



1/1/2023

SYLLABUS DISTRIBUTION SEM I (NEP)2023

SYLLABUS DISTRIBUTION

Semester I

MAJOR-PHYSICS COURSE

COURSE OBJECTIVE: The aim of this course is to equip students with mathematical methods that are

important prerequisites for physics courses.

Unit	Syllabus	Teacher
Unit -1	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). (3 Lectures)	MKS
Unit -2	First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of the existence and the Uniqueness theorem for Initial Value Problems. Particular Integral. (9 Lectures) Calculus of functions of more than one variable: Partial derivatives, Exact and inexact differentials. (6 Lectures)	DKD
Unit -3	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. (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. Del and Laplacian operators. Vector identities. (6 Lectures) Vector Integration: Ordinary integrals of vectors, Multiple integrals, Jacobian. Notion of an 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). (10 Lectures)	DKD
Unit -4	Orthogonal Curvilinear Coordinates: Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. (6 Lectures)	RL

MATHEMATICAL PHYSICS-I: PHYS1011 (Credits: Theory-03, Practicals-01) F.M.=75 (Theory-40, Practical-20, Internal Assessment-15)

***** Practical for MAJOR-I: PHYS1011: MATHEMATICALPHYSICS-I will be covered by DKD and RL**

Semester I

MINOR-PHYSICS COURSE

MINOR-I: PHYS1021: MATHEMATICAL PHYSICS-I (Credits: Theory-03, Practicals-01) F.M.=75
(Theory-40, Practical-20, Internal Assessment-15)

Unit	Syllabus	Teacher
Unit -1	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). (3 Lectures)	MKS
Unit -2	First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of the existence and the Uniqueness theorem for Initial Value Problems. Particular Integral. (9 Lectures) Calculus of functions of more than one variable: Partial derivatives, Exact and inexact differentials. (6 Lectures)	DKD
Unit -3	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. (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. Del and Laplacian operators. Vector identities. (6 Lectures) Vector Integration: Ordinary integrals of vectors, Multiple integrals, Jacobian. Notion of an 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). (10 Lectures)	DKD
Unit-4	Orthogonal Curvilinear Coordinates: Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. (6 Lectures)	

***** Practical for MINOR-I: PHYS1021: MATHEMATICAL PHYSICS-I:
MATHEMATICAL PHYSICS-I will be covered by DKD and RL**

SEC-1:PHYS1051: RENEWABLE ENERGY AND ENERGY HARVESTING (Credits: 03) F.M.=50 (Theory-40, Internal Assessment–10)

Unit	Syllabus	Teacher
Unit -1	<p>Fossil Fuels and Alternate Sources of Energy: Fossil fuels and nuclear energy, Their limitation, Need of renewable energy, Non-conventional energy sources. An overview of the developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, Solar energy, Biomass, Biochemical conversion, Biogas generation, Geothermal energy, Tidal energy, Hydroelectricity. (8 Lectures)</p> <p>Solar energy: Solar energy and its importance, Storage of solar energy, Solar pond, Non-convective solar pond, Applications of solar pond and solar energy, Solar water heater, Flat plate collector, Solar distillation, Solar cooker, Solar green houses, Solar cell, Absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits and sun tracking systems. (8 Lectures)</p> <p>Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces and grid interconnection topologies. (5 Lectures)</p> <p>Ocean Energy: Ocean Energy, Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. (5 Lectures)</p>	MKS
Unit-2	<p>Geothermal Energy: Geothermal resources, Geothermal technologies. (4 Lectures)</p> <p>Hydro Energy: Hydropower resources, Hydropower technologies, Environmental impact of hydro power sources.(5 Lectures)</p>	DS
Unit-3	<p>Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modelling piezoelectric generators, Piezoelectric energy harvesting applications, Human power. (5 Lectures)</p> <p>Electromagnetic Energy Harvesting: Linear generators, Related Physics, Mathematical models, Recent applications, Carbon captured technologies, cell, Batteries, Power consumption, Environmental issues and Renewable sources of energy, Sustainability. (5 Lectures)</p>	RL

MULTI-DISCIPLINARY-1: PHYS1031: CONCEPTS OF PHYSICS 1

(Credits: 03) F.M.=50 (Theory-40, Internal Assessment–10)

Unit	Syllabus	Teacher
Unit-1	<p>Unit, Dimensions and Measurement of Physical Quantities: Need for a measurement, Units of measurement, Systems of units, SI units, Fundamental and derived units. Length, mass and time measurements, Accuracy and precision of measuring instruments, Errors in measurements, Significant figures. Dimensions of physical quantities, Dimensional analysis and its applications. (4 Lectures)</p> <p>Kinematics: Motion in a Straight Line, Uniform and non-uniform rectilinear motion, Average speed and instantaneous velocity, Uniformly accelerated motion, Velocity-time and position-time graphs, Kinematic equations for uniformly accelerated motion (graphical treatment). (3 Lectures)</p> <p>Scalar and vector quantities: Unit vector, Position and displacement vectors, Equality of vectors, Multiplication of vectors by a real number, Addition and subtraction of vectors, Relative velocity, Resolution of a vector in a plane, Rectangular components, Scalar and vector product of two vectors. (3 Lectures)</p> <p>Motion in a plane : Uniform circular motion, projectile motion. (2 Lectures)</p> <p>Laws of Motion: Intuitive concept of force, Inertia, Newton's first law of motion, Momentum and Newton's second law of motion, Impulse, Newton's third law of motion. Law of conservation of linear momentum and its applications. Static and kinetic friction, Laws of friction, Rolling friction, Lubrication. Dynamics of uniform circular motion, Centripetal force, Examples of circular motion (vehicle on a levelled circular road, vehicle on a banked road). (8 Lectures)</p>	DS
Unit-2	<p>Work, Energy and Power: Work done by a constant force and a variable force, Kinetic energy, Work-energy theorem, power. Notion of potential energy, Potential energy of a spring, Conservative forces, Conservation of mechanical energy (Sum of kinetic and potential energies), Non-conservative forces, Motion in a vertical circle, Elastic and inelastic collisions in one and two dimensions. (8 Lectures)</p> <p>System of Particles and Rotational Motion: Centre of mass of a two-particle system, Momentum conservation and Motion of centre of mass. Centre of mass of a rigid body, Centre of mass of a uniform rod. Moment of a force, Angular momentum, Law of conservation of angular momentum and its applications. Equilibrium of rigid bodies, Rigid body rotation and equations of rotational motion, Comparison of linear and rotational motion. Moment of inertia, Radius of gyration, Values of moments of inertia for simple geometrical objects (no derivation). (12 Lectures)</p>	RL
Unit-3	<p>Gravitation : Universal law of gravitation, Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy and gravitational potential, Escape velocity, Orbital velocity of a satellite, Geo-stationary satellites. (5 Lectures)</p>	MKS