to

- understand various oscillatory motions
- determine the characteristics of various oscillatory motions
- apply superposition principle to find the resultant motion due to the combinations of two SHMs under different conditions
- analyse the Lissajous figures.

2.1	Introduction (1.1), linear harmonic oscillator (1.2), rotating phasors (1.3), determination of constants (1.4), energy of a linear harmonic oscillator (1.5), some harmonic oscillators (1.6), superposition of simple harmonic motions (1.7), Lissajous figures (1.8), uniform circular motion generated from two simple harmonic motions at right angles (1.9), superposition of two opposite circular motions (1.10).	**[15L]**

Text book:
A treatise on oscillations, waves and acoustics by D. Chattopadhyay, Books and Allied (P) Ltd., 1st Ed., 2016.

Unit III	Elasticity	[15L]

Learning Objective:
This unit is intended to

- familiarize the students about the property of elasticity and its types
- make them use Hooke's law and determine different elastic constants
- introduce to them the twisting couple and its use
- inform them about the different beams and their elasticity

Learning Outcomes:
At the end of this unit, learners will be able to

- compare the elastic properties of various materials
- develop quantitative problem-solving skills in all the topics covered
- apply theoretical knowledge to measure physical quantities by performing various practical in the laboratory.

3.1	Introduction (8.1), Load, stress and strain (8.2), Hooke's law (8.3), three types of elasticity (8.8), equivalence of a shear to a compression and an extension at right angles to each other (8.9), deformation of a cube – bulk modulus (8.12), modulus of rigidity (8.13), Young's modulus (8.14), relations connecting the elastic constant (8.15), Poisson's ratio (8.16), relations for K and η in terms of Poisson's ratio (8.17), limiting values of σ (8.18).	**[8L]**
3.2	Twisting couple on a cylinder (8.22), torsional pendulum (8.26), determination of coefficient of rigidity (n) for a wire (8.27), bending of a beam (8.29), the cantilever (8.30), transverse vibrations of a loaded cantilever (8.32), depression of a beam supported at the ends (8.33), determination of Y by bending of beams (8.34), Determination of elastic constants by Searle's method (8.36).	**[7L]**

Text book:

Properties of Matter by D. S. Mathur, 1st Ed., S. Chand and Co. 2016.

Reference Books:

1. Mathematical Methods in Physical Sciences by Mary L. Boas, 3rd Ed., Wiley publications, 2006.
2. Mechanics, Berkley Physics Course 1 by C. Kittle, W. D. Knight, M. Alvine and A. Ruderman, 2nd Ed., Tata McGraw-Hill, 1991.
3. University Physics by Sears and Zemansky, 15th Ed., Pearson publication, 2011.
4. University Physics by H. D. Young, R A Freedman and A Lewis Ford, 13th Ed. Pearson Education, 2013.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	30%	30%	30%	-	-	100%
II	20%	30%	25%	25%	-	-	100%
III	20%	30%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• apply the concepts of vector algebra and vector calculus		√				
• analyse different motions	√					
• explain SHMs and their combinations	√	√				
• analyse Lissajous figures	√		√			
• classify various elastic properties of solids	√					
• interpret various moduli of elasticity	√					

B. Sc. (Physics) SEMESTER I
COURSE TITLE: MJ COURSE-II
COURSE CODE: PHYMJ-S1P2-3CR24 [CREDITS - 03]

CC II	Course Code: PHYMJ-S1P2-3CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- understand the basic concepts of geometrical optics, such as Fermat's principle and its applications
- understand the laws of reflection and refraction
- interpret different aberrations and their resolution
- extract the basic concepts of temperature, thermodynamics and entropy
- study particle properties of electromagnetic waves.

Unit I	Geometrical Optics	[15L]

Learning objectives:

This unit is intended to

- make the students familiarize with the behaviour of light rays and ray tracing techniques
- introduce to them the techniques of formation of images by mirrors and lenses
- apply them solving optical problems
- analyse optical phenomena, such as reflection, refraction, dispersion, aberrations, etc.
- make them understand how light behaves and how it can be manipulated using geometric optics principles.

Learning outcomes:

After the successful completion of the unit, learners will be able to

- understand optical elements and describe behaviour of light ray such as how light rays reflect, refract and disperse when interacting with optical elements
- calculate properties such as the position, size, orientation and nature of images formed (virtual or real) by optical systems
- gain skill to solving optical problems and understanding of optical instruments, such as different lenses, microscopes, telescopes and camera based on geometric optics.

1.1	Introduction (3.1), laws of reflection and refraction from Fermat's principle (3.2).	**[2L]**
1.2	Refraction at a single spherical surface (4.2), reflection by a single spherical surface (4.3), the thin lens (4.4), the principle foci and the focal length of a lens (4.5), the Newton's formula (4.6), lateral magnification (4.7), aplanatic points of a sphere (4.8), The Cartesian Oval (4.9),	**[10L]**

	Geometrical Proof for the Existence of Aplanatic Points (4.10), The Sine Condition (4.11).	
1.3	Chromatic Aberration (6.2), Monochromatic Aberrations (6.3), Distortion (6.4).	**[3L]**

Text book:
Optics by Ajoy Ghatak, 6th Ed., McGraw Hill Edu. Pvt. Ltd., 2017.

Unit II	**Thermodynamics I**	**[15L]**

Learning objectives:
This unit is intended to

- provide an in-depth study of thermodynamics by covering its fundamental principles and concepts extensively.
- establish a solid foundation and equipping students with the necessary skills to apply thermodynamic principles effectively in various field of study.
- foster an intuitive grasp of thermodynamics by prioritizing the underlying Physics.

Learning outcome:
After the successful completion of the unit, learners will be able to

- explain the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium
- identify situations of thermal equilibrium and describe the factors influencing it
- define energy transfer through mass, heat and work for closed and control volume systems
- apply the first law of thermodynamics on closed and control volume systems
- recognize the distinction between reversible and irreversible processes and understand the concept of entropy production and its relation to irreversibility.

2.1	Temperature and thermal equilibrium (21.1), the ideal gas (21.5), a molecular view of pressure (22.2), the distribution of molecular speeds (22.4), distribution of molecular energies (22.5), equations of state for real gas (22.6).	**[7L]**
2.2	Heat: energy and transit (23.1), the transfer of heat (23.2), the first law of thermodynamics (23.8), the application of the first law of thermodynamics (23.8) Defining entropy change (24.2), entropy change for irreversible process (24.3).	**[8L]**

Text book:
Physics by Halliday, Resnik and Krane, Vol. 2, 5th Ed., Wiley. 2017.

Unit III	**Modern Physics I**	**[15L]**

Learning objectives:
This unit is intended to

- familiarize students with the particle properties of waves

- make them understand the three phenomena, viz, blackbody radiation, photoelectric effect and Compton effect, which eventually lead to the development of quantum mechanics
- make them learn production and properties of x-rays.

Learning outcome:

After the successful completion of the unit, learners will be able to

- understand the nature of electromagnetic waves and its properties
- analyse the properties of blackbody radiation and photoelectric effect and learn about the failure of wave theory of electromagnetic radiation to explain them
- apply x-ray diffraction techniques to determine some properties of solids
- correlate the properties of photons with those of the matter particles.

3.1	Electromagnetic waves (2.1), Blackbody radiation (2.2), photo-electric effect (2.3), what is light (2.4), X- rays (2.5), X-ray diffraction (2.6), Compton effect (2.7), pair production (2.8), photons and gravity (2.9).	**[15L]**

Text book:

Concepts of Modern Physics by A. Beiser, 6th Ed., McGraw Hill Edu. Pvt. Ltd. 2003.

Reference Books:

- University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed. Pearson Education, 2013.
- Fundamentals of Optics by F. Jenkins and H. White, 4th Ed., McGraw Hill Education, 2017.
- Heat and Thermodynamics by Mark W. Zemansky and Richard H. Dittman, 8th Ed., McGraw Hill Education, 2017.
- Modern Physics by Kenneth Krane, 4th Ed., Wiley, 2021.
- Modern Physics by Jeremy Bernstein, Paul Fishbane, Stephen Gasiorowicz, 1st Ed., Pearson, 2000.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	25%	25%	-	-	100%
II	20%	30%	25%	25%	-	-	100%
III	20%	30%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• understand the basic concepts of geometrical optics, such as Fermat's principle and its applications	√	√				
• understand the laws of reflection and refraction	√					
• interpret different aberrations and their resolution	√	√				
• extract the basic concepts of temperature, thermodynamics and entropy	√	√				
• study particle properties of electromagnetic waves	√					

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MJ LAB COURSE-I

COURSE CODE: PHYMJ-S1PR1-1CR24 [CREDITS - 01]

Practical I	Course Code: PHYMJ-S1PR1-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	Various measurements using Vernier calliper and screw gauge and to do error analysis
2	Various measurements using travelling microscope and cathetometer and to do error analysis
3	Understanding spectrometer and determination of angle of prism.
4	To plot the graph of various functions, such as linear, parabolic etc.
5	To determine force constant (k) of a spring.
6	To determine Poisson's ratio of rubber.
7	To determine "Y" by cantilever.
8	To determine "Y" by the method of bending.
9	To determine modulus of rigidity of a wire using torsional pendulum.
10	To study one-dimensional elastic collision using two hanging balls.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical I	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MJ LAB COURSE-II

COURSE CODE: PHYMJ-S1PR2-1CR24 [CREDITS - 01]

Practical II	Course Code: PHYMJ-S1PR2-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	To make students familiarize with appropriate use of various analog meters.
2	To compare the values of the passive components with their values obtained using colour code/printed values using DMM.
3	To study wattage of lamp.
4	To determine elastic constants Y and K by Searle's method.
5	To determine elastic constants η and K by Searle's method.
6	To determine resistivity of the material of a conductor using Ohm's law.
7	To determine the refractive index of the material of prism using spectrometer.
8	To determine focal length of a convex lens and a plano-convex lens using auto-correlation method.
9	To verify Newton's formula for a lens.
10	Study of liquid lens.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.

- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical II	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MN COURSE-I

COURSE CODE: PHYMN-S1P1-2CR24 [CREDITS - 02]

EC I	COURSE CODE: PHYMN-S1P1-2CR24	
Course Learning Outcomes		
At the end of this course, learners will be able to • discover the difference between scalars and vectors • interpret the vector algebra • articulate the vector operator and its applications to various functions • extract the basics of Newtonian mechanics • classify the types of collisions and solve problems related to them.		
Unit I	**Vector Analysis**	**[15L]**
Learning Objective: This unit is intended to • familiarize the students with the concepts of scalar product and vector product of two and three vectors • make them learn vector differentiation and integration • discuss gradient, divergence and curl of different point functions • train them solve problems of Physics using products of vectors • study the line, surface and volume integrals and associated theorems.		
Learning Outcomes: At the end of this unit, learners will be able to • apply the concepts of scalar product and vector product of vectors in solving problems • use differentiation, gradient, divergence and curl of the point functions in different cases • interpret the line, surface and volume integrals and apply them to understand various theorems in vector calculus.		
1.1	Review of dot or scalar product and Cross or vector product. Triple product (2.4), reciprocal sets of vectors (2.5).	**[3L]**
1.2	Ordinary derivatives of vectors, space curves (3.2), continuity and differentiability, differentiation formulae (3.3), Partial derivatives of vectors (3.4), differential geometry (3.5). The vector differential operator del (4.1), the gradient (4.2), the divergence (4.3), the curl (4.4), formulae involving del (4.5), invariance (4.6).	**[6L]**
1.3	Ordinary integrals of vectors (5.2), line integrals (5.3), surface integrals (5.4), volume integrals (5.5). The divergence theorem of Gauss, Stokes' theorem, Green's theorem in the plane (statements only) (6.2).	**[6L]**
Text book:		

Vector Analysis by Murray Spiegel, Schaum's Outline, 2nd Ed. McGraw-Hill, 2009.

Unit II	Newtonian Mechanics	[15L]

Learning Objective:

This unit is intended to

- make the students familiarize with the Newton's laws of motion and their applications
- to make them analyse projectile motion
- to teach them to use basic laws of Physics while solving the problems of collisions.

Learning Outcomes:

At the end of this unit, learners will be able to

- discuss Newton's laws of motion and their applications
- describe the motion of a projectile in detail
- explain the collision problems and analyze them using the basic conservation laws.

2.1	Classical Mechanics (3.1), Newton's first law (3.2), Force (3.3), Mass (3.4), Newton's second law (3.5), Newton's third law (3.6), Weight and mass (3.7), Applications of Newton's laws in one dimension (3.8).	**[5L]**
2.2	Motion in three dimensions with constant acceleration (4.1), Newton's laws in three dimensional vector form (4.2), Projectile motion (4.3), Drag forces and the motion of projectile (4.4), Uniform circular motion (4.5), Relative motion (4.6).	**[5L]**
2.3	Collisions (6.1), Linear momentum (6.2), Impulse and momentum (6.3), conservation of momentum (6.4), Two-body collisions (6.5).	**[5L]**

Text book:

Physics by Halliday, Resnik and Krane, Vol. 1, 5th Ed., Wiley.

Reference Books:

1. Mathematical Methods in Physical Sciences by Mary L. Boas, 3rd Ed., Wiley publications.
2. Mechanics, Berkley Physics Course 1 by C. Kittle, W. D. Knight, M. Alvine and A. Ruderman, 2nd Ed., Tata McGraw-Hill, 1991.
3. University Physics by Sears and Zemansky, 15th Ed., Pearson publication, 2011.
4. University Physics by H. D. Young, R A Freedman and A Lewis Ford, 13th Ed. Pearson Education, 2013.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	30%	30%	30%	-	-	100%
II	20%	30%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• discover the difference between scalars and vectors	√	√				
• interpret the vector algebra	√	√				
• articulate the vector operator and its applications to various functions	√	√				
• extract the basics of Newtonian mechanics	√	√				
• classify the types of collisions and solve problems related to them	√	√				

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MN LAB COURSE-I

COURSE CODE: PHYMN-S1PR1-1CR24 [CREDITS - 01]

Practical I	Course Code: PHYMN-S1PR1-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	Various measurements using Vernier calliper and screw gauge and to do error analysis
2	Various measurements using travelling microscope and cathetometer and to do error analysis
3	Understanding spectrometer and determination of angle of prism.
4	To plot the graph of various functions, such as linear, parabolic etc.
5	To study one-dimensional elastic collision using two hanging balls.
6	To study projectile motion.
7	To determine ‘g’ using free fall method.
8	To determine height of a ceiling using free fall method.
9	To verify law of conservation of linear momentum.
10	To verify law of conservation of kinetic energy during elastic collision.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical I	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MN LAB COURSE-II

COURSE CODE: PHYMN-S1PR2-1CR24 [CREDITS - 01]

Practical II	Course Code: PHYMN-S1PR2-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	To do data analysis using excel.
2	To do least square fitting of the given data.
3	To study exponential decay of random numbers.
4	To verify the perpendicular axes theorem of moment of inertia.
5	To verify the parallel axes theorem of moment of inertia.
6	To study simple pendulum.
7	To determine resistivity of the material of a conductor using Ohm's law.
8	To study the probability distribution for two option system.
9	To study liquid lens.
10	To determine of focal length of lens using Gauss' equation.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical II	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MDC COURSE-I (Space Science-I)

COURSE CODE: PHYMDC-S1P1-2CR24 [CREDITS - 02]

MDC I	COURSE CODE: PHYMDC-S1P1-2CR24	
Course Learning Outcomes		
At the end of this course, students will be able to • interpret the celestial objects and astronomical instruments • explain the principle of astronomical instruments in the observation of celestial phenomena and objects • use the Stellarium and Skyview software • extract the physical properties of planets of our solar system • classify the different layers of the Sun and explain different natural occurring phenomena such as sunspots, solar flares and prominences in the Sun.		
Unit I	**Astronomical Instruments and Celestial Objects**	**[15L]**
Learning objectives: This unit is intended to • familiarize the students with the celestial objects and astronomical units • familiarize the students with the kinds of telescopes • infer the students about different parameters of telescope • explore the universe by combining modern technologies with the application of modern Physics • explore Stellarium and Skyview software.		
Learning outcomes: At the end of this unit, learners will be able to • identify different celestial objects • use the astronomical instruments to observe the celestial phenomena or object • design and use the basic telescopes • convert units in astronomical units.		
1	**Brief Introduction of Celestial Objects:** Planets, Natural Satellites, Asteroids, Meteors, Comets, Nebula, Black holes, White dwarfs, Red Giant, Super Giant, Neutron Stars, Binary Stars. Galaxies. **Telescopes:** Optical telescope, Radio telescope and Hubble Telescope. **Software:** Stellarium and SkyView software. **Units:** Units used in Astronomy such as parsec, AU, light year etc.	**[15L]**
Text book: • Schaum's Outline of Astronomy: Stacy E. Palen, McGraw-Hill Publishing Company Limited, 2020.		
Unit II	**Our solar system**	**[15L]**

Learning objectives:

This unit is intended to

- study the physical properties of planets
- study the orbital motion of planets of our solar system
- understand the rotational motion of planets and explain the magnetic field of planets
- study the crust, mantle and core of the Earth and study its motion and its magnetic field
- describe the different layers of the Sun
- explain different phenomena occurring on the Sun such as sunspots, solar flares, prominences etc.

Learning outcome:

At the end of this unit, learners will be able to

- estimate the physical properties of planets such as temperature, albedo, solar day etc.
- understand curst, core of the Earth and its magnetic field
- understand the core of the Sun and differentiate its different layers
- explain different phenomena and nuclear fusion reaction in the Sun.

2.1	**Planets:** Interior planets, Exterior planets; crust, mantle and core of the Earth; Different region of earth's atmosphere; Rotation of Earth, Magnetosphere; Van Allen Belts- Aurora.	**[10L]**
2.2	**The Sun:** Structure of Photosphere, Chromosphere, Corona, Sunspots, Solar Flares, Solar Prominences, Solar Plages.	**[5L]**

Text book:

- Schaum's Outline of Astronomy: Stacy E. Palen, McGraw-Hill Publishing Company Limited, 2020.

Reference Books:

1) An Introduction to Astrophysics: Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas, 2nd Ed., Prentice Hall India Learning Private Limited, 2010.
2) An Introduction to Astronomy and Astrophysics: Pankaj Jain, 1st Ed., CRC Press Publishing Company, 2015.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	40%	40%	10%	10%	-	-	100%
II	40%	40%	10%	10%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• interpret the celestial objects and astronomical instruments	√					
• explain the principle of astronomical instruments in the observation of celestial phenomena and objects	√					
• use the Stellarium and Skyview software	√	√	√			
• extract the physical properties of planets of our solar system	√					
• classify the different layers of the Sun and explain different natural occurring phenomena such as sunspots, solar flares and prominences in the Sun.	√					

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MDC LAB COURSE-I

COURSE CODE: PHYMDC-S1PR1-1CR24 [CREDITS - 01]

MDC Practical I	Course Code: PHYMDC-S1PR1-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	Various measurements using Vernier calliper and screw gauge and to do error analysis.
2	Various measurements using travelling microscope and cathetometer and to do error analysis.
3	To plot the graph of various functions, such as linear, parabolic etc.
4	To make students familiarize with appropriate use of various analog meters.
5	To compare the values of the passive components with their values obtained using colour code/printed values using DMM.
6	To study wattage of lamp.
7	To study projectile motion.
8	To determine resistivity of the material of a conductor using Ohm’s law.
9	To determine height of a ceiling using free fall method.
10	Understanding spectrometer and determination of angle of prism.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical I	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: MDC LAB COURSE-II

COURSE CODE: PHYMDC-S1PR2-1CR24 [CREDITS - 01]

MDC Practical II	Course Code: PHYMDC-S1PR2-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to:

- demonstrate practical skills
- correlate the Physics theory concepts through practical

1	To study the I-V characteristics of solar cell.
2	To study exponential decay of random numbers.
3	To determine focal length of a convex lens and a plano-convex lens by auto-collimation method.
4	To determine the focal length of a convex lens using two pins.
5	To study intensity distribution curve of ordinary electric bulb using photo-cell.
6	To perform Sunspots activity analysis.
7	To determine the Planck's constant using LED.
8	To calibrate spectrometer.
9	To study plane diffraction grating.
10	To determine wavelength of given LASER source using diffraction Grating.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical II	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER I

COURSE TITLE: SEC COURSE-I (Programming in "C" Language-I)

COURSE CODE: PHYSEC-S1P1-1CR24 [CREDITS - 01]

SEC I	COURSE CODE: PHYSEC-S1P1-1CR24

Course Learning Outcomes

At the end of this course, learners will be able to

- define types of programming languages and their uses, basic idea of flow chart
- infer basic competency with numerical constants, define operators and expression In C-programming
- explain arithmetic operators and modes of expression, defining constants and declaring variable names
- classify the input and output statement, conditional statement and loops
- interpret arithmetic conversion, assignment expression and increment decrement statement
- apply numerical algorithms into C-program and visualize the results of the computations.

Unit I	Basics of C Programming	[15L]

Learning objectives:

This unit is intended to

- familiarize the students with different the programming languages and theiruses
- infer about the flowchart and algorithms
- learn different types of constants, declaration of variables, operators and expression
- study input and output statements
- study control statements
- infer about switching statements
- learn the working of loops in C-programming.

Learning outcomes:

At the end of this unit, learners will be able to

- get to know about different the programming languages and their uses
- interpret flowchart and algorithms
- apply the use different types of constants, declaration of variables, operators and expression
- understand the use of input and output statements
- understand and apply different control statements like if, if-else
- analyze how switching statements works in C-programming
- apply the use of different loops like while, do-while and for.

1.1	Input unit - output unit – Central Processing Unit (CPU) – programming	**[8L]**

	languages - algorithms - flow charts - operating system- basic principle Basic structure of C - programs - constants - variables - data type - declaration of variables – defining symbolic constants, operators and expression - reading a character - writing a character - formatted input and output statements.	
1.2	Control statements - simple if, if - else, else - if ladder – switching statements - go to statement -break and continue looping - while-do for statements.	**[7L]**

Text book:

- ANSI C by E Balaguruswamy, 8th Ed., TATA McGraw-Hill Publication 2019.

Reference Books:

- Computer Programming in C by V. Rajaraman, 2nd Ed., PHI Learning Pvt. Ltd.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	10%	40%	40%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• define types of programming languages and their uses, basic idea of flow chart	√	√	√			
• infer basic competency with numerical constants, define operators and expression in C-programming	√	√	√			
• explain arithmetic operators and modes of expression, defining constants anddeclaring variable names	√	√	√			
• classify the input and output statement, conditional statement and loops	√					
• interpret arithmetic conversion, assignment expression and increment decrementstatement	√	√				
• apply numerical algorithms into C-program and visualize the results of the computations.		√	√			

B. Sc. (Physics) SEMESTER I
COURSE TITLE: SEC LAB COURSE-I
COURSE CODE: PHYSEC-S1PR1-1CR24 [CREDITS - 01]

SEC Practical I	Course Code: PHYSEC-S1PR1-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- demonstrate practical skills
- correlate the Physics theory concepts through practical

To develop algorithm, flow chart and program for the following:	
1	Average of a set of numbers
2	Area of a triangle
3	Sorting a set of numbers in ascending and descending order
4	Summing the series of numbers
5	To find largest/smallest of three integers
6	Convert temperature in Celsius to Fahrenheit and Kelvin.

Reference Books:

- ANSI C by E Balaguruswamy, 8th Ed., TATA McGraw-Hill Publication.
- Computer Programming in C by V. Rajaraman, 2nd Ed., PHI Learning Pvt. Ltd.

Note:

- The duration of each experiment is of 2 hours. One experiment is to be performed by each student per week
- In the external exam, a student will have to perform one experiment
- The experiments will be of 2-hour duration
- The batch for external examination shall have maximum 20 students
- There should be two examiners in the external examination
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical I	25%	25%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the Physics theory concepts with appropriate practical	√	√			√	