Sir P. T. Sarvajanik College of Science (Autonomous)
Athwalines, Surat-395001

SYLLABUS

for

Semester I

Program: M. Sc.

Course: Physics

Effective from

Academic Year

2026-27

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. Bhupesh Lad	Associate Professor	Sir P. T. Sarvajanik College of Science
5	Dr. Naveen Kumar Singh	Adhyapak Sahayak	Sir P. T. Sarvajanik College of Science
6	Dr. Jenishkumar Patel	Adhyapak Sahayak	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
3	Prof. Debesh R. Roy	Nominated Member	Sardar Vallabhbhai National Institute of Technology, Surat
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 units in different courses of M. Sc. PHYSICS, the learner will be able to:

GA 1: Capacity to conduct the experiments and evaluate the findings based on the knowledge gained in the scientific domain.

GA 2: Ability to organize, carry out and document theoretical and/or experimental Physics problems using scientific methods in their future endeavours.

GA 3: Ability to generate, process, analyse, model and visualise data by using a variety of tools such as programming, sophisticated instrumentation and other resources.

GA 4: Exhibiting creativity and problem-solving skills through appropriate planning and organizational skills to work as a team.

GA 5: Honouring and adhering to professional ethics and standards.

GA 6: Capacity to engage in the technical domain via written and oral communication effectively.

Programme Specific Outcomes:

PO 1: Apply knowledge of Physics to analyze problems; evaluate and validate experimental results and draw logical conclusions thereof.

PO 2: Utilize technical and analytical skills through experiential learning.

PO 3: Recognize the need for continuous learning and knowledge updation throughout their professional career.

PO 4: Demonstrate and maintain the highest standard on ethical issues in the professional career.

PO 5: Exhibit the ability to work both, as an individual and as a team member in a variety of situations and disciplines.

PO 6: Communicate effectively with the scientific community and the general public using written and spoken language as well as the electronic media.

Content

Sr. No	Semester	Course Type	Course Code	Course Name
Semester-I				
1	I	CC I	PHYMSC-S1P1-4CR26	Mathematical Methods in Physics
2		CC II	PHYMSC-S1P2-4CR26	Classical Mechanics
3		CC III	PHYMSC-S1P3-4CR26	General Electronics
4		IKS-I	PHYMSC-S1IKS1-2CR26	Telescopic Astronomy & Ancient Knowledge - Framework
5		SEC-I	PHYMSC-S1SEC1-2CR26	Introduction to Microprocessor
6		CC PRACTICAL-1	PHYMSC-S1PR1-2CR26	Physics Practical-1
7		CC PRACTICAL-2	PHYMSC-S1PR2-2CR26	Physics Practical-2
8		CC PRACTICAL-3	PHYMSC-S1PR3-2CR26	Physics Practical-3
Semester-II				
1	II	CC IV	PHYMSC-S2P4-4CR26	Classical Electrodynamics
2		CC V	PHYMSC-S2P5-4CR26	Quantum Mechanics- I
3		CC VI	PHYMSC-S2P6-4CR26	Statistical Physics
4		VOC-1	PHYMSC-S2VOC1-4CR26	Introduction to Arduino
5		CC PRACTICAL-4	PHYMSC-S2PR4-2CR26	Physics Practical-4
6		CC PRACTICAL-5	PHYMSC-S2PR5-2CR26	Physics Practical-5
7		CC PRACTICAL-6	PHYMSC-S2PR6-2CR26	Physics Practical-6

Distribution of Credit M. Sc. Physics Syllabus

M. Sc. (Physics) 1st Year Syllabus with effect from the Academic year June, 2026-27

Course Name	Course Code	Credits	Hours	Module	Lectures per module (1 Hr)	Examination		
						Internal Marks	External Marks	Total Marks
SEMESTER I								
COURSES THEORY and PRACTICAL								
Mathematical Methods in Physics	PHYMSC-S1P1-4CR26	4	60	4	15	50	50	100
Classical Mechanics	PHYMSC-S1P2-4CR26	4	60	4	15	50	50	100
General Electronics	PHYMSC-S1P3-4CR26	4	60	4	15	50	50	100
Telescopic Astronomy & Ancient Knowledge - Framework	PHYMSC-S1IKS1-2CR26	2	30	2	15	25	25	50
Introduction to Microprocessor	PHYMSC-S1SEC1-2CR26	2	60	2	-	25	25	50
Physics Practical-1	PHYMSC-S1PR1-2CR26	2	60	-	-	25	25	50
Physics Practical-2	PHYMSC-S1PR2-2CR26	2	60	-	-	25	25	50
Physics Practical-3	PHYMSC-S1PR3-2CR26	2	60	-	-	25	25	50
SEMESTER II								
Classical Electrodynamics	PHYMSC-S2P4-4CR26	4	60	4	15	50	50	100
Quantum Mechanics- I	PHYMSC-S2P5-4CR26	4	60	4	15	50	50	100
Statistical Physics	PHYMSC-S2P6-4CR26	4	60	4	15	50	50	100
Introduction to Arduino	PHYMSC-S2VOC1-4CR26	4	90	4	15	50	50	100
Physics Practical-4	PHYMSC-S2PR4-2CR26	2	60	-	-	25	25	50
Physics Practical-5	PHYMSC-S2PR5-2CR26	2	60	-	-	25	25	50
Physics Practical-6	PHYMSC-S2PR6-2CR26	2	60	-	-	25	25	50

M. Sc. (Physics) SEMESTER I

COURE NAME: Mathematical Methods in Physics

COURSE CODE: PHYMSC-S1P1-4CR26 [CREDITS - 04]

CC I	Course Code: PHYMSC-S1P1-4CR26	
Course Learning Outcomes		
After the successful completion of the course, the learner will be able to • apply the eigenvalues and eigenvectors for solving various problems in Physics • categorize various special functions and their properties • apply the Fourier transform and Laplace transform for solving complex problems • apply the Binomial, Poisson and Gaussian distribution functions and Group theory for statistical analysis		
Unit I	**Matrices, Vector Spaces and Tensors**	**[15L]**
Learning Objective This unit is intended to • familiarize the students with the concepts of operators, vector spaces and their properties • study the eigenvalues and eigenvectors and their relevance in Physics • infer the types of tensors and their properties		
Learning Outcomes: At the end of this unit, the learner will be able to • apply the concepts of operators and vector spaces in solving problems • apply the eigenvalues and eigenvectors for solving various problems in Physics • classify the tensors and their properties		
1.1	Review of matrices - vector spaces, basis vectors, linear operators, linear dependence and independence, inverse	**[4L]**
1.2	Eigenvalues and eigenvectors, diagonalising matrices – hermitian matrices, anti-hermitian matrices, orthogonal matrices, applications. Commutator, change of basis, similarity transformations, Jacobi method.	**[7L]**
1.3	Tensors – introduction, tensors of rank zero, one and two, covariant and contravariant tensors, symmetry, contraction, direct product, inverse transformation, quotient rule	**[4L]**
Unit II	**Special Functions**	**[15L]**
Learning Objective This unit is intended to • study special functions such as Legendre function, Bessel function, etc. and their properties relevant in Physics		
Learning Outcomes: At the end of this unit, the learner will be able to • categorize various special functions and their properties		

2.1	Legendre's equation, Legendre polynomials, Rodrigues' formula, Generating function, recursion relations, orthogonality and normalization properties of the Legendre polynomial, extended power series method, Euler-Cauchy equation and its solution, Associated Legendre functions, orthogonality and normalization properties of the Associated Legendre polynomial, Spherical Harmonics, Bessel's equation, Bessel functions, Bessel Functions: Generating function, recursion relations, orthogonality and normalization properties of the Bessel functions, integral and half integral orders, Bessel functions of second kind, Hankel functions, Hermite functions – recurrence relations, Rodrigue's formula, orthogonality	**[15L]**
Unit III	**Integral Transforms**	**[15L]**

Learning Objective

This unit is intended to

- infer the concepts of Fourier transform and its applications
- familiarize students with Laplace transform and relevant theorems.

Learning Outcomes:

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

- apply the Fourier transform and Laplace transform for solving complex problems.

3.1	Fourier integral, Fourier cosine and sine integral, Fourier cosine and sine transform, Fourier complex integral, Fourier transform, properties of Fourier transform, application of Fourier transforms - uncertainty principle and Fraunhofer diffraction, Dirac delta function, Fourier transform of derivatives, Discrete Fourier Transform, Fast Fourier Transform	**[8L]**
3.2	Laplace transform, linearity, first shifting theorem (s-shifting), Laplace transform of derivatives, Laplace transform of integral, Laplace transform for solving differential equations, initial value problems, Heaviside function and its relevance, second shifting theorem (t-shifting), short impulses, Dirac delta function	**[7L]**
Unit IV	**Probability and Group theory**	**[15L]**

Learning Objective

This unit is intended to

- study probability distributions
- infer the concepts of group theory and its relevance.

Learning Outcomes:

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

1. apply the Binomial, Poisson and Gaussian distribution functions for statistical analysis
2. interpret the concepts of group theory.

4.1	Data representation – average and spread, mean, standard deviation, variance, experiments, outcomes, events, probability, permutations,	**[9L]**

	combinations, probability distributions, discrete random variables, mean and variance of a distributions, binomial distributions, poisson distributions, gaussian distributions.	
4.2	Group Theory: Introduction and definitions – Group, finite group, order of group, Abelian group, symmetric group, Subgroup and classes, Group representations.	**[6L]**

References:

1. Mathematical Methods for Physics and Engineering by Riley, Hobson and Bence, 2nd Ed. Cambridge University Press 2006.
2. Mathematical Methods for Physicists: G. Arfken and H. J. Weber, 7th Edition, Academic Press, 2013.
3. Mathematical Methods in the Physical Sciences by M L Boas, 3rd Ed. Wiley 2006.
4. Advanced Engineering Mathematics, 10th Edition, Erwin Kreyszig Wiley 2011.
5. Mathematical Methods of Physics: Mathews and Walker, 2nd Edition, Pearson Education, 2004.
6. Matrix Methods and Vector Spaces in Physics by Vinod Sharma, Kindle Ed. PHI Learning Pvt. Ltd. 2009.

Question Paper Template

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

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• apply the eigenvalues and eigenvectors for solving various problems in Physics		√				
• categorize various special functions and their properties	√					
• Apply the Fourier transform and Laplace transform for solving complex problems	√	√				
• apply the Binomial, Poisson and Gaussian distribution functions and Group theory for statistical analysis	√		√			

M. Sc. (Physics) SEMESTER I

COURE NAME: Classical Mechanics

COURSE CODE: PHYMSC-S1P2-4CR26 [CREDITS - 04]

CC II	Course Code: PHYMSC-S1P2-4CR26	
Course Learning Outcomes		
At the end of this course, learners will be able to • understand and apply the Lagrangian approach and Hamiltonian approach in classical mechanics • use mathematical tools necessary to analyse and solve a wide range of physical problems • apply principles of Classical Mechanics to analyse various system • investigate the normal modes of vibration for linearized systems • understand the concept of rigid body and small oscillations and appraise their significance in the dynamics of physical systems • explain and use canonical transformations.		
Unit I	**Central Force Problem**	**[15L]**
Learning Objective: This unit is intended to • explain the motion under the influence of central force • introduce the properties and characteristics of central force potentials • explain the use of mathematical methods to solve central force problems.		
Learning Outcomes: At the end of this unit, the learner will be able to • analyze the motion of a particle under the influence of a central force using the principles of classical mechanics • apply angular momentum and energy conservation principles to central force problems and analyze the implications for the trajectory of the particle • investigate the properties and characteristics of central force potentials, including Keplerian orbits • apply mathematical methods to solve central force problems • understand and apply the principles of Coulomb's law and classical mechanics to predict the scattering pattern of alpha particles by a nucleus.		
1.1	Reduction of two body problem to one body problem; equation of motion and first integrals; equivalent one-dimensional problem; classification of orbits; differential equation for the orbit; power law potentials; Bertrand's theorem; the Kepler's problem; scattering in a central force field; Rutherford scattering cross section.	**[15L]**
Unit II	**Rigid Body Motion and Small Oscillations**	**[15L]**
Learning Objective:		

This unit is intended to

- introduce rigid body dynamics
- explain the concept of small oscillations and their significance
- introduce use of mathematical techniques (vector calculus, differential equations, and matrix algebra, etc) to solve complex problems of rigid body dynamics and small oscillations.

Learning Outcomes:

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

- understand the principles and techniques of rigid body dynamics
- apply mathematical techniques, including vector calculus, differential equations, and matrix algebra, to solve complex problems in rigid body dynamics
- examine the dynamics of rigid bodies subject to external forces and torques, including the effects of moments of inertia and external constraints
- investigate the normal modes of vibration for linearized systems
- explore the concept of eigenvalues and eigenvectors in the context of small oscillations and understand their role in determining the frequencies and modes of vibration
- apply mathematical techniques to solve for the normal modes and frequencies of small oscillation systems.

2.1	Eigen-values of the inertia tensor and the principal axis transformation; Euler's and Lagrangian's treatment for rigid body motion; force free motion of a symmetrical top; motion of a heavy symmetrical top with one point fixed.	**[7L]**
2.2	Formulation of the problem; the eigenvalue equation and the principal axis transformation; normal modes and normal coordinates for small oscillations; examples: free vibrations of a linear tri-atomic molecule, coupled pendulums, double pendulum.	**[8L]**
Unit III	**Hamiltonian Dynamics and Canonical Transformations**	**[15L]**

Learning Objective:

This unit is intended to

- introduce Hamiltonian formulation
- make students familiarize with Hamiltonian equations of motion
- introduce the concept of canonical transformations.

Learning Outcomes:

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

- derive the Hamiltonian function for a given system using the Lagrangian formulation and Legendre transformation.
- apply the Hamiltonian formulation to a variety of physical systems, including simple mechanical systems, electromagnetic systems, and quantum mechanical systems.
- establish connection between ignorable coordinates and laws of conservations.

- understand the concept of canonical transformations and their significance in classical mechanics for describing the evolution of dynamical systems.
- demonstrate proficiency in applying canonical transformations to analyze and solve problems in various areas of Physics.

3.1	Hamilton's equations of motion: Legendre transformation and Hamiltonian function; canonical equations of Hamilton; cyclic coordinates and conservation theorems; Routh's procedure.	**[7L]**
3.2	Generators of canonical transformations, equations of canonical transformations; examples; the harmonic oscillator; Poisson brackets; equation of motion in Poisson bracket; infinitesimal canonical transformation.	**[8L]**
Unit IV	**Hamilton-Jacobi Theory**	**[15L]**

Learning Objective:

This unit is intended to

- introduce Hamilton-Jacobi theory
- explain the method of separation of variables and its application
- introduce concept of action-angle variables and their significance.

Learning Outcomes:

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

- examine the concept of canonical transformations and their role in simplifying the Hamilton-Jacobi equation and generating solutions
- investigate the method of separation of variables and its application to solve the Hamilton-Jacobi equation for specific dynamical systems
- understand the concept of action-angle variables and their significance in integrable Hamiltonian systems.

4.1	Hamilton-Jacobi Theory: Hamilton-Jacobi equation; Hamilton's principle and characteristic function; examples; separation of variables in Hamilton-Jacobi equation; orbit equation for central force problem; periodicity and action angle variables, frequencies of periodic motion.	**[15L]**

Reference Books:

- Classical Mechanics by H. Goldstein, 3rd Ed., Pearson education, 2002.
- Classical Mechanics by Tai L. Chaw, 2nd Ed., CRC Press, 2013.
- Introduction to Classical Mechanics by Kleppner and Kolenkow, 2nd Ed., Cambridge University Press, 2021.
- Classical Dynamics of Particles and Systems by J. B. Marion and S. T. Thronton, 5th Ed., Saunders College Publishing, 1995
- Classical Mechanics by N. C. Rana and P. S. Joag, 1st Ed. (42nd reprint, 2016), TMH, 1991.

- Introduction to Classical Mechanics by R. G. Takwale and P. S. Puranik, 1st Ed. (37th reprint, 2008), Tata McGraw-Hill, 1990.
- Mechanics: Course of Theoretical Physics Vol. 1 by L D Landau and E M Lifshitz, 3rd Ed., Butterworth-Heinemann Publishing co., 2010.
- Fundamental Principles of Classical Mechanics: A Geometrical Perspective by Kai S Lam, 1st Ed., World Scientific Publishing Company, 2014.
- Solved Problems in Classical Mechanics: Analytical and Numerical Solutions with Comments by Owen de Lange and John Pierrus, 1st Ed., Oxford University Press, 2010.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	40%	20%	20%	-	-	100 %
II	-	20%	40%	20%	20%	-	100 %
III	-	20%	40%	20%	20%	-	100 %
IV	20%	20%	40%	20%	-	-	100 %

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• Understand and apply the Lagrangian approach and Hamiltonian approach in Classical Mechanics.	√		√		√	
• To use mathematical tools necessary to analyze and solve a wide range of physical problems.	√	√	√		√	
• Apply principles of Classical Mechanics to analyse various system.	√	√	√			
• Investigate the normal modes of vibration for linearized systems.	√	√	√			
• Understand the concept of rigid body and small oscillations and appraise their significance in the dynamics of physical systems.	√	√	√			
• Explain and use canonical transformations.	√	√	√			

M. Sc. (Physics) SEMESTER I
COURE NAME: General Electronics

COURSE CODE: PHYMSC-S1P3-4CR26 [CREDITS - 04]

CC III	Course Code: PHYMSC-S1P3-4CR26	
Course Learning Outcomes		
At the end of this course, learners will be able to • understand the fundamentals of analog circuits and working of digital electronics • learn applications of the operational amplifier • study the signal conversion of analog to digital and digital to analog. • learn the design of SMPS (Switch Mode Power Supply).		
Unit I	**Registers and Counters**	**[15L]**
Learning Objective: This unit is intended to • understand different kinds of registers and learn their uses • introduce asynchronous and synchronous counters and their features.		
Learning Outcomes: At the end of this unit, the learner will be able to • classify and understand different types of registers and counters • use digital counters and registers for various applications.		
1.1	**Registers:** Types of Registers, Serial In-Serial Out, Serial In-Parallel Out, Parallel In-Serial Out, Parallel In-Parallel Out, universal shift register, applications of shift registers, applications of register, delay line, serial to parallel data convertor.	**[6L]**
1.2	**Display Systems:** seven segment display, alpha numeric display, dot matrix display and multiplexed display system.	**[3L]**
1.3	**Counters:** asynchronous counters, decoding gates, synchronous counters, changing the counter modulus, decade counters, presetable counters, asynchronous counters, ring counter, applications of counter, digital clock.	**[6L]**
Unit II	**Operational Amplifier Applications**	**[15L]**
Learning Objective: This unit is intended to • introduce active filters of different types • understand the application of operational amplifiers in designing multivibrators, PLL and phase detector.		
Learning Outcomes:		

At the end of this unit, the learner will be able to • design Butterworth's first order filters • use op-amp in designing various multivibrators • apply the PLL and Phase detector circuits.		
2.1	**Operational amplifier:** Active filter - 1st order only of butterworth low pass, high pass, band-pass filter, band-reject filters.	**[8L]**
2.2	**Applications of operational amplifier:** Designing multivibrators, phase lock loop (PLL), phase detector, voltage-to-current convertor, current-to-voltage convertor, Voltage Controlled Oscillator (VCO)	**[7L]**
Unit III	**Signal Conversion (A/D & D/A)**	**[15L]**
Learning Objective: This unit is intended to • introduce the students with A/D and D/A convertors.		
Learning Outcomes: At the end of this unit, the learner will be able to • design various A/D and D/A convertors.		
3.1	**D/A Convertors:** Digital to analogue convertor, D/A convertor with binary weighted resistors, D/A convertor with R-2R resistors, Monolithic / hybrid D/A convertor	**[7L]**
3.2	**A/D convertor:** Sample-and-hold circuit, successive-approximation A/D Convertor, Monolithic / hybrid A/D convertor	**[8L]**
Unit IV	**SMPS (Switch Mode Power Supply)**	**[15L]**
Learning Objective: This unit is intended to • infer the concepts of fixed/adjustable and positive/ negative voltage supply • introduce the Switch Mode Power Supply (SMPS).		
Learning Outcomes: At the end of this unit, the learner will be able to • design and troubleshoot the power supply circuits using three-terminal voltage regulators.		
4.1	Power supply design using three terminal regulator, fixed voltage Regulator, positive voltage regulator series with seven voltage options, negative voltage regulator series with nine voltage options, adjustable voltage regulators, adjustable positive voltage regulators, adjustable negative voltage regulators, DC to DC convertor, switching regulated power supply.	**[15L]**

Reference Books:

- Digital Principles and Applications, Donald P. Leach, Albert Paul Malvino, Goutam Shah, 8th Ed., Tata McGraw Hill Edu. Pvt. Ltd. 2013
- Op-amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Ed., Pearson
- Electronic Principles, Albert Malvino and David Bates 7th Ed., Tata McGraw Hill Edu. Pvt. Ltd. 2017
- Digital Fundamentals Floyd and Jain 8th Ed., Pearson Education 2005

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Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	40%	20%	20%	-	10%	100 %
II	10%	20%	30%	30%	-	10%	100 %
III	40%	40%	10%	10%	-	-	100 %
IV	20%	30%	20%	20%	-	10%	100 %

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• understand the fundamentals of analog circuits and working of digital electronics	√	√	√		√	
• learn applications of the operational amplifier	√	√	√		√	
• study the signal conversion of analog to digital and digital to analog.	√	√	√		√	
• learn the design of SMPS (Switch mode power supply	√	√	√		√	

M. Sc. (Physics) SEMESTER I

COURSE NAME: Telescopic Astronomy and Ancient Knowledge Framework

COURSE CODE: PHYMSC-S1IKS1 -2CR26 [CREDITS - 02]

IKS-I	Course Code: PHYMSC-S1IKS1-2CR26	
Course Learning Outcomes		
At the end of this course, learners will be able to • understand the evolution of astronomical practices in India and evaluate their scientific impact • interpret the contributions of early Indian astronomers and construct a coherent narrative of the transition to modern Indian astronomy • understand the framework for establishing the right knowledge • interpret the Vaisesikan approach to describe the physical reality through various components and classifications • apply the Nyaya approach for resolving ambiguity through logic and argumentation.		
Unit I	**Telescopic Astronomy in India**	**[15L]**
Learning Objective: This unit is intended to make the learners • aware about various astronomical instruments used in ancient India • study about the early Indian astronomers and transition to modern times.		
Learning Outcomes: After successful completion of the course, students will be able to: • understand the evolution of astronomical practices in India and evaluate their scientific impact • interpret the contributions of early Indian astronomers and construct a coherent narrative of the transition to modern Indian astronomy.		
1.1	Early Telescopic Astronomy in India: arrival of Jesuit Priests, Jai Sing and telescopic astronomy, Transit of Venus and Mercury, Observation of the transit of Venus from India	**[4L]**
1.2	Organized Astronomical Activities and the Early Observations: Early Observatories, Madras observatory, Lucknow and Trivandrum observatories	**[3L]**
1.3	Emergence of Physical Astronomy: Dehra Dun observatory, Observatories in Calcutta, Takhta Singh observatory, Poona, Kodaikanal observatory, Nizamiah observatory	**[3L]**
1.4	Some Early Personalized Astronomical Activities by Indian Astronomers: G. V. Juggarow and A. V. Nurshing Row, Kalinath Mukherjee and Radha Gobinda Chandra	**[3L]**
1.5	Astronomy in Modern India: Calcutta University, Allahabad University, Benaras Hindu University, Astronomy post independence India	**[2L]**
Text book: History of Science in India, Vol. I: Part II, Astronomy by Prof. Amitabha Ghosh, The National Academy of Sciences, India and The Ramkrishna Mission institute of Culture, Kolkata, 2017		

Unit II	Knowledge: Framework and Classification	[15L]

Learning Objective:

This unit is intended to make the learners

- aware about the foundations of Indian epistemology and debate
- explore the Vaiśeṣika framework of physical reality
- understand the basis of logical reasoning and argumentation skills.

Learning Outcomes:

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

- understand the framework for establishing the right knowledge
- interpret the Vaisesikan approach to describe the physical reality through various components and classifications
- apply the Nyaya approach for resolving ambiguity through logic and argumentation.

2.1	Vada: Indian Art of Debate, the knowledge triangle – Pramatr, Prameya, Pramana, Nyaya and Vaisesika school of thoughts, right knowledge of reality, prameya – a vaisesikan approach to physical reality, three-pronged approach – uddesa, laksana and pariksa, dravya, guna, karma, samavaya, samanya and visesa, dravyas (substances) – the constituents of the physical realty, attributes – the properties of substances, action – the driver of conjunction and disjunction, gravitational pull, properties of objects in motion, Pramana – the means of valid knowledge, pratyaksa, anumana, upamana and sabda, samsya – ambiguities in existing knowledge, framework for establishing valid knowledge – argumentation, prayojana and logic, jalpa, vitanda, chala, jati and nigrahasthana, deductive/inductive logic framework – pratijna, hetu, udhaharana, upanaya and nigamana, potential fallacies in the reasoning process – savyabhicara, viruddha, prakaranasama, sadhyasama and kalatita	**[15L]**

Text book:

Introduction to Indian Knowledge System: Concepts and Applications by B. Mahadevan, Nagendra Pavana, Vinayak Rajat Bhat. PHI Learning, 2022

Reference Books:

- Indian Knowledge Systems: Vol. 1 & Vol. 2 by Kapil Kapoor and Awadhesh Kumar Singh. D.K. Print World Ltd., 1st Ed., 2005
- Introduction to Indian Knowledge System by Dr. Rohidas Nitonde, Notion Press, 2024
- Indian astronomy: An historical perspective. Cosmic Perspectives: Essays Dedicated to MKV Bappu by Subbarayappa BVedited by SK Biswas, DCV Mallik and CV Vishveshwara, Cambridge University Press. 1989
- B Mohanapriya, M. Suriya. Indian knowledge systems: Principles and practices. SSS Publications 2025.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/121/104/121104006/
- https://iksindia.org/lectures-and-videos.php
- https://onlinecourses.swayam2.ac.in/e-learning/preview/aic22_ge18

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	40%	40%	-	-	-	100 %
II	20%	40%	40%	-	-	-	100 %

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Specific Outcomes					
	1	2	3	4	5	6
understand the evolution of astronomical practices in India and evaluate their scientific impact	√	√			√	
interpret the contributions of early Indian astronomers and construct a coherent narrative of the transition to modern Indian astronomy		√	√		√	√
Understand the framework for establishing the right knowledge	√	√			√	
Interpret the Vaisesikan approach to describe the physical reality through various components and classifications	√	√	√	√		
Apply the Nyaya approach for resolving ambiguity through logic and argumentation	√	√				√

M. Sc. (Physics) SEMESTER I
COURSE NAME: Introduction to Microprocessor
COURSE CODE: PHYMSC-S1SEC1-2CR26 [CREDITS - 02]

SEC I	Course Code: PHYMSC-S1SEC1-2CR26	
	Course Learning Outcomes	
At the end of this course, learners will be able to • interpret the conversion of number system and will acquire basic understanding and concept of Microprocessors. • relate the usage of Intel 8085 instruction set and to learn writing of assembly language programs for beginners. • design microprocessor-based project. • use combination of input and output devices to work in programmed manner		
Unit I	**Assembly Language Programming**	**[60L]**
Learning Objectives: This unit is intended to make the learners • study programming using assembly language on 8085 IC. • aware of the connection of the real world with machine.		
Learning Outcomes: At the end of this unit, the learner will be able to • acquire basic understanding and concept of Microprocessors • interpret the usage of Intel 8085 instruction set • learn writing of assembly language programs • design microprocessor-based projects		
1.1	1. Data transfer program: A) To load register A, B, C, D with same content. B) From four memory location [X] to [X + 3] load l the register E, D, C, A respectively. 2. Two bites of data are stored at location X and Y interchange them. 3. Two bytes of data are stored at consecutive location in memory at [x]. Write a program to move the data from [X], [X + 1] to [Y], [Y + 1]. 4. Data test program: All zero conditions of byte at memory location [x] B) all 1's conditions of byte at memory location[x]. If condition is true right '01' or else '00' at location [X + 1]. 5. Mask off least significant 4- bits of 8-bit number, 6. Mask off most significant 4- bits of 8-bit number. 7. Shifting of a 16-bit number left by two bits, 8. Arithmetic Program: A. Addition of two 8-bit B. Subtraction of two 8-bit C. addition of two 16-bit numbers, D. Subtraction of two 16-bit numbers E. 1's Complement of 16-bit number,	

	F. 2's Complement of 16-bit number, 9. A) 4 bits of data are stored at 4 consecutive location starting at X. Write a program which increment the values of all the four data. B) 2 bits of data stored at X and X + 1 compute the sum of the two and store the result at Y location ignore the possible overflow. 10. A) 4 bits of data are stored at 4 consecutive locations starting at X. Write a program which increment the values of all the four data. B) 2 bits of data stored at X and X + 1 compute the sum of the two and store the result at Y location ignore the possible overflow. C) four unsigned numbers are stored at consecutive data memory location starting at Memory location X. Compute the summation and ignore the possible overflow. 11. Perform binary additional subtraction in 2's complement between two bytes 12. Perform BCD addition and subtraction in 10's compliments between two bytes. 13. A) Find the largest and smallest from array of data. B) Computer number of ones in one byte of data	

Reference Books:

- Microprocessor Architecture, programming and application with 8085, McGraw-Hill in New Jersey and Ohio. Ramesh Gaonkar, 5th Ed., 2000.
- Fundamentals of Microprocessors and Microcomputers: B. Ram, Dhanpat Rai Publications (1992).

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc22_ee12/preview
- https://onlinecourses.nptel.ac.in/noc25_ee48/preview

NOTE:

- The candidates will have to appear for a viva voce while submitting the project.
- The examiner will mark the candidates based on their performance. The suggested marking scheme is given below.

M. Sc. (Physics) SEMESTER I

COURE NAME: Physics Practical-1

COURSE CODE: PHYMSC-S1PR1-2CR26 [CREDITS - 02]

Practical I	Course Code: PHYMSC-S1PR1-2CR26

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

Practical

1	To obtain the Fourier transforms of given function.
2	To obtain the Laplace transforms of given function.
3	To obtain spherical harmonics for different values of *l*.
4	To evaluate the given data by applying Binomial distribution function.
5	To evaluate the given data by applying Poisson distribution function.
6	To evaluate the given data by applying Gaussian distribution function.
7	To determine the eigenvalues and eigenvectors of the given matrix.

Reference Books:

- Mathematical Methods for Physics and Engineering by Riley, Hobson and Bence, 2nd Ed. Cambridge University Press 2006.
- Mathematical Methods for Physicists: G. Arfken and H. J. Weber, 7th Edition, Academic Press, 2013.
- Mathematical Methods in the Physical Sciences by M L Boas, 3rd Ed. Wiley 2006.
- Advanced Engineering Mathematics, 10th Edition, Erwin Kreyszig Wiley 2011.
- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- Experimental Physics: Modern Methods by R. A. Dunlap, Oxford University Press, New Delhi 1988.
- Methods of Experimental Physics: Series of Volumes by D. Malacara, Academic Press Inc. 1988.

Note:

- The duration of each experiment is of 4 hours.
- In the external exam, a student will have to perform one experiment of 4-hours duration.

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	√	√			√	

M. Sc. (Physics) SEMESTER I

COURE NAME: Physics Practical-2

COURSE CODE: PHYMSC-S1PR2-2CR26 [CREDITS - 02]

Practical II	Course Code: PHYMSC-S1PR2-2CR26

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

Practical

1	To measure the period of oscillation of the given pendulum by changing (i) angle of inclination and (ii) length using variable 'g' pendulum setup.
2	To determine the resistivity of the material by using Four-probe method.
3	To identify the crystal structure by X- ray diffraction pattern.
4	To study Linear Variable Differential Transducer (LVDT).
5	To determine the range of projectile as a function the angle of inclination using Projectile Motion experiment setup.
6	To determine the wavelength of monochromatic light by using Michealson Interferometer.
7	To study absorption spectrum of Iodine molecule.

Reference Books:

- Classical Mechanics by H. Goldstein, 3rd Ed., Pearson education, 2002.
- Classical Mechanics by Tai L. Chaw, 2nd Ed., CRC Press, 2013.
- Introduction to Classical Mechanics by Kleppner and Kolenkow, 2nd Ed., Cambridge University Press, 2021.
- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- Experimental Physics: Modern Methods by R. A. Dunlap, Oxford University Press, New Delhi 1988.
- Methods of Experimental Physics: Series of Volumes by D. Malacara, Academic Press Inc. 1988.

Note:

- The duration of each experiment is of 4 hours.
- In the external exam, a student will have to perform one experiment of 4-hours duration.

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	√	√			√	

M. Sc. (Physics) SEMESTER I

COURE NAME: Physics Practical-3

COURSE CODE: PHYMSC-S1PR3-2CR26 [CREDITS - 02]

Practical III	Course Code: PHYMSC-S1PR3-2CR26

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

Practical

1	To design, build and test 4-bit Up/Down counter using IC 7493.
2	To design, build and test triangular wave generator.
3	To study Voltage-Controlled Oscillator using IC 566.
4	To design, build and test active low pass and high pass filter.
5	To design, build and test active band pass and notch filter.
6	To design, build and test universal shift register.
7	To design, build and test adjustable voltage regulator using LM 317.

Reference Books:

- Digital Principles and Applications, Donald P. Leach, Albert Paul Malvino, Goutam Shah, 8th Ed., Tata McGraw Hill Edu. Pvt. Ltd. 2013
- Op-amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Ed., Pearson
- Electronic Principles, Albert Malvino and David Bates 7th Ed., Tata McGraw Hill Edu. Pvt. Ltd. 2017
- Digital Fundamentals Floyd and Jain 8th Ed., Pearson Education 2005.

Note:

- The duration of each experiment is of 4 hours.
- In the external exam, a student will have to perform one experiment of 4-hours duration.

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	√	√			√	