TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar

SYLLABUS

OF

Physics
(General & Major)

Semester-I

Year 2014

THREE-YEAR-DEGREE COURSE

PHYSICS (MAJOR)

First Semester:

Total Marks 100

Paper Name : H1 (Theory = 100)

Theory = 100, Practical = 00

(80 + 20 internal)

Four units : each unit has (20 + 5 marks internal)

First Semester:

Paper = H1

UNIT-I

MATHEMATICAL METHODS IN PHYSICS – I : (20 + 5 internal)

Scalar and vector fields, Differentiation of vectors, Gradient, Divergence and Curl - their physical meaning and applications. Vector integrations - Line, Surface and Volume integrations, Gauss Divergence theorem, Stoke's theorem, Green's theorem and their applications to simple problems.

Orthogonal curvilinear coordinate systems, unit vectors in such systems, gradient, divergence, curl and Laplacian in orthogonal curvilinear coordinates, illustration by spherical polar and cylindrical polar coordinate systems as special case.

Matrices: Hermitian matrices, Eigen value and eigen vectors of matrix, Cayley-Hamilton theorem, diagonalization of a matrix.

Beta and Gamma functions, their properties, interrelationship, their applications to simple problems.

Fourier series: Statement of Dirichlet's condition, Fourier series for the expansion of some simple functions. Analysis of different simple waveforms with Fourier series.

UNIT-II

MECHANICS – I: (20 + 5 internal)

Mechanics of a particle: Equation of motion of a particle under time dependent force, velocity dependent force (resistive force) and their applications.

Moment of inertia, Radius of gyration, parallel and perpendicular axes theorems, calculation of moments of inertia for sphere, cylinder, cone, ellipsoid, motion of a sphere and cylinder along an inclined plane.

Frames of reference, inertial and non-inertial reference frame, Rotating frames of references, transformations of operators, Corioli's and centrifugal force in a rotating frame of reference, explanation of some physical phenomena from the point of view of Corioli's force.

Plane .curvilinear motion: velocity and acceleration of particle in plane polar coordinate system (radial and transverse components of velocity and acceleration), tangential and normal components of velocity and acceleration.

Central force, conservative force and related theorems, central orbit, differential equation of motion of a particle moving under central force in plane polar coordinate system, nature of orbits in an inverse square attractive force field, areal velocity, Kepler's laws of planetary motion and their applications, proofs of Kepler's laws considering the inverse square law.

UNIT-III

GENERAL PROPERTIES OF MATTER:

(GRAVITATION, ELASTICITY, SURFACE TENSION AND VISCOSITY): (20 + 5 internal)

Gauss's theorem in gravitation and its application to spherical and cylindrical cases. Poisson's and Laplaces equations (derivation using divergence theorem).

Elastic moduli and their interrelations, bending moment, depression at the free end of a light cantilever, depressions of a beam supported at the two ends and loaded at the middle, bending of beam due to its own weight (fixed at one end & supported at the two ends), torsion of a cylinder, torsional oscillations, strain energy in all cases.

Fluid dynamics: Derivation of equation of continuity in differential form, rigorous derivation of Bernoulli's theorem, Applications of Bernoulli's theorem to venturimeter, pitot tube, Torricelli's theorem.

Motion of viscous fluid: Poiseuille's equation for the flow of an incompressible fluid with necessary corrections. Poiseuille's equation for the flow of a compressible fluid, Statement of Stoke's law, equation of motion of a body through viscous medium under gravity and it's solution, terminal velocity.

Surface tension: Calculation of excess pressure across a curved film with special cases. Determination of surface tension using Sessile drop, Surface wave in a liquid.

UNIT-IV

VIBRATION AND WAVES: (20 + 5 internal)

Simple Harmonic Motion (SHM): Differential equation of SHM and its solution (rigorous method). Compositions of SHM. Lissajou's figure, damped and forced vibrations, their differential equations and solutions, resonance and sharpness of resonance.

Differential equation of longitudinal plane progressive wave and its solution in one dimension, energy of waves, pressure distribution in longitudinal waves, dispersion in wave propagation, phase velocity and group velocity on the basis of consideration of superposition of two waves.

Differential equation for transverse wave in stretched string, Theories of plucked, struck and bowed string, basic principle underlying the production of combination tone.

Acoustics of building: Growth of sound intensity, reverberation time and Sabine's law. Chracteristics of a good Auditorium.

PHYSICS (GENERAL)
TRIPURA UNIVERSITY
Paper C-1
Full Marks - 100
Total Lecture 60
(Each lecture period = 1 hour)

Each unit

Unit – I: Vectors, Mechanics

15 lectures

Vectors: Differentiation of vectors, Gradient , Divergence and Curl-their meanings and applications. Vector integrations-Line, Surface and Volume integrations, Gauss's divergence theorem, Green's theorem and Stoke's theorem (Only their statements), their applications to simple problems.

Moment of inertia. Radius of gravitation, Parallel and perpendicular axes theorems (in two dimension), calculation of moments of inertia for uniform rod, uniform lamina, sphere, cylinder.

Velocity and acceleration in Cartesian and plane polar co-ordinate systems.

Degrees of freedom, Generalised co-ordinates, Lagranges and Hamilton's equations (only their statements), applications in simple pendulum, simple harmonic oscillator, and projectile, Cyclic corordinate and its importance.

Unit - II: Gravitation and elasticity and Fluid

15 lectures

Gravitational potential and intensity for spherical shell. Hollow and solid sphere, Kater's pendulum with Bessel's correction.

Elastic constants, modulli and heir interrelations, bending moment, depression at the free end of a light cantilever, depressions of a beam supported at the two ends and loaded at the middle, torsion of a cylinder and torsional constant, torsional escillations, strain energy of torsion.

Surface tension surface energy molecular theory of surface tension, Explanation of elevation and depression of a liquid in a capillary tube with calculation of rise. Jurin's law.

Viscosity and Newton's law, Poiseuille's equation for the flow of an incompressible fluid (Correction only qualitative), Statement of stoke's law terminal velocity.

Unit - III: THERMODYNAMICS AND RADIATION

15 lectures

Andrew's and Amagat,s experiment, Van der waal's equartion(Simple derivation), merits and demerits of van der waal's equation, critical constants, expression for Boyle temperature,.

Second law of thermodynamies. reversible and irreversible changes, Carnot's cycle and its efficiency. Carnot's theorem, thermodynamic scale of temperature..

its properties and physical significance, change of entropy in reversible and irreversible changes,

Porus plug experiment Joule-Thomson effect and inversion temperature.

Kirchoff's law and its simple derivation, pressure and energy density of diffused radiation(Expressions only).

Unit IV optics:

15 Lectures

Fermat's principles reflection and refraction at plane surfaces by Fermat's principle, Refraction at spherical surface, thin lenses and their combination, cardinal points, equivalent lens, Ramsden and Huygen's eyepiece.

Wave nature of light. Huygen's principle, explation of reflection, refraction and experiment. Fresnel's biprism experiment, Newtons ring experiment with theory.

Diffraction (Fresnel class): half period zone, explanation of rectilinear propagation of light, principle of zone plate and its behavior as convergent lens.

Diffraction (Fraunhoffer class): diffraction pattern of single slit, double slit and plane transmlssion grating (simple treatment), circular aperture(qualitative).. Polarisation: Double refraction , Huygen's construction for uniaxial crystal.