

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

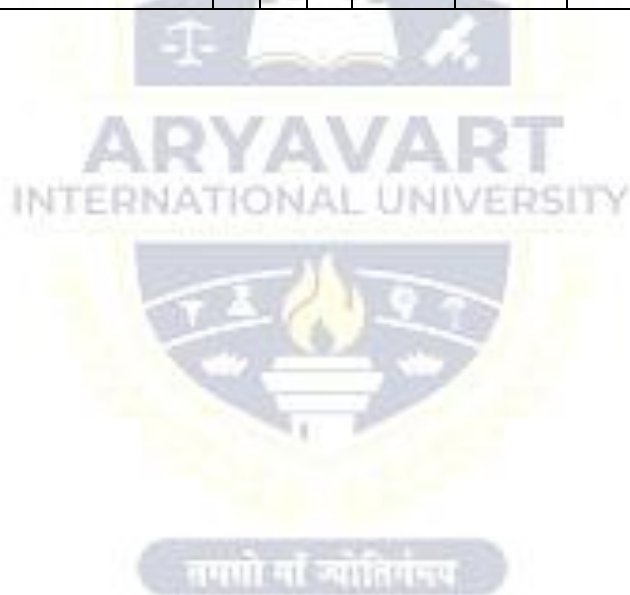
ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for B. Sc. (Physics)

Semester 1

Theory										
Sl. No.	Course Code	Topic	L	T	P	Credit	Theory Marks	Internal Marks	Practical Marks	Total Marks
1	24PY101	Mathematical Physics-I	4	0	0	4	70	30	0	100
2	24PY102	Mechanics	4	0	0	4	70	30	0	100
3	24PY103	Mechanics and Relativity	4	0	0	4	70	30	0	100
4	24EN102	Business Communication	0	0	0	4	70	30	0	100
5	24PY191	Mathematical Physics - I Lab	0	0	4	4	0	30	70	100
6	24PY192	Mechanics Lab	0	0	4	4	0	30	70	100
Total						24	280	180	140	600



Detailed Syllabus

MATHEMATICAL PHYSICS I

Code: 24PY101

Max. Marks: 70

UNIT I

Calculus: Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First Order Differential Equations and Integrating Factor.

Second Order Differential equations: Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral.

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.

UNIT II

Vector Calculus: Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities, Gradient, divergence, curl and Laplacian in spherical and cylindrical coordinates.

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

UNIT III

Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Dirac Delta function and its properties: Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.

Suggested Readings:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
5. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
6. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
7. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
8. Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press

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MECHANICS

Code: 24PY102

Max. Marks: 70

UNIT I

Fundamentals of Dynamics: Reference frames. Inertial frames; Galilean transformations; Galilean invariance. Review of Newton's Laws of Motion. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Momentum of variable-mass system: motion of rocket.

Work and Energy: Work and Kinetic Energy Theorem. Conservative and nonconservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.

UNIT II

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts.

UNIT III

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

UNIT IV

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Mass-less Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy Momentum Four Vector.

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Suggested Readings:

1. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
4. Analytical Mechanics, G. R. Fowles and G. L. Cassiday. 2005, Cengage Learning.
5. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

MECHANICS AND RELATIVITY

Code: 24PY103

Max. Marks: 70

UNIT I

Mathematical Preliminaries

Scalar and vector fields. Gradient of a scalar field, and Divergence and Curl of a vector field in three dimensional cartesian coordinates. Line, surface and volume integrals. Divergence theorem and Stokes' theorem.

UNIT II

Mechanics of a single particle

Inertial reference frame. Newton's laws of motion, Galilean transformation. Analytical solutions of the dynamical equation for special cases, Conservative forces and concept of potential, Linear momentum, Variable mass problem, Rocket motion, Simple harmonic oscillator with damping, Motion of a charged particle in crossed electric and magnetic field. Velocity and acceleration in plane polar coordinates, Motion under a central force, Conservation laws.

UNIT III

Rotational motion

Torque, energy and angular momentum of rotating rigid bodies, Calculation of moments of inertia of simple symmetric objects, Parallel and perpendicular axis theorems, Solution of dynamical problems.

UNIT IV

Special Relativity

Frames of reference, Space-time diagrams, Postulates of special relativity, Lorentz transformation and its consequences, Relativistic dynamics.

Suggested Readings:

1. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
4. Analytical Mechanics, G. R. Fowles and G. L. Cassiday. 2005, Cengage Learning.
5. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

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BUSINESS COMMUNICATION

Code: 24EN102

Max Marks: 70

UNIT I

(10 Hrs)

Concepts and Fundamentals: Introduction to Technical Communication, Need and importance of communication, Channel, Distinction between general and technical communication, Nature and features of technical communication, Seven Cs of communication, Types of Technical communication, Style in technical communication, Technical communication skills, Language as a tool of Communication, History of development of Technical Communication, Computer Aided Technical Communication

UNIT II

(12 Hrs)

Oral Communication: Principles of effective oral communication, Introduction of Self and others, Greetings, Handling Telephone Calls Interviews: Meaning & Purpose, Art of interviewing, Types of interview, Interview styles, Essential, Techniques of interviewing, Guidelines for Interviewer, Guidelines for interviewee. Meetings: Definition, Kind of meetings, Agenda, Minutes of the Meeting, Advantages and disadvantages of meetings/ committees, Planning and organization of meetings. Project Presentations: Advantages & Disadvantages, Executive Summary, Charts, Distribution of time (presentation, questions & answers, summing up), Visual presentation, Guidelines for using visual aids, Electronic media (power-point presentation). The technique of conducting Group Discussion and JAM session.

UNIT III

(12 Hrs)

Written Communication: Overview of Technical Writing: Definition and Nature of Technical Writing, Basic Principles of Technical Writing, Styles in Technical Writing.

Note – Making, Notice, E-mail Writing.

Writing Letters: Business letters, Persuasive letters- Sales letters and complaint letters, Office memorandum, Good news and bad news letters.

Report Writing: Definition & importance; categories of reports, Elements of a formal report, style and formatting in report.

Special Technical Documents Writing: Project synopsis and report writing, Scientific Article and Research Paper writing, Dissertation writing: Features, Preparation and Elements.

Proposal Writing: Purpose, Types, characteristics and structure.

Job Application: Types of application, Form & Content of an application, Drafting the application, Preparation of resume.

UNIT IV

(10 Hrs)

Soft Skills: Business Etiquettes – Professional Personality, Workplace Protocols, Cubicle. Non-Verbal Communication: Kinesics and Proxemics, Paralanguage.

Interpersonal Skills.

Language Skills: Improving command in English, improving vocabulary, Choice of words, Common problems with verbs, Adjectives, adverbs, Pronouns, Tenses, Conjunctions, Punctuations, Prefix, Suffix, Idiomatic use of prepositions. Sentences and paragraph construction, Improve spellings, Common errors and misappropriation, Building advanced Vocabulary (Synonyms, Antonyms), Introduction to Business English.

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Suggested Readings:

1. Kavita Tyagi and Padma Misra , “Advanced Technical Communication”, PHI, 2011
2. P.D.Chaturvedi and Mukesh Chaturvedi, “Business Communication – Concepts, Cases and Applications”, Pearson, second edition.
3. Rayudu, “C.S- Communication”, Himalaya Publishing House, 1994.
4. Asha Kaul, “Business Communication”, PHI, second edition.

Reference Books:

1. Raymond Murphy, “Essential English Grammar- A self study reference and practice book for elementary students of English” , Cambridge University Press, second edition.
2. Manalo, E. & Fermin, V. (2007). Technical and Report Writing. ECC Graphics. Quezon City.
3. Kavita Tyagi and Padma Misra , “Basic Technical Communication”, PHI, 2011.
4. Herta A Murphy, Herbert W Hildebrandt and Jane P Thomas, “Effective Business Communication”, McGraw Hill, seventh edition.



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MATHEMATICAL PHYSICS I LAB

Code: 24PY191

Max. Marks: 70

Contents:

1. Introduction to plotting graphs with Gnuplot:
 - a. Plotting 2D graphs: both functions and data files. Changing plot range, plot style: the options- with points (w p), with dots (w d), with lines (w l), with linespoints (w lp), linetype (lt), linewidth (lw). Using the set command for samples, xrange, yrange, xlabel , ylabel, title etc. The using and every option.
 - b. User defined functions [Including the use of ternary operator (? :) for piece-wise defined functions.]
 - c. Fitting data files using gnuplot.
 - d. Polar and parametric plots. [Graphs to be saved by using GUI - The “export” protocol is not needed.]
2. Introduction to programming in python:
 - a. Introduction
 - i. Using the python interpreter as a calculator
 - ii. Variable and data types (int, float, complex, list, tuple, string, the type() function)
 - iii. Basic mathematical operations
 - iv. Compound statements in python – Conditionals if: elif: else: – Loops for: , while: – User defined functions def: [return statement, default values for arguments, keyword arguments]
 - v. Importing modules with math and cmath as examples
 - vi. Using online help
 - vii. Basic idea of namespaces-local and global
 - viii. Python scripts, I/O operations (including opening and writing to files)
 - b. The python iterables data type
 - i. List: defining lists, reading and changing elements from lists, slicing (with discussion on the difference between ll=mm and ll=mm[:]), concatenation, list comprehension.
 - ii. – built in functions involving lists: range(), len(), sum(), min(), max()
 - iii. – list methods: append(), extend(), count(), index(), sort(), insert(), pop(), remove(), reverse() • Tuples: Contrast and compare with lists, packing/unpacking using tuples (including a,b=b,a to swap variables)
 - iv. Strings: defining strings, the use of single, double or triple quotes as string delimiters, len(),indexing, slicing, string concatenation, some string methods: strip(), split(), join(), find(), count(), replace(), string formatting in python (using the % operator.
 - c. Problems and applications

Problem 0: Observe and interpret the result of the following two scripts

i=0	i=0
a=1	a=1

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<pre>while a>0: i=i+1 a=a/2 print i</pre>	<pre>b=1 while a+b > b: i=i+1 a=a/2 print i</pre>
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Problem 1. Root finding for a single variable (basic theory and algorithm)

- Bisection method
- Newton-Raphson Method Problem

Problem 2. Sorting of lists (algorithm, flowchart and code)

- Bubble sort
- Selection sort Problem

Problem 3. ODE in one and two dimensions using Euler algorithm (output to be saved in data files and gunuplot to be used to plot graphs)

- Capacitor charging/discharging
- Simulating a half-wave rectifier with a capacitor filter
- Particle dynamics in 1D

Problem 4. Matrix operations using list of lists

- Matrix Addition
- Matrix Multiplication
- Transpose of a Matrix

Reference Books

1. Gnuplot in Action understanding data and Graphs, Phillipp K. Janert.
2. Scientific Computing in Python. Abhijit Kar Gupta, Techno World.
3. Physics in Laboratory including python Programming (Semester I), Mandal, Chowdhury, Das, Das, Santra Publication.

Additional Reference Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd
2. Numerical Methods, Arun Kr Jalan, Utpal Sarkar, Univerisity Press
3. Numerical Mathematical Analysis, J. B. Scarborough, OXFORD and IBH Co. Pvt. Ltd.
4. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition
5. An Introduction to computational Physics, T.Pang, 2nd Edn., 2006,Cambridge Univ. Press
6. Learning with Python-how to think like a computer scientist, J. Elkner, C. Meyer, and A. Downey, 2015, Dreamtech Press
7. Gnuplot 5, Lee Phillips, Alogus Publishing, edition 2012.
8. Python Programming, Satyanarayana, Radhika Mani, Jagdesh, Univerisity Press
9. Python 2.1 Bible Dave Brueck, Stephen Tanner, Hungry Minds Inc, New York
10. Computaional Physics problem solving with Computers, Landau, Paez, Bordeianu etextbook in Python 3rd Edition

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MECHANICS LAB

Code: 24PY191

Max. Marks: 70

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine g and velocity for a freely falling body using Digital Timing Technique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater's Pendulum.

Theory Paper

Total: 100 Marks

External: 70 Marks

Internal: 30 Marks

External: 70 Marks

10 Question (MCQ): 1 marks each ($1 \times 10 = 10$)

Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each ($2 \times 6 = 12$)

Answer any 6 out of 8 (Short 50-70 Words): 3 marks each ($3 \times 6 = 18$)

Answer any 6 out of 8 (Long 100-120 Words): 5 marks each ($5 \times 6 = 30$)

Internal: 30 Marks

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The higher of the two scores will be considered for the final assessment.

Lab

Practical: 100 Marks

External: 70 Marks

Internal: 30 Marks

External (Two programs): 70 Marks

Program Writing: 10 + 10 Marks

Algorithm & Flowchart: 5 + 5 Marks

Program Execution: 15 + 15 Marks

Viva: 10 Marks

Internal Assessment (30 Marks)

Internal Assessment Examinations will be conducted, carrying 50 marks

Record: 5 Marks

Attendance: 5 Marks

Program Writing: 15 Marks

Program Execution: 15 Marks

Viva: 10 Marks