Government General Degree College, Chapra

Department of Physics (Sem-I)

Lesson Plan 2024-2025, Undergraduate Course in Physics (NEP-2020)

Semester	Tentative dates of University Exam	Name of the faculty	Course code	Allotted topic/text	Sub-topic/Lesson plan (No. Of Lecture)
Sem- I	Follow the latest notification by KU	**Sudipta Das (SD)**	**PHY-M-T-1** (MATHEMATICAL PHYSICS-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. **(5 Lectures)** 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. **(10 Lectures)** Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **(5 Lectures)**
			PHY-M-P-1 (MATHEMATICAL PHYSICS-I) **Practical**	**Introduction and Overview** **Basics of scientific computing** **Errors and error Analysis** **Introduction to programming in Python/Fortran/**	Computer architecture and organization, memory and Input/output devices. **(2 Lectures)** 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. **(6 Lectures)** Truncation and round off errors, Absolute and relative errors, Floating point computations. **(2 Lectures)** Introduction to programming, constants, variables and data types, dynamical typing, operators and expressions, modules, I/O statements, iterables, compound statements, indentation in python, the if-elif-else block, for and while loops, nested compound

				Matlab/C/C++	statements, lists, tuples, dictionaries and strings, basic ideas of object-oriented programming. **(10 Lectures)**
			PHY-MI-T-1 (Mathematical Physics-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. **(5 Lectures)**
				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. **(10 Lectures)**
			PHY-MI-P-1 (MATHEMATICAL PHYSICS-I) **Practical**	**Introduction to programming in Python/Fortran/ Matlab/C/C++**	Introduction to programming, constants, variables and data types, dynamical typing, operators and expressions, modules, I/O statements, iterables, compound statements, indentation in python, the if-elif-else block, for and while loops, nested compound statements, lists, tuples, dictionaries and strings, basic ideas of object-oriented programming.
			PHY-SEC-T-1 (Electrical circuit and network skills)	**Understanding Electrical Circuits**	Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources (principle of generation, output wave form, advantage of using three- phase). Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **(10 Lectures)**
				Generators and Transformers	DC Power sources (basic idea). AC and DC generators (basic principle of action). Inductance, capacitance, and impedance. Operationof transformers (Step-up and step-down). **(5 Lectures)**
		Dr. Shaikh Safikul Alam (SSA)	**PHY-M-T-1** (MATHEMATICAL PHYSICS-I)	**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. **(6 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, Gradient, divergence, curl and Laplacian in spherical and cylindrical coordinates. **(7 Lectures)**
					Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line,

				Vector Integration	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 proof) **(10 Lectures)**
			PHY-M-P-1 (MATHEMATICAL PHYSICS-I) **Practical**	**Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods** **Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation** **Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method**	Solution of linear and quadratic equation, solving, $\theta = tan\ \theta$, $I = I_0\{\sin\alpha/\alpha\}^2$ in optics. **(5 Lectures)** Evaluation of trigonometric functions e.g. sinθ, cosθ, tanθ etc. **(5 Lectures)** Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop. Monte-Carlo integration. Curve fitting, Least square fit, Goodness of fit, standard deviation Ohms law to calculate R, Hooke's law to calculate spring constant. **(10 Lectures)**
			PHY-MI-T-1 (Mathematical Physics-I)	**Vector Calculus** **Vector Differentiation**	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. **(6 Lectures)** 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. **(7 Lectures)**
			PHY-MI-P-1 (Mathematical Physics-I)	**Introduction to plotting graphs with Matplotlib/Gnuplot /Origin/Excel** **Programs**	Basic 2D and 3D graph plotting - plotting functions and datafiles, fitting data using gnuplot's fit function, modifying the appearance of graphs. Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search, Factorial of a

					number, sum of a power series e.g. sin, cosine, exponential series etc.
			PHY-SEC-T-1 (Electrical circuit and network skills)	**Basic Electricity Principles** **Electric Motors**	Voltage, Current, Resistance, and Power. Ohm's law, Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with digital multimeter (name of the circuit elements and their ranges), Analog voltmeter and analog ammeter. **(10 Lectures)** Single-phase, three-phase & DC motors. Basic design. Speed & power of ac motor. **(5 Lectures)**
		Dr. Supriya Mandal (SM)	**PHY-M-T-1** (MATHEMATICAL PHYSICS-I)	**Orthogonal Curvilinear Coordinates** **Matrices** **Introduction to probability** **Dirac Delta function and its properties**	Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. **(4 Lectures)** Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew- Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix. Eigen-values and Eigenvectors (Degenerate and non-degenerate). Cayley-Hamiliton Theorem. Diagonalization of Matrices. Solutions of Coupled Linear Ordinary homogeneous Differential Equations. Functions of a Matrix. **(6 Lectures)** Independent random variables: Sample space and Probability distribution functions. Binomial, Gaussian, and Poisson distribution with examples. Mean and variance. **(5 Lectures)** Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. **(2 Lectures)**
			PHY-M-P-1 (MATHEMATICAL PHYSICS-I)	**Introduction to plotting graphs with Matplotlib/Gnuplot/Origin/Excel**	Basic 2D and 3D graph plotting - plotting functions and datafiles, fitting data using gnuplot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface and contour plots, exporting plots. **(8 Lectures)** Sum & average of a list of numbers, largest of a given list of numbers and its location in the

			Practical	**Programs** **Random number generation**	list, sorting of numbers in ascending descending order, Binary search, Factorial of a number, sum of a power series e.g. sin, cosine, exponential series etc. **(8 Lectures)** Area of circle, area of square, volume of sphere, value of pi (π). **(4 Lectures)**
			PHY-MI-T-1 (Mathematical Physics-I)	**Vector Integration** **Matrices** **Dirac Delta function and its properties**	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 proof) **(10 Lectures)** Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew- Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix. Eigen-values and Eigenvectors (Degenerate and non-degenerate). **(5 Lectures)** Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. **(2 Lectures)**
			PHY-MI-P-1 (Mathematical Physics-I)	**Random number generation** **Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods**	Area of circle, area of square, volume of sphere, value of pi (π) Solution of linear and quadratic equation, solving, $\theta = tan\ \theta$
			PHY-SEC-T-1 (Electrical circuit and network skills)	**Solid-State Devices** **Electrical Protection** **Electrical Wiring**	Resistors, inductors and capacitors. Diode and rectifiers (half wave and full wave rectifier with L, C, L-C filter arrangement, regulation). Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources. **(6 Lectures)** Relays, Fuses and disconnect switches, Working principle of Circuit breakers, Miniature circuit breaker and its types. **(5 Lectures)** Conduit wiring (basic idea of house hold wiring). Basics of wiring: Star and Delta Connections. Preparation of extension board, Wiring Materials (Basic information about the wiring components). **(4 Lectures)**