ANNAMALAI UNIVERSITY
BACHELOR OF SCIENCE
B.Sc. PHYSICS DEGREE COURSE
(2021 - 2022)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
							CIA	Uni. Exam	Total
		SEMESTER I							
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3	III	Core Theory	Paper-1	6	4	Mechanics	25	75	100
5	III	Allied -1	Paper-1	4	3	Chemistry I or Biochemistry I	25	75	100
6	III	Allied Practical	Practical-1	2	0		0	0	0
7	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
8	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEME STER II					CIA	Uni. Exam	Total
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English (CE)	Paper-2	6	4	**Communicative English II**	25	75	100
10	III	Core Theory	Paper-2	4	4	Heat and Thermodynamics	25	75	100
11	III	Core Practical	Practical-1	3	2	Practical - I	25	75	100
12	III	Allied-1	Paper-2	4	3	Chemistry II or Biochemistry II	25	75	100
13	III	Allied Practical	Practical-1	2	2	Practical-Allied	25	75	100
14	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15	IV	Value Education		2	2	Value Education	25	75	100
16	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		**36**	**25**		**225**	**675**	**900**

ANNAMALAI UNIVERSITY

B.Sc. PHYSICS

SYLLABUS
CBCS PATTERN
(2021 - 2022)

SEMESTER I

CORE PAPER - 1

MECHANICS

Course Objectives

1. To know the basics of vectors algebra and the dynamic of a system
2. To understand the dynamics of rigid bodies
3. To learn the concept of work, energy and collisions
4. To study the basics of elasticity
5. To expose the knowledge on gravitation and satellites

UNIT-1: Vectors and Dynamics

Introduction to Vectors - Vector algebra-Scalar and vector products-Gradient of a scalar field - Divergence of a vector field - Line integral - Curl of a vector field - Surface and volume integrals -Stoke's theorem - Gauss theorem of divergence - Green's theorem -Newton's laws of motion-Principle of conservation of momentum-Impulse-Projectile-Range on an inclined plane- Range and Time of fight down an inclined plane-Two body problem and the reduced mass-Centre of mass-Centre of gravity-Centre of gravity of a solid tetrahedron-Analytical problems solving.

UNIT-2: Dynamics of rigid bodies

Rotational kinetic energy and moment of inertia-Angular acceleration and angular momentum-Law of conservation of angular momentum-Torque-Work done by a torque-Theorem of perpendicular and parallel axes-Moment of inertia of a thin uniform rod-rectangular lamina-uniform circular disc (through the centre of gravity for all)-Determination of acceleration due to gravity-Compound pendulum-Centre of suspension and centre of oscillation are interchangeable- Bifilar pendulum (parallel threads)- Analytical problems solving.

UNIT-3: Work, Energy & Collisions

Work-Energy Theorem – Conservative forces - Potential Energy-Force as gradient of potential energy-Principle of conservation of energy of a freely falling body.

Elastic and inelastic collisions-Coefficient of restitution-Oblique impact of a smooth sphere on a fixed smooth plane-Oblique impact of two smooth spheres-Loss of kinetic energy due to oblique impact- Analytical problems solving.

UNIT-IV: Elasticity

Elastic moduli-Hooke's law- Relation between elastic constants – Poisson's Ratio - Work done in stretching twisting a wire-Twisting couple on a cylinder-Rigidity modulus of a wire by Torsional pendulum-Rigidity modulus of a rod by Static torsion method-Bending of beams -Expression for bending moment – Cantilever -Expression for depression at the loaded end- Non-uniform bending-Determination of young's modulus pin & microscope and Koenig's method- Uniform bending-Expression for elevation – Experiment to determine young's modulus using optic lever method- Analytical problems solving,

UNIT-V: Gravitation

Law of gravitation-Acceleration due to gravity- Inertial mass and gravitational mass-Gravitational field-Gravitational potential-Gravitational potential energy- Potential and field due to spherical shell and solid sphere.

Kepler's Laws-Basic principles of rocket motion-Rocket Equation, thrust and acceleration-Escape velocity-Orbital velocity-Satellite in circular orbit-Geosynchronous orbits-Weightlessness- Basic idea of global positioning system (GPS)-Physiological effects on astronauts- Analytical problems solving.

Course outcomes

1. After studied unit-1, the student will be able to know fundamentals of vectors and able to formulate the expression for projectiles.
2. After studied unit-2, the student will be able to study the dynamics of rigid bodies in terms of moment inertia and also able to find the moment of inertia of different systems.
3. After studied unit-3, the student will be able to define work, energy and also able to understand the oblique impact between smooth spheres.
4. After studied unit-4, the student will be able to learn the elastic property of the solid materials and also derive the relation between elastic moduli.
5. After studied unit-5, the student will be able to explain the concept of gravitation and able to know the principles of rocket and satellite.

Text Books

Unit 1

1. R. Murugeshan, Mechanics and Mathematical methods, S.Chand&Co.Ltd, New Delhi, 2016

Unit 2

1. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002

Unit 3

1. M. Narayanamurti and N.Nagartnam, Dynamics, The National Publishing Company, Chennai, 2005.
2. Prof. D.S. Mathur revised byDr.P.S. Hemne, Mechanics, S. Chand and Company Limited, 2014

3. R. Murugeshan, Mechanics and Mathematical methods, S.Chand&Co.Ltd, New Delhi, 2016

Unit 4

1. R. Murugeshan, Properties of Matter and Acoustics, S.Chand&Co.Ltd, New Delhi, 2016
2. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002
3. K. Ilangovan, Properties of Matter and Sound, Ananda Book Depot, Chennai, 2018.
4. J.Jayachitra and M. Gunasekaran, Properties of Matter and Acoustics, KRU Publications, Kumbakonam, 2007.

Unit 5

1. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002
2. Prof. D.S. Mathur revised byDr.P.S. Hemne, Mechanics, S. Chand and Company Limited, 2014

Reference Books

1. Sathyaprakash, Mathematical Physics, Sultanchand& Sons, New Delhi, Revised Ed.
2. Resnick, Halliday and Walker, Physics, 8/e. 2008, Wiley
3. J.W. Jewett, R.A. Serway ,Physics for scientists and Engineers with Modern Phys., , 2010, Cengage Learning
4. R.P.Feynman, R.B.Leighton, M.Sands ,Feynman Lectures, Vol. I, , 2008, Pearson Education
5. M.R. Spiegel, Theoretical Mechanics, , 2006, Tata McGraw Hill.
6. C.Kittel, W.Knight, et.al, Mechanics, Berkeley Physics, vol.1. 2007, Tata McGraw-Hill.
7. G.R. Fowles and G.L. Cassiday, Analytical Mechanics,. 2005, Cengage Learning.
8. Higher Secondary Plus 1 and Plus 2 Physics Books- TN State Board and NCERT Books.

E-Materials

1. https://sites.google.com/a/euhsd.org/physics/
2. https://en.wikipedia.org/wiki/Euclidean_vector
3. https://www.youtube.com/watch?v=sXKiAKn0WCM
4. https://en.wikipedia.org/wiki/Center_of_mass
5. https://en.wikipedia.org/wiki/Moment_of_inertia
6. https://www.toppr.com/guides/physics/system-of-particles-and-rotational-dynamics/moment-of-inertia/
7. https://byjus.com/physics/work-energy-power/
8. https://www.physicsclassroom.com/class/energy
9. https://en.wikipedia.org/wiki/Bending_moment
10. https://www.youtube.com/watch?v=CQGlgu-8dmA (Tamil video)
11. https://en.wikipedia.org/wiki/Newton%27s_law_of_universal_gravitation
12. https://www.youtube.com/watch?v=kxkFaBG6a-A
13. http://hyperphysics.phy-astr.gsu.edu/hbase/rocket2.html
14. https://en.wikipedia.org/wiki/Global_Positioning_System
15. https://study.com/academy/lesson/the-global-positioning-system-and-its-uses.html
16. https://www.nasa.gov/centers/johnson/pdf/584739main_Wings-ch5d-pgs370-407.pdf

SEMESTER II

CORE PAPER - 2
HEAT AND THERMODYNAMICS

Course Objectives

1. Get clear idea about the specific heat capacity and kinetic theory of gases
2. Knowledge about the conduction, radiation and low temperature physicswill be gained
3. To know the thermodynamic system and its laws
4. To learn the concept of entropy and Mawell'sthermodynamical relations
5. To study the basic ideas of statistical mechanics

Unit-1: Specific Heat & Kinetic theory of gases

Specific heat capacity-Principle of method of mixtures-Specific heat capacity of liquid by method of mixtures-Newton's law of cooling-Specific heat capacity of a liquid by the method of cooling- Specific heat capacity of a liquid by Callender and Barne's method-Specific heat capacity of gases- Meyer's relation between C_P and C_v.

Kinetic theory of gases-Expression of pressure of gas-Boyle's law-Charle's law-Perfect gas equation- Mean free path-Expression for mean free path-Maxwell's velocity distribution law-Transport phenomena-Diffusion-Law of equipartition energy- Application to specific heat of gases.

Unit-2: Transmission of Heat & Low Temperature Physics

Conduction-Coefficient of thermal conductivity-thermal conductivity of a good conductor--Forbe's method – thermal conductivity of a poor conductor -Lee's disc method-Black body radiation-Stefan -Boltzmann law-determination of Stefan's constant -laboratory method-Solar energy-Solar cooker-solar constant- temperature of the Sun.

Joule-Kelvin effect-Porous plug experiment- liquefaction of hydrogen- liquefaction of helium-Kammerling-Onne's method-Helium I and II -Lambda point-Superconductivity-Type I and II superconductors -Meissner effect-applications of superconductors.

UNIT-3: Thermodynamics

Thermodynamic system- Zeroth law, First and Second law of thermodynamics -Carnot's theorem-Statement and proof-Otto (petrol) engine and Diesel engine –Construction, working and efficiency- Thermodynamic scale of temperature- Thermodynamic and perfect gas scale.

UNIT-4: Entropy & Enthalpy

Entropy- Change in entropy in a reversible/irreversible process-Temperature entropy diagram -Entropy of perfect gas- Third law of thermodynamics-Maxwell's thermo dynamical relations--Clapeyron latent heat equation-Clausius latent heat equation-Helmholtz and Gibb's free energy-Enthalpy.

UNIT-5:Statistical Mechanics

Phase space- Macrostate and Microstate- Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity -Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics-Ensembles-Micro,canonical and grand canonical ensembles.

Text Books

Unit 1 to Unit 5
1. D. Jayaraman, K. Ilangovan, Thermal Physics &Stastical Mechanics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2016.
2. BrijLal and N Subrahmanyam,Heat Thermodynamics and Statistical Physics,S Chand & Company Pvt Ltd, New Delhi, 2016.

Reference Books

1. D.S. Mathur, Heat and Thermodynamics**,** S Chand & Company Pvt Ltd, 2008.
2. J.B. Rajam, Heat and thermodynamics,S Chand & Co., New Delhi, 1990.
3. R Murugeshan and KiruthigaSivaprasad, Thermal Physics, S Chand & Co., New Delhi, 2002.
4. Gupta and Kumar, Elements of Statistical Mechanics, PragatiPrakashan, Meerut, 2000.
5. SathyaPrakash and J P Agarwal , Statistical Mechanics , KedarNath& Ram Nath& Co., Meerut, 2002.

E- Materials

1. https://www.e-booksdirectory.com/details.php?ebook=1778
2. https://www.ugrad.math.ubc.ca/coursedoc/math100/notes/diffeqs/cool.html
3. https://www.youtube.com/watch?v=JLU0phEP7h4
4. https://www.youtube.com/watch?v=Q7qzc7-flMY (Tamil Video)
5. https://www.youtube.com/watch?v=Atnjo7dD_bA
6. https://www.youtube.com/watch?v=iENG9VnBeP0
7. http://www.iiserpune.ac.in/~bhasbapat/phy221_files/Lee's%20Method.pdf
8. https://vikaspedia.in/energy/energy-production/solar-energy/solar-cookers
9. https://www.youtube.com/watch?v=ZWDl1-oZLJQ (Tamil Video)
10. https://www.youtube.com/watch?v=6IRXVZKH6WQ
11. https://www.youtube.com/watch?v=DPjMPeU5OeM
12. https://statisticalphysics.openmetric.org/equilibrium/ensembles.html

Course Out Comes

1. After studied unit-1, the student will be able to know fundamentals specific heat capacity and able to explain the kinetic theory of gases.

2. After studied unit-2, the student will be able to describe the conduction and radiation of heat and also able to study the Joule-Kelvin effect based on the low temperature phenomena and its applications.

3. After studied unit-3, the student will be able to cite the laws of thermodynamics and their applications.

4. After studied unit-4, the student will be able to explore the equations governing second law of thermodynamics and entropy.

5. After studied unit-5, the student will be able to explain Phase-space, micro and macrostates and able to distinguish MB,FD and BE statistics.

CORE PRACTICAL-1

List of Experiments (Any 15 Experiments only)

1. Compound Pendulum -Determination of 'g' and 'k'.
2. Young's modulus -non uniform bending -Pin and microscope.
3. Young's modulus -uniform bending -Optic lever.
4. Young's modulus cantilever- depression- dynamic method-Mirror, Scale and Telescope.
5. Rigidity modulus -Torsional Pendulum -without masses.
6. Rigidity modulus and moment of inertia -Torsional Pendulum -with identical masses.
7. Rigidity modulus -Static torsion -Mirror, scale and telescope.
8. Surface tension and Interfacial surface tension - drop weight method.
9. Coefficient of viscosity of liquid-Graduated burette -Radius of capillary tube by using microscope.
10. Thermal conductivity of a poor conductor -Lee's disc method.
11. Specific heat capacity of liquid -Newton's law of cooling.
12. Sonometer -Frequency of Tuning fork.
13. Sonometer -Relative density of a solid and liquid.
14. Focal length -R and μ of a convex lens [focal length i) u-v and ii) conjugate foci method; Radius of curvature by telescope method].
15. Focal length -R and μ of a concave lens [focal length i) in contact and ii) auxiliary lens method; Radius of curvature by Boy's method].
16. Spectrometer -Solid prism- Refractive indexof material of a prism.
17. Spectrometer- Hollow prism – Refractive index of a liquid.
18. Potentiometer -Calibration of low range voltmeter.
19. Potentiometer - Internal resistance of a Cell.
20. Post office box -Temperature coefficient of resistance of a coil.

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.
2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Samir Kumar Ghosh, A Textbook of Advanced Practical Physics, NCBA, Kolkatta, 2000.
2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics,NCBA, Kolkatta, 2011
3. C.L.Arora, B.Sc., Practical Physics,S. Chand and Company., New Delhi.
4. D.P.Khandelwal , A Laboratory Manual of Physics for Undergraduate Classes,VaniPublications.
5. B.Saraf et al, Physics through Experiments,Vikas Publications.
6. Harnaam Singh., B.Sc., Practical Physics,S. Chand and Company., New Delhi.
7. D C Tayal, University Practical Physics, Himalaya Publishing House.
8. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut