ACADEMIC YEAR 2017--2018

DEPARTMENT OF PHYSICS
ABHEDANANDA MAHAVIDYALAYA
ACADEMIC PLAN (SUGGESTIVE) FOR B.SC (HONS)

Semester: - I (From July 2017 - December 2017)

Course: - (AECC – 1) - Environmental Studies
CC-I : Mathematical Physics-I
CC-II : Mechanics
GE 1: Mechanics

Total Marks: - 75 (for each Course) Theory 40, Practical 20 and Internal assessment 15

Total Credit: - 6 (for each Course) Theory 4 & Practical 2

Total No. of Lectures: - Theory 60 & Laboratory 60 (for each Course)

Objectives: - To have a tentative course of action well in advance through the said Academic Plan to be able to: -

- Execute the new CBCS with ease
- Finish syllabus and conduct evaluations due time to the satisfaction of both the students and teachers.

Evaluation Method: -

C 1 – 10% of total marks (class test/ assignment/ seminar + class attendance)
C 2 - 10% of total marks (class test/ assignment/ seminar + class attendance)
C 3 – 80% of total marks (60) i.e. Theory 40 marks [(10x2) + (5x2) + (2x5)] and Practical 20 marks semester- end Examination.

C 1 8^{th} week from the beginning of the semester
Completion of 1/3 of the total syllabus
Around 2^{nd} week of September 2017

C 2 16^{th} week from the beginning of the semester
Completion of 2/3 of the total syllabus
Around 2^{nd} week of November 2017

C3 22th to 24^{th} week from the beginning of semester
Full syllabus
Around 2^{nd} week of December 2017.

SYLLABUS OF CC-I : Mathematical Physics-I Follow the Burdwan University website
CC-II : Mechanics Do
GE 1: Mechanics Do

ACADEMIC PLAN FOR SEMESTER 1.

CC- I: MATHEMATICAL PHYSICS- I (Credits: Theory-04, Practicals-02)

FOR C-I

- Classes begin from 2nd week of July 2017
- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 1/3 of the total syllabus of CC1 should be completed before C1
- Tentative no. of lectures and syllabus covered before C 1:

Name of the Teacher: - Dr. TAPAN KUMAR PRAMANIK (TKP):-

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ALAMGIR(ALG)

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

FOR C-2

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 2/3 of the total syllabus of CC1 should be completed before C2
- Tentative no. of lectures and syllabus covered before C 2

Name of the Teacher: - Dr. TAPAN KUMAR PRAMANIK :-

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ALAMGIR

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

FOR C-3

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- Total syllabus of CC1 should be completed before C3
- Tentative no. of lectures and syllabus covered before C 3

Name of the Teacher: - Dr. TAPAN KUMAR PRAMANIK :-

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ALAMGIR

(a): - Theory (10 lectures)
(b): - Practical (10 lectures)

FOR C-II: Mechanics (Credits: Theory-04, Practicals-02)

FOR C-I

- Classes begin from 2nd week of July 2017
- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 1/3 of the total syllabus of CC1 should be completed before C1
- Tentative no. of lectures and syllabus covered before C 1:

Name of the Teacher: -PROF. SHYAMAL BARAN DUTTA(SBD) :-

(a): - Theory (6 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. JAYANTA KUMAR BAL(JKB)
(a): - Theory (4 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. PRADIP KUMAR GHOSH(PKG)
(a): - Theory (4 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR(AS)
(a): - Theory (6 lectures)

For C 2

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 2/3 of the total syllabus of CC1 should be completed before C2
- Tentative no. of lectures and syllabus covered before C 2

Name of the Teacher: -PROF. SHYAMAL BARAN DUTTA :-

(a): - Theory (6 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. JAYANTA KUMAR BAL
(a): - Theory (4 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. PRADIP KUMAR GHOSH
(a): - Theory (4 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR

(a): - Theory (6 lectures)

FOR C 3

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- Total syllabus of CC1 should be completed before C3
- Tentative no. of lectures and syllabus covered before C 3

Name of the Teacher: -PROF. SHYAMAL BARAN DUTTA :-

(a): - Theory (6 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. JAYANTA KUMAR BAL
(a): - Theory (4 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. PRADIP KUMAR GHOSH
(a): - Theory (4 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR
(a): - Theory (6 lectures)

FOR GE-1 Mechanics (Credits: Theory-04, Practicals-02)

FOR C1

- Classes begin from 2nd week of July 2017
- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 1/3 of the total syllabus of CC1 should be completed before C1
- Tentative no. of lectures and syllabus covered before C 1:

Name of the Teacher: - Dr. ALAMGIR

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR
(a): - Theory (6 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. JAYANTA BAL

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. PRADIP KUMAR GHOSH

(a): - Practical (10 lectures)

FOR C-2

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- 2/3 of the total syllabus of CC1 should be completed before C2
- Tentative no. of lectures and syllabus covered before C 2

Name of the Teacher: - Dr. ALAMGIR

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR
(a): - Theory (6 lectures)
(b): - Practical (10 lectures)
Name of the Teacher: - Dr. JAYANTA BAL

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)
Name of the Teacher: - Dr. PRADIP KUMAR GHOSH

(a): - Practical (10 lectures)

FOR C3

- Number of lectures / week: - 6 lectures of 1 hour duration (6x1 = 6 hours) for theory and 6 lectures of 1 hour duration (6x1 = 6 hours) for Practical classes.
- Total syllabus of CC1 should be completed before C3
- Tentative no. of lectures and syllabus covered before C 3

Name of the Teacher: - Dr. ALAMGIR

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. ANUPAM SARKAR
(a): - Theory (6 lectures)
(b): - Practical (10 lectures)
Name of the Teacher: - Dr. JAYANTA BAL

(a): - Theory (7 lectures)
(b): - Practical (10 lectures)

Name of the Teacher: - Dr. PRADIP KUMAR GHOSH

(a): - Practical (10 lectures)

CORE COURSE (HONOURS IN PHYSICS)

Semester I

CC- I: MATHEMATICAL PHYSICS- I

FOR C1

TKP

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). (2 Lectures)

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor.(5 Lectures). Homogeneous Equations with constant coefficients.Wronskian and general solution. (3 Lectures)

ALG

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. (5 Lectures)

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation.Divergence and curl of a vector field. (5 Lectures).

For C2

TKP

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. Vector Calculus: Introduction to probability: Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing. (10 Lectures)

ALG

Gradient of a scalar field and its geometrical interpretation.Divergence and curl of a vector field.Del and Laplacian operators.Vector identities. Gradient of a scalar field and its geometrical interpretation.Divergence and curl of a vector field.Del and Laplacian operators.Vector identities. (10 Lectures)

TKP

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials.

Integrating factor, with simple illustration.Constrained Maximization using Lagrange Multipliers. Vector Calculus: 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. (10 Lectures)

ALG

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). Orthogonal Curvilinear Coordinates: (10 Lectures)

CC- I : MATHEMATICAL PHYSICS- I Practical :

C1

TKP & ALG

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- The course will consist of lectures (both theory and practical) in the Lab
- Evaluation done not on the programming but on the basis of formulating the problem

- Aim at teaching students to construct the computational problem to be solved
- Students can use any one operating system Linux or Microsoft Windows

Topics Description with Applications Introduction and Overview Computer architecture and organization, memory and Input/output devices Basics of scientific computing

Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow- emphasize the importance of making equations in terms of dimensionless variables, Iterative methods Errors and error Analysis

Truncation and round off errors, Absolute and relative errors, Floating point computations.

C2

TKP & ALG

Review of C & C++ Programming fundamentals

Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, cin and cout, Manipulators for data formatting, Control statements (decision making and looping statements) (If statement. If else Statement. Nested if Structure. Else if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. For Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects Programs: Sum & average of a list of numbers, largest of a givenlist of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search Random number generation Area of circle, area of square, volume of sphere, value of pi (π) Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods

Solution of linear and quadratic equation, solving in optics.

C3

TKP & ALG

Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation Evaluation of trigonometric functions e.g. sin θ, cos θ, tan θ, etc Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte

Carlo method Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Attempt following problems using RK4 order method: • Solve the coupled differential equations

For four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions on the same screen for $0 \leq t \leq 15$. The differential equation describing the motion of a

pendulum is . The pendulum is released

from rest at an angular displacement α, i. e. (0)= and . Solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plot as a function of time in the range $0 \leq t \leq 8\pi$.

CC II: MECHANICS

Theory:

C1

SBD

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non- conservative 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. (6 Lectures)

JKB

Fundamentals of Dynamics: Reference frames; Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable- mass system: motion of rocket. Motion of a projectile in Uniform gravitational field (4 Lectures)

AS

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. (6 Lectures)

PKG

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 pplications.Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems. (4 Lectures)

C2

SBD

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque.Principle of conservation of angular momentum.Rotation about a fixed axis. (6 Lectures)

JKB

Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. (4 Lectures)

AS

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). (6 Lectures)

PKG

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. (4 Lectures)

C3

SBD

Moment of Inertia.Calculation of moment of inertia for rectangular, cylindrical and spherical bodies.Kinetic energy of rotation.Motion involving both translation and rotation. Fluid Motion: Kinematics of Moving Fluids: Poiseuille‟s Equation for Flow of a Liquid through a Capillary Tube. (6 Lectures)

JKB

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire. (4 Lectures)

AS

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. (6 Lectures)

PKG

Time dilation.Relativistic transformation of velocity, frequency and wave number.Relativistic addition of velocities.Variation of mass with velocity. Massless Particles.Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics.Transformation of Energy and Momentum. (4 Lectures)

CC- II: MECHANICS

Practical :

C1

SBD & JKB

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c)Modulus of rigidity.

C2

SBD & JKB

4. To determine the Moment of Inertia of a Flywheel / regular shaped body.
5. To determine g and velocity for a freely falling body using Digital Timing Technique.
6. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille‟s method).
7. To determine the Young's Modulus of a Wire by Optical Lever Method.

C3

SBD & JKB

8. To determine the coefficient of viscosity of highly viscous liquid by Stoke's method.

9. To determine the Modulus of Rigidity of a Wire by Maxwell‟s needle/ dynamical method.

10. To determine the elastic Constants of a wire by Searle‟s method.

11. To determine the value of g using Bar pendulum / Kater‟s Pendulum.

12. To determine the value of Young‟s Modulus by Flexure method.

GE-1/CC- 1A: MECHANICS

Theory:

C1

ALG

Vectors: Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter. Ordinary Differential Equations: 1storder homogeneous differential equations. (7Lectures)

AS

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. (6Lectures)

JKB

Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (7 Lectures)

C2

ALG

2nd order homogeneous differential equations with constant coefficients.Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. (7 Lectures)

AS

RotationalMotion: Angular velocity and angular momentum. Torque. Conservation of angular momentum (6Lectures)

JKB

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants-Work done in stretching and

work done in twisting a wire-Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum- Determination of Rigidity modulus and moment of inertia - q, η and by Searles method (7 Lectures)

AS

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). (6 Lectures)

JKB

Oscillations: Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities. (7Lectures)

GE-1/ CC- 1A: MECHANICS Practical:

C1

AS &ALG

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel/ regular shaped objects.

JKB & PKG

3. To determine Young's Modulus by flexure method.

C2

AS &ALG

4. To determine the Young's Modulus of a Wire by Optical Lever Method.

JKB & PKG

5. To determine the Modulus of Rigidity of a wire by Maxwell's needle / dynamical method.
6. To determine the Elastic Constants of a Wire by Searle's method.

C3

AS &ALG

7. To determine g by Bar/Kater's Pendulum.

8. To determine the coefficient of viscosity by Poiseuille's method.

JKB & PKG

9. To study the Motion of a Spring and calculate (a) Spring Constant (b)Value of g.