

LESSON PLAN

Department Name: Physics, AY 2026-27

**Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG),
Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)**

Paper Name & Code: PHS-DSCC-1-1, Basic Physics-I , Sem - I

Planned					
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
(A) Mathematical Physics					
Preliminaries (GP)	a) Units & Dimension , Plotting functions	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk	
	b) Limits And continuity		1		
	c) Taylor and Binomial series		1		
	d) Calculus, maxima. Minima		1		
	e) Partial derivatives		1		
2. Ordinary Differential Equations (SDG)	a) First order	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk, Assignment	
	b) Second order		1		
3 Vectors (SC)	a) Vector products	Vector Analysis (Schaum's outline series) By Spiegel	2	Chalk & talk	
	b) Vector differentiations, gradient , curl,		3		
	c) Divergence and Stoke's theorem		2		
4. Curvilinear Coordinates (SC)	a) Plane polar, spherical, cylindrical coordinates, vectors. velocity and acceleration		5		
	b) Vector integrals		1		
Total			20		

LESSON PLAN

Department Name: Physics, AY 2026-27

**Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG),
Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)**

Paper Name & Code: PHS-DSCC-1-1, Basic Physics-I , Sem - I

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
(B) Classical Mechanics					
1. Review of Newton's Laws (AS)	a) Inertial frames , Galilean transformation	Classical Mechanics By A.B. Gupta	1	Chalk & talk	
	b) Newton's laws conservation of linear momentum		1		
	c) Rotational motion		2		
	d) Problems		2		
2. Work Kinetic energy Theorem (AS)	a) Conservative and non conservative forces, potential		2		
	b) potential energy curves and Stability		1		
	c) Small oscillation		1		
3. Dynamics of a system of particles (GP)	a) COM and reduced mass	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Momentum and energy of a system of particles		2		
4. Central forces (GP)	a) Laws of Gravitation		1		
	b) Gravitational Potential and Intensity		2		
	c) Equation of motion in Central forces		3		
	d) Motion under inverse square law		2		

LESSON PLAN

Department Name: Physics, AY 2026-27

**Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG),
Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)**

Paper Name & Code: PHS-DSCC-1-1, Basic Physics-I , Sem - I

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
5. Scattering (KB)	a) Two body collision and scattering	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
6 . Mechanics of Continuum (KB)	a) Kinematics of moving fluids, equation of continuity	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	Total		30		
TOTAL (A+B)			20+30=50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Introduction to Computer Programming
and Graph Plotting (Pr) PHS-SEC-1-1, Semester - I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Introduction to Graph Plotting (2D only, using GNUPLOT) (SC)	a) Plotting 2D graphs: both functions and data files. Changing plot range and plot styles: the options- with points (w p), with dots (w d), with lines (w l), with lines points (w lp), linestyle (lt),linewidth (lw). Using the set command for samples, xrange, yrange, xlabel ,ylabel, title etc. Theusing option	1) Scientific Computing in Python by Abhijit Kar Gupta	2	Computer Practical	
	b) User defined functions [Including the use of ternary operator for piece-wise defined functions.]		3		
	c) Fitting data files using gnuplot.		3		
	d) Polar and parametric plots		3		
	e) Conditional Plotting of data from file using \$, &&, operators. (Graphs to be saved withoutusing GUI)		3		

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Paper Name & Code: Introduction to Computer Programming
and Graph Plotting (Pr) PHS-SEC-1-1, Semester - I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Introduction to programming in python (Version 3): (SDG)	a) Introduction Using the python interpreter as a calculator Variable and data types (int, float, complex, list, tuple, set, string, the type () function) Basic mathematical operations Compound statements in python Conditionals (if, elif, else) Loops (for, while)	1) Scientific Computing in Python by Abhijit Kar Gupta	3	Computer Practical, Study material	
	b) User defined functions def: (return statement, default values for arguments, keywordarguments), lambda function. Importing modules with math and cmath as examples, Using help and dir command to use the inbuilt manual, Basic idea of namespaces- local and global Python scripts, I/O operations (including opening and writing to files)		3		
	b) The python data types List: defining lists, reading and changing		4		

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Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	elements from lists, slicing (with discussion on the difference between <code>ll=mm</code> and <code>ll=mm[:]</code> , concatenation, list comprehension. built in functions involving lists: <code>range()</code> , <code>len()</code> , <code>sum()</code> , <code>min()</code> , <code>max()</code> – list methods: <code>append()</code> , <code>extend()</code> , <code>count()</code> , <code>index()</code> , <code>sort()</code> , <code>insert()</code> , <code>pop()</code> , <code>remove()</code> , <code>reverse()</code>				
	Tuples: Contrast and compare with lists, packing/unpacking using tuples (including <code>a,b=b,a</code> to swap variables) • Sets : set methods: <code>update()</code> , <code>pop()</code> , <code>remove()</code> , Set Theoretic operations: union, intersection, difference and symmetric difference of two sets.		4		
	Strings: defining strings, the use of single, double or triple quotes as string delimiters, <code>len()</code> , indexing, slicing, string concatenation, some string methods: <code>strip()</code> , <code>split()</code> , <code>join()</code> , <code>find()</code> , <code>count()</code> , <code>replace()</code> , string formatting in python (using the <code>%</code> operator	1) Scientific Computing in Python by Abhijit Kar Gupta	2	Computer Practical	

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Paper Name & Code: Introduction to Computer Programming
and Graph Plotting (Pr) PHS-SEC-1-1, Semester - I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
3. Problems and Applications (SDG)	Finding factors of an integer Determining whether an integer is prime or not. Finding out prime number greater than or lesser than a given value. Finding out all prime numbers within a given range	1) Scientific Computing in Python by Abhijit Kar Gupta	10		
	Root finding for a single variable (basic theory and algorithm) using Newton-Raphson and Bisection method Sorting of lists (algorithm, flowchart and code) using Bubble or Selection sort Sum of series correct up to given decimal places (Sine, Cosine, Exponential etc.)		8		
	Simulation of motion of a particle in 1D under a given force $F(x, t, v)$ with given initial condition and plotting (x, t) , (x, v) , (t, v) . (Output to be saved in data files and Gnuplot to be used to plot graphs), using		6	Computer Practical	

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Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Introduction to Computer Programming
and Graph Plotting (Pr) PHS-SEC-1-1, Semester - I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Euler's method only.				
	Matrix Addition, Multiplication and Transpose using List Comprehension.		6		
		Total	60		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-CC-1-1/PHS-Minor4/1-1-1, Sem - I

Planned							
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments		
(A) Mathematical Physics							
1. Preliminaries (KB)	a) Units & Dimension , Plotting functions	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk			
	b) Limits And continuity		1				
	c) Taylor and Binomial series		1				
	d) Calculus, maxima. Minima		1				
	e) Partial derivatives		1				
2. Ordinary Differential Equations (KB)	a) First order	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk, Assignment			
	b) Second order		1				
3 Vectors (KB)	a) Vector products	Vector Analysis (Schaum’s outline series) By Spiegel	2	Chalk & talk. Assignment			
	b) Vector differentiations, gradient , curl,		3				
	c) Divergence and Stoke’s theorem		2				
4. Curvilinear Coordinates (KB)	a) Plane polar, spherical, cylindrical coordinates, vectors. velocity and acceleration		5				
	b) Vector integrals		1				
	Total		20				

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-CC-1-1/PHS-Minor4/1-1-1, Sem - I

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
(B) Classical Mechanics					
1. Review of Newton's Laws (AS)	a) Inertial frames , Galilean transformation	Classical Mechanics By A.B. Gupta	1	Chalk & talk	
	b) Newton's laws conservation of linear momentum		1		
	c) Rotational motion		2		
	d) Problems		2		
2. Work Kinetic energy Theorem (AS)	a) Conservative and non conservative forces, potential		2		
	b) potential energy curves and Stability		1		
	c) Small oscillation		1		
3. Dynamics of a system of particles (AS)	a) COM and reduced mass	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Momentum and energy of a system of particles		2		
4. Central forces (AS)	a) Laws of Gravitation		1		
	b) Gravitational Potential and Intensity		2		
	c) Equation of motion in Central forces		3		
	d) Motion under inverse square law		2		
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments

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Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-CC-1-1/PHS-Minor4/1-1-1, Sem - I

5. Scattering (AS)	a) Two body collision and scattering	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
6. Mechanics of Continuum (AS)	a) Kinematics of moving fluids, equation of continuity	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	Total		30		
TOTAL (A+B)			20+30=50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Nature of Science	Role of proper reasoning and experiments, with examples. Inductive and deductive logic.	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes – Steven Weinberg	2	Chalk and Talk	
	The character of physical laws, including universality.		2		
	Difference between science and pseudo science		1		
2. Universe	The Copernican revolution, Kepler's laws and the Solar system, Galileo and birth of Telescopic Astronomy,	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes – Steven Weinberg	4	Chalk and Talk	
	Modern observations: Stars and galaxies, Life cycle of stars. Birth of the Universe,		3		
	Big Bang and Hubble expansion, Dark matter and dark energy.		3		
3. Matter	Atoms and molecules: The physical basis of the Periodic Table	1. The character of physical laws –	2	Chalk and Talk	

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Heat and Thermodynamics: Basic idea about the kinetic theory of gases; Distinction between ideal and real gases; The three laws of thermodynamics. Concept of Entropy.	Richard P. Feynman 2. Introduction to Astronomy: From Darkness to Blazing Glory – J. W Scott, JAS Educational Publications	6		
	Radioactivity: Alpha, beta & gamma decay; X-Rays – Properties		3		
	Structure of the atom: Electron, Nucleus: proton and neutron. Mention of the Standard Model of particles & interactions.		4	Chalk and Talk	
4. Forces	Laws of falling bodies, Inertia, Gravitation, Electricity and Magnetism, Light and its dual property.	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes	5	Chalk and Talk	

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-I

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	The microscopic world of Quantum Mechanics.	– Steven Weinberg	5	Chalk and Talk	
	Special and General Theory of Relativity (brief and qualitative ideas only)		5		
	Total Lectures		45		

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Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG) , Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-DSCC-3-1, Sem III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Oscillations (SC)	Differential equation of simple harmonic oscillation and its solution. Kinetic energy, potential energy, total energy and their time average values.	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit	2	Chalk & talk, Assignment	
	Damped and forced oscillations: Transient and steady states, resonance, sharpness of resonance; power dissipation and Quality Factor.		2		
2. Superposition of Harmonic Oscillations (SC)	Superposition of two collinear Harmonic oscillations having equal frequencies and different frequencies (beats).	3) A Treatise on Oscillations, Waves And Acoustics by Dr. D. Chattopadhyay	1	Chalk & talk, Assignment	
	Superposition of two Perpendicular Harmonic Oscillations for phase difference $\delta = 0, \pi, 2\pi$: Graphical and analytical methods, Lissajous' figures with equal and unequal frequency and their uses.		2		
3. Wave motion (SC)	Plane and spherical waves. Longitudinal and transverse waves. Plane progressive (travelling) waves. Wave equation for travelling waves. Particle and wave velocities.		2	Chalk & talk	

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Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG) , Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-DSCC-3-1, Sem III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Superposition of harmonic Waves (SC)	Velocity of transverse vibrations of stretched strings; standing (stationary) waves in a string: fixed and free ends (analytical treatment).	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit 3) A Treatise on Oscillations, Waves And Acoustics by Dr. D. Chattopadhyay	2	Chalk & talk	
	Changes with respect to position and time. Energy of vibrating string. Transfer of energy.		2		
	Normal modes of stretched strings. Plucked and struck strings, Superposition of N harmonic waves. Phase and group velocities.		2		
	Numerical problems		1		
5. Fermat's Principle (AS)	Fermat's principle, laws of reflection and refraction at a plane and curved surface.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	2	Chalk & talk	
6. Interference (AS)	Huygens principle, division of amplitude and wavefront. Young's double slit experiment. Fresnel's Biprism.		2	Chalk & talk	
	Phase change on reflection: Stokes' treatment. Interference in thin films: parallel and wedge shaped films.		3		

Subject Name/Code: Physics Major, PHSM

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Shinjinee Das Gupta (SDG) , Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-DSCC-3-1, Sem III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Fringes of equal inclination (Haidinger fringes); Fringes of equal thickness (Fizeau fringes). Newton's Rings: Measurement of wavelength and refractive index.		3		
	Michelson interferometer (no detailed theory required), Fabry Perot interferometer. temporal and spatial coherence.		3		
	Numerical problems.		1		
7. Diffraction (AS)	Fraunhofer diffraction: Single slit, double slit and diffraction grating. Resolving power of grating.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	4	Chalk & talk	
	Rayleigh criterion for resolution. Circular aperture (qualitative discussion only).		2		
	Fresnel diffraction: Fresnel's half-period zones for plane wave. Explanation of rectilinear propagation of light. Theory of a Zone Plate: Multiple foci of a Zone Plate.		3		
	Class test		1		

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Paper Name & Code: Waves and Optics, PHS-DSCC-3-1, Sem III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
. Polarization (SDG)	Description of linear, circular and elliptical polarization.	1) Optics by E. Hecht 2) Optics by Ajoy Ghatak 3) Introduction to Optics by E. L. Pedrotti	2	Chalk & talk, PPT, Assignment	
	Propagation of electromagnetic waves in birefringent medium, polarization in uniaxial crystals. Double refraction. Polarization by double refraction. Nicol prism. Ordinary and extraordinary refractive indices.		2		
	Phase Retardation plates: Quarter-wave and Half-wave plates. Production and analysis of polarized light.		2		
	Rotatory polarization, Biot's laws for rotatory polarization. Fresnel's theory of optical rotation. Calculation of angle of rotation. Specific rotation.		2		
	Numerical problems and Quiz		1		
	Class test.		1		
		Total	50		

Subject Name/Code: Physics Major, PHSM

LESSON PLAN

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Paper Name & Code: Waves and Optics, PHS-DSCC-3-1, Sem III

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Mathematical Physics I , PHS-DSCC-3-2, Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Convergence of infinite series (KB)	Convergence of power series. Idea of interval convergence.	1) Mathematical Methods in the Physical Science by M. L. Boas	1	Chalk & talk, PPT, Assignment	
	Different convergence tests of power series: D'Alembert's ratio test, Cauchy's root test, Integral test.		2		
	Alternating series test. Absolute and conditional convergence.		1		
2. Fourier Series (KB)	Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients.	2) Mathematical Physics by H. K. Dass	2	Chalk & talk, PPT, Assignment	
	Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.	3) Mathematical Methods for Physics and Engineering by K. F Riley, Michael Paul Hobson, and Stephen John Bence	2		
	Applications. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.		1		
	Class test and quiz.		1		

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Paper Name & Code: Mathematical Physics I , PHS-DSCC-3-2, Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
3. Fourier Transform (SDG)	Fourier Integral theorem. Fourier Transform (FT) with examples. FT of trigonometric, Gaussian, finite wave train, and other functions.	1) Mathematical Methods in the Physical Science by M. L. Boas	2	Chalk & talk, PPT, Assignment	
	Inverse Fourier transform, Properties of FT (translation, change of scale, complex conjugation etc.). Parseval's identity.	2) Mathematical Physics by H. K. Dass	2		
	Applications of FT in single slit, double slit, rectangular aperture and N-slit grating.	3) Mathematical Methods for Physics and Engineering by K. F Riley, Michael Paul Hobson, and Stephen John Bence	1		
	Class Test		1		
4. Partial Differential Equations (GP)	Solution to partial differential equations using separation of variables: Solutions of Laplace's equation in problems with Cartesian and spherically symmetric cases only.	1) Mathematical Physics by H. K. Dass 2) Mathematical Methods by Potter and Goldberg	4	Chalk & talk	
	Wave equation and its solution for vibrational modes of a stretched string, Diffusion Equation in one dimension.		3		
	Numerical and quiz		1		

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Paper Name & Code: Mathematical Physics I , PHS-DSCC-3-2, Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Introduction to Probability (GP)	Probability for discrete events, and combined probability for uncorrelated events. Mean and variance.	1) Mathematical Methods in the Physical Science by M. L. Boas 2) Mathematical Physics by H. K. Dass	3	Chalk & talk	
	Independent random variables: Sample space and Probability distribution functions. Binomial, Gaussian, and Poisson distribution with examples.		3		
	One dimensional Random walk.		1		
	Class Test		1		
6. Dirac δ -function (GP)	Definition of Dirac δ -function. Delta function as limit of different delta-sequence functions. Properties of δ -function: $\delta(-x)$, $\delta(f(x))$.	1) Mathematical Methods for Physics and Engineering by K. F Riley, Michael Paul Hobson, and Stephen John Bence	2	Chalk & talk	
	Derivative of the step function. Fourier transform of δ -function. Two-and three-dimensional δ -function. Fourier transform of three-dimensional Coulomb potential, evaluation of $\nabla^2 \left(\frac{1}{r}\right)$.		2		

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Paper Name & Code: Mathematical Physics I , PHS-DSCC-3-2, Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
7. Some special integrals (GP)	Beta and Gamma functions and relation between them. Expression of integrals in terms of Gamma functions.	1) Mathematical Physics by H. K. Dass	3	Chalk & talk	
	Error function (probability integral). Numerical problems.		1		
8. Numerical Analysis I (KB)	<i>Approximation in numerical computation:</i> Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors: errors in normal distribution as quadrature (uncorrelated).	1) Numerical Methods, Arun Kr Jalan, Utpal Sarkar, 2015, University Press	1	Chalk & talk, PPT	
	<i>Numerical solution of Algebraic equation:</i> Bisection method, Newton-Raphson method.		1		
	<i>Interpolation:</i> Finite difference operators, Newton (Gregory) forward and backward interpolation, Lagrange's Interpolation.		2		
	<i>Numerical integration:</i> Trapezoidal rule, Simpson's 1/3 rule.		1		

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Paper Name & Code: Mathematical Physics I , PHS-DSCC-3-2, Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	<i>System of linear algebraic equations:</i> Direct methods: Gaussian elimination; Iterative methods: Gauss-Jacobi method, Gauss-Seidel method. Some qualitative discussion on matrix inversion technique.		2		
	<i>Numerical solution of ordinary differential equation:</i> Euler's method, Runge-Kutta methods (order two and four).		2		
	<i>Curve fitting:</i> Curve fitting by the method of least squares. Fitting of curves of the form $y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$.		1		
		Total	50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino, PHS- SEC-3-1, Semester- III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Prerequisite	1. Basic Electronics: Familiarity with fundamental electronic components like resistors, capacitors, diodes, and transistors is essential. Understanding concepts like voltage, current, resistance and Ohm's law is crucial for working with circuits.	1) Arduino Cookbook, Michael Margolis, 2011, O'Reilly Media 2) Getting Started with Arduino, Massimo Banzi, 2009, O'Reilly Media	1	Hands on training, PPT	
	2. Circuit Design: Knowing how to design and analyze simple circuits is important. This includes understanding circuit diagrams, bread-boarding and connecting components properly.		1		
	3. Programming Fundamentals: Basic programming knowledge is necessary since Arduino programming involves writing code in C/C++. Understanding variables, loops, conditional statements and functions is vital.		2		
	4. Understanding Sensors and Actuators: Arduino projects often involve interfacing with sensors (e.g., temperature, light, motion) and actuators (e.g., motors, LEDs). Understanding how these devices work and how to interface them with the Arduino is essential.		2		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino, PHS- SEC-3-1, Semester- III

Planned				Content Delivery Technique	Remarks / Comments
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned		
	5. Digital and Analog Signals: Understanding the difference between digital and analog signals, as well as concepts like analog-to-digital conversion (ADC) and pulse-width modulation (PWM), is crucial for working with Arduino.		2		
	6. Serial Communication: Knowing how to communicate between the Arduino and other devices (e.g, computers, sensors) via serial communication (e.g, UART, 12C, SPI) is important for more advanced projects.	1) Arduino Cookbook, Michael Margolis, 2011, O'Reilly Media 2) Getting Started with Arduino, Massimo Banzi, 2009, O'Reilly Media	1	Hands on training, PPT	
	7. Problem-Solving Skills: Being able to troubleshoot and debug circuits and code is essential. This involves logical thinking and the ability to break down problems into smaller, more manageable parts.		1		
Introduction of Microcontroller & Arduino	Basic Idea about Microcontroller; Introduction to Arduino: Brief history of the Arduino; Pin configurations of the board Arduino Uno. Brief idea about Arduino-nano/Arduino R4 WiFi/Arduino MRGA. Sources of constant voltages 5volt/3.3 volt		5	Hands on training, PPT	

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino, PHS- SEC-3-1, Semester- III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	and ground and corresponding pins of the respective boards. PWM and idea of duty cycle.				
Arduino Programming	1. Setting up the arduino board. Installation of IDE in PC/laptop for Arduino programming.	1) Arduino Cookbook, Michael Margolis, 2011, O'Reilly Media 2) Getting Started with Arduino, Massimo Banzi, 2009, O'Reilly Media	1	PPT, Practical	
	2. Programming structure : Data types, variables, constants, operators, control statements, loops, functions, string.		3		
	Conditional like if, elseif; for and while loop. Idea about global variable and local variable.		2		
	Use of serial monitor for input/output and serial plotter for observation of variation of data.		2		
	3. Some Basic Operations: i) Binary operation through HIGH/LOW status of digital pin. Operation on inbuilt LED/LED connected externally in series with a resistance e.g., blinking.		1		
	ii) Sending analog voltage. Use of analog pins. Changing brightness of an LED.		1		
	iii) Measurement of voltage through appropriate pins.		1		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino, PHS- SEC-3-1, Semester- III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Projects	10 Projects using Arduino	1) Arduino Cookbook, Michael Margolis, 2011, O'Reilly Media, 2) Physics Today 66, 11, 8 (2013) 3) The Physics Teachers 52, 157 (2014)	25	Hands on training using Arduino.	
		Total	50		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-CC-3-1 , Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Oscillations (GP)	Differential equation of simple harmonic oscillation and its solution. Kinetic energy, potential energy, total energy and their time average values.	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit	3	Chalk & talk, Assignment	
	Damped and forced oscillations: Transient and steady states, resonance, sharpness of resonance; power dissipation and Quality Factor.		3		
2. Superposition of Harmonic Oscillations (AS)	Superposition of two collinear Harmonic oscillations having equal frequencies and different frequencies (beats).		1	Chalk & talk, Assignment	
	Superposition of two Perpendicular Harmonic Oscillations for phase difference $\delta = 0, \pi, 2\pi$:		2		
3. Wave motion (GP)	Plane progressive (travelling) waves. Wave equation for travelling waves. Particle and wave velocities.		2	Chalk & talk	

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-CC-3-1 , Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Velocity of transverse vibrations of stretched strings; standing (stationary) waves in a string.	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit	3	Chalk & talk	
	Phase and group velocities, Doppler effect.		2		
	Numerical problems		1		
4. Geometrical Optics (GP)	Fermat's principle. Laws of reflection and refraction at a plane surface, refraction at a spherical surface, lens formula.	1) Optics by Ajoy Ghatak 2) Optics by B. Ghosh	2	Chalk & talk, PPT	
	Combination of thin lenses-equivalent focal length. Dispersion and dispersive power.		2		
	Numerical problems		1		
5. Interference (AS)	Huygens principle: explanation of the laws of reflection and refraction.		2	Chalk & talk	
	Division of amplitude and wavefront. Young's double slit experiment. intensity distribution, conditions of interference.		3		

Subject Name/Code: Physics MDC Core, MPHS

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-CC-3-1 , Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Interference in thin films: parallel and wedge shaped films: parallel and wedge shaped films.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	3		
	Fringes of equal inclination (Haidinger fringes); Fringes of equal thickness (Fizeau fringes). Newton's Rings: Measurement of wavelength and refractive index.		3		
	Numerical problems.		1		
6. Diffraction (AS)	Fraunhofer diffraction: Single slit, double slit and diffraction grating. Resolving power of grating.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	3	Chalk & talk	
	Rayleigh criterion for resolution. Circular aperture (qualitative discussion only).		2		
	Fresnel diffraction: Fresnel's half-period zones for plane wave. Theory of a Zone Plate: Multiple foci of a Zone Plate.		2		
	Class test		1		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: Waves and Optics, PHS-CC-3-1 , Semester - III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
7. Polarization (AS)	Description of linear, circular and elliptical polarization.	1) Optics by E. Hecht 2) Optics by Ajoy Ghatak 3) Introduction to Optics by E. L. Pedrotti	1	Chalk & talk, PPT, Assignment	
	Propagation of electromagnetic waves in birefringent medium, polarization in uniaxial crystals. Double refraction. Polarization by double refraction. Ordinary and extraordinary refractive indices.		2		
	Phase Retardation plates: Quarter-wave and Half-wave plates.		1		
	Rotatory polarization, Biot's laws for rotatory polarization. Specific rotation.		2		
	Numerical problems		1		
	Class test.		1		
		Total	50		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-Minor4/2-3-1, PHS-Minor3-3-1 Sem - III

Planned					
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
(A) Mathematical Physics					
1. Preliminaries (GP)	a) Units & Dimension , Plotting functions	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk	
	b) Limits And continuity		1		
	c) Taylor and Binomial series		1		
	d) Calculus, maxima. Minima		1		
	e) Partial derivatives		1		
2. Ordinary Differential Equations (GP)	a) First order	Mathematical Methods in the Physical Sciences by M.L. Boas	1	Chalk & talk, Assignment	
	b) Second order		1		
3 Vectors (KB)	a) Vector products	Vector Analysis (Schaum's outline series) By Spiegel	2	Chalk & talk. Assignment	
	b) Vector differentiations, gradient , curl,		3		
	c) Divergence and Stoke's theorem		2		
4. Curvilinear Coordinates (KB)	a) Plane polar, spherical, cylindrical coordinates, vectors. velocity and acceleration		5		
	b) Vector integrals		1		
Total			20		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-Minor4/2-3-1, PHS-Minor3-3-1 Sem - III

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
(B) Classical Mechanics					
1. Review of Newton's Laws (GP)	a) Inertial frames , Galilean transformation	Classical Mechanics By A.B. Gupta	1	Chalk & talk	
	b) Newton's laws conservation of linear momentum		1		
	c) Rotational motion		2		
	d) Problems		2		
2. Work Kinetic energy Theorem (GP)	a) Conservative and non conservative forces, potential		2		
	b) potential energy curves and Stability		1		
	c) Small oscillation		1		
3. Dynamics of a system of particles (GP)	a) COM and reduced mass	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Momentum and energy of a system of particles		2		
4. Central forces (AS)	a) Laws of Gravitation		1		
	b) Gravitational Potential and Intensity		2		
	c) Equation of motion in Central forces		3		
	d) Motion under inverse square law		2		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: Basic Physics-I, PHS-Minor4/2-3-1, PHS-Minor3-3-1 Sem - III

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
5. Scattering (AS)	a) Two body collision and scattering	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
6. Mechanics of Continuum (AS)	a) Kinematics of moving fluids, equation of continuity	Classical Mechanics By A.B. Gupta	2	Chalk & talk	
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	Total		30		
TOTAL (A+B)			20+30=50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Nature of Science	Role of proper reasoning and experiments, with examples. Inductive and deductive logic.	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes – Steven Weinberg	2	Chalk and Talk	
	The character of physical laws, including universality.		2		
	Difference between science and pseudo science		1		
2. Universe	The Copernican revolution, Kepler's laws and the Solar system, Galileo and birth of Telescopic Astronomy,	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes – Steven Weinberg	4	Chalk and Talk	
	Modern observations: Stars and galaxies, Life cycle of stars. Birth of the Universe,		3		
	Big Bang and Hubble expansion, Dark matter and dark energy.		3		
3. Matter	Atoms and molecules: The physical basis of the Periodic Table	1. The character of physical laws –	2	Chalk and Talk	

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Heat and Thermodynamics: Basic idea about the kinetic theory of gases; Distinction between ideal and real gases; The three laws of thermodynamics. Concept of Entropy.	Richard P. Feynman 2. Introduction to Astronomy: From Darkness to Blazing Glory – J. W Scott, JAS Educational Publications	6		
	Radioactivity: Alpha, beta & gamma decay; X-Rays – Properties		3		
	Structure of the atom: Electron, Nucleus: proton and neutron. Mention of the Standard Model of particles & interactions.		4	Chalk and Talk	
4. Forces	Laws of falling bodies, Inertia, Gravitation, Electricity and Magnetism, Light and its dual property.	1. Six Easy Pieces – Richard P. Feynman 2. The first three minutes	5	Chalk and Talk	

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS, Sem-III

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	The microscopic world of Quantum Mechanics.	– Steven Weinberg	5	Chalk and Talk	
	Special and General Theory of Relativity (brief and qualitative ideas only)		5		
	Total Lectures		45		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Maitreyi Ray Kanjilal (MRK), Dr Subhendu Chandra (SC)

Paper Name & Code: Electronics I, PHS- DSCCC-5-1, Sem - V

Planned					
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
1. Circuits and network (DC) (SC)	Discrete components, active and passive components, ideal constant voltage and constant current sources.	1) Circuit Theory by Chattopadhyay and Rakshit 2) Electricity and Magnetism by B. Ghosh	2	Chalk & talk	
	Network analysis: Kirchhoff's laws, Thevenin's and Norton's theorem, Superposition theorem. Maximum power transfer theorem.		2		
2. Semiconductor diodes and applications (SC)	P and N type semiconductors. Energy level diagram. Conductivity and mobility, concept of drift velocity. PN junction fabrication (simple idea only). Barrier formation in PN junction diode. Static and dynamic resistance. Current flow mechanism in forward and reverse biased diode. Drift velocity.	1) Basic Electronics by Chattopadhyay and Rakshit 2) Principles of Electronics by Malvino	4	Chalk & talk	
	Rectifier diode: Half-wave rectifiers. Centre-tapped and Bridge full-wave rectifiers, Calculation of Ripple Factor and Rectification Efficiency,		2		
	L and C filter. Circuit and operation of clipping and clamping circuit; principle and structure of LEDs, photodiode, solar cell.		3		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Maitreyi Ray Kanjilal (MRK), Dr Subhendu Chandra (SC)

Paper Name & Code: Electronics I, PHS- DSCCC-5-1, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
3. Bipolar junction transistors and biasing (SC)	n-p-n and p-n-p transistors. Characteristics of CB, CE and CC configurations. Physical mechanism of current flow. Relations between the current gains of the three modes. Active, cut-off and saturation regions. DC load line and Q-point;	1) Basic Electronics by Chattopadhyay and Rakshit	4	Chalk & talk	
	Transistor biasing and stabilization circuits. Fixed bias, collector to base bias, emitter or self bias, voltage divider bias.	2) Principles of Electronics by Malvino	3		
	Transistor as 2-port network. h-parameter equivalent circuit. Analysis of a single-stage CE amplifier using hybrid model. Input and output impedance.	3) Circuits and Networks by Boyelsted and Nesalsky	3		
4. Field Effect transistors (SC)	JFET and MOSFET (both depletion and enhancement type) as a part of MISFET. Basic structure and principle of operations and their characteristics. Pinch off, threshold voltage and short channel effect.	1) Basic Electronics by B. L. Theraja	3	Chalk & talk	
5. Regulated power supply (SC)	Load regulation and line regulation. Zener diode as a voltage regulator. Problem with the Zener regulator circuit. Requirement of feedback and error amplifier. Study of series regulated power supply using pass and error transistor assisted by Zener diode as a reference voltage supplier.	1) Basic Electronics by Chattopadhyay and Rakshit	3	Chalk & talk	

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Maitreyi Ray Kanjilal (MRK), Dr Subhendu Chandra (SC)

Paper Name & Code: Electronics I, PHS- DSCCC-5-1, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
6. Amplifiers (SC)	Transistor amplifier; CB, CE and emitter follower circuit and their uses. Load Line analysis of transistor amplifier.	1) Basic Electronics by B. L. Theraja	2	Chalk & talk	
	Classification of class A, B and C amplifiers with respect to placement to Q point. Frequency response of a CE amplifier. Role of series and parallel capacitors for cut off frequencies.	2) Circuits and Networks by Boyelsted and Nesalsky	3		
7. Feedback amplifiers and OPAMP (MRK)	Effects of positive and negative feedback. Voltage series, current series, voltage shunt and current shunt feedback and uses for specific amplifiers. Estimation of input impedance, output impedance, gain, stability;	1) Analog Electronics by Milman & Halkias 2) OP-AMPs and Linear Integrated Circuits by R. A. Gayakwad	3	Chalk & talk	
	Operational Amplifiers (black Box approach): Characteristics of ideal and practical OP-AMP (IC 741), Open-loop and closed-loop voltage gain. Frequency response. CMRR. Slew rate and concept of virtual ground.		2		
	Application of OP-AMP: DC application — inverting and non-inverting amplifiers, inverting and noninverting adder, differentiator as subtractor, error amplifier, comparator, Schmidt trigger. AC applications: differentiator, integrator.		3		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Maitreyi Ray Kanjilal (MRK), Dr Subhendu Chandra (SC)

Paper Name & Code: Electronics I, PHS- DSCCC-5-1, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
8. Multivibrator (SC)	Transistor as a switch, Explanation using CE output characteristics. Construction and operation using wave shapes of collector coupled Bistable, Monostable and astable multivibrator circuits, Expression for time period.	1) Basic Electronics by Chattopadhyay and Rakshit 2) Basic Electronics by B. Ghosh	5	Chalk & talk	
9. Oscillators (SC)	Sinusoidal oscillators: Barkhausen's criterion for self-sustained oscillations. RC phase shift oscillator, Wien bridge oscillator, determination of feedback factor and frequency of oscillation. Relaxation oscillator using OP-AMP	1) Basic Electronics by Chattopadhyay and Rakshit 2) Analog Electronics by Milman & Halkias	3	Chalk & talk	
TOTAL			50		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS). Dr. Kathakali Biswas (KB)

Paper Name & Code: Nuclear and Particle Physics, PHS-DSCC-5-2, Sem-V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Rutherford scattering(AS)	Calculation of differential cross-section.	1) Nuclear Physics by S.N. Ghosal 2) Nuclear Physics by Satadal Bhattacharya 3) Radiation detection and measurement by G.F. Knoll	2	Chalk and talk	
2. Nuclear properties and structure (AS)	Mass, charge, size, B.E, spin and magnetic moment of the nucleus; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle		4	Chalk and talk	
	Isotopes, isobars, isotones. Bainbridge Mass Spectrograph. Nature of nuclear force between nucleons, Stability and binding, N -Z plot.		2	Chalk and talk	
	Nuclear models: Liquid Drop model. Bethe-Weizsäcker semi-empirical mass formula and binding energy.		3	Chalk and talk	
	Some applications: explanation of α decay by heavy nuclei, mass parabola, explanation of β decay by mirror nuclei. Nuclear shell model and magic numbers, ground state spin parity, Nordheim's Rule (qualitative discussion on phenomenology with examples).		6	Chalk and talk	

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS). Dr. Kathakali Biswas (KB)

Paper Name & Code: Nuclear and Particle Physics, PHS-DSCC-5-2, Sem-V

3. Interaction with and within the nucleus (AS)	Radioactivity: α -decay — kinematics, range-energy relationship and Geiger-Nuttall Law; β -decay — energy released, spectrum and Pauli's prediction of neutrino; Energy levels and decay schemes, positron emission and electron capture, selection rules: Fermi and Gamow-Teller transitions.	1)Nuclear Physics by S.N. Ghosal 2)Nuclear Physics by Satadal Bhattacharya 3)Radiation detection and measurement by G.F. Knoll	6	Chalk and talk	
	γ -ray emission, nuclear isomerism, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.		4	Chalk and talk	
4. Nuclear Reactions (KB)	Types of reactions, conservation laws, kinematics of reactions, Q-value, reaction rate, reaction cross-section. Concept of compound and direct reaction, Ghoshal's experiment.	1)Nuclear Physics by S.N. Ghosal 2)Solid State and Nuclear Physics by Dr. J.P Agrawal	3	Chalk and talk, PPT	
	Resonance reaction, fission and fusion: mass deficit and generation of energy. Reaction characteristics, explanation in terms of liquid drop model, fission products and energy release, spontaneous and induced fission, transuranic elements.	3)Introduction to Elementary Particles, D. Griffiths, 2008, John Wiley & Sons	3	Chalk and talk, PPT	
	Chain reaction and basic principle of nuclear reactors. Nuclear fusion: energetics in terms of liquid drop model. Chain reaction and basic principle of nuclear reactors, slow neutrons interacting with U-235, Nuclear Fusion — energetics in terms of liquid drop model (brief qualitative discussions).	1)Nuclear Physics by S.N. Ghosal 2)Nuclear Physics by Satadal Bhattacharya	4	Chalk and talk, PPT	

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Atri Sarkar (AS). Dr. Kathakali Biswas (KB)

Paper Name & Code: Nuclear and Particle Physics, PHS-DSCC-5-2, Sem-V

5. Particle accelerators and detectors (KB)	Linear accelerator, cyclotron, betatron, gas detectors — GM Counters. Semiconductor detectors.		3	Chalk and talk, PPT	
6. Particle physics (AS)	Elementary particles and their families, interactions and basic features. Symmetry and conservation laws: energy and momentum, angular momentum, parity, baryon number, lepton number, isospin, hypercharge, and strangeness.	1)Nuclear Physics by S.N. Ghosal	3	Chalk and talk	
	Wu's experiment and basic idea of parity violation. Gell-Mann–Nishijima formula. The baryon and meson octet and baryon decuplet diagrams. Quark structure of hadrons. Concept of quark model, color quantum number and gluons (qualitative discussion only).		4	Chalk and talk	
7. Nuclear Astrophysics (AS)	Energy production in stars, p-p chain, CNO cycle. Production of heavier elements (qualitative discussion).	1)Nuclear Physics by S.N. Ghosal	3	Chalk and talk	
		Total	50		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP) , Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Quantum Mechanics, PHS-DSCC-5-3, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Formulation of Quantum Mechanics in vector space language (SDG)	State as a vector in a complex vector space, inner product, its properties using Dirac bra-ket notation.	1) Quantum Mechanics Concepts and Applications by Nouredine Zettili 2) Introduction to Quantum Mechanics by Krishnendu Sengupta and Palash B. Pal	2	Chalk & talk, Assignment, PPT	
	Physical observables as Hamiltonian operators on state space; eigenvalues, eigenvectors and completeness property of the eigenvectors-matrix representation of Hermitian operators.		3		
	Unitary time evolution. Wavefunction as the probability amplitude distribution of a state for the observables with continuous eigenvalues.		2		
	Position representation and momentum representation of wave-function and operators. Interpretation of $\psi(r)=\langle r \psi\rangle$.		2		
	One dimensional harmonic oscillator by raising and lowering operator method. Matrix representation of position and momentum operators.		3		
	Numerical Problems		1		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP) , Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Quantum Mechanics, PHS-DSCC-5-3, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Two and three dimensional problems (SDG)	Two and three dimensional problems in Cartesian coordinates: separation of variables. Application for free particle, Particle in 2-d and 3-d box. Degeneracy of energy levels. Concept of symmetry and accidental degeneracy in 2-d box. Isotropic and anisotropic harmonic oscillator. Degeneracy for isotropic harmonic oscillator in 2-d and 3-d.	1) Quantum Mechanics Concepts and Applications by Nouredine Zettili	3	Chalk & talk, PPT, Assignment	
	Class test		1		
3. Angular momentum algebra using Ladder operators (SDG)	Construction of matrix representation of L_x , L_y , L_z for $l=1$. Algebra with Ladder operators.	2) Introduction to Quantum Mechanics by Krishnendu Sengupta and Palash B. Pal 3) Quantum Mechanics by Walter Greiner	2	Chalk & talk, PPT, Assignment	
	Addition of angular momenta $l_1 + l_2$, and their projections. Spin as an intrinsic angular momentum and its relation with the Pauli matrices for spin-1/2.		2		
	Numerical Problems		1		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP) , Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Quantum Mechanics, PHS-DSCC-5-3, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Quantum theory of hydrogen-like atoms (SDG)	Reduction of a two-body problem to a one body problem. The time independent Schrödinger equation for a particle moving under central force; the Schrödinger equation in spherical polar coordinates.	1) Quantum Mechanics Concepts and Applications by Nouredine Zettili 2) Introduction to Quantum Mechanics by Krishnendu Sengupta and Palash B. Pal 3) Quantum Mechanics by Walter Greiner	2		
	Separation of variables. Angular equation and orbital angular momentum. Spherical Harmonics (solution to Legendre differential equation may be assumed).		3		
	Radial equation for attractive Coulomb interaction- Hydrogen atom. Solution for the radial wavefunctions (solution to Laguerre differential equation may be assumed). Sketch of probability densities. Orbital angular momentum number l and m , s, p, d shells.		3		
	Peer teaching		1		
	Numerical problems		1		

Subject Name/Code: Physics Major, PHSM

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP) , Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Quantum Mechanics, PHS-DSCC-5-3, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Quantum Statistical Mechanics 5. System of identical particles (GP)	Collection of non-interacting identical particles. Classical approach and quantum approach: distinguishability and indistinguishability.	1) Statistical Mechanics: Theory, Problems, and Solutions by Dr. Upendranath Nandi 2) Statistical Mechanics R.K.Patharia	1	Chalk & talk, assignment	
	Composite system postulate and symmetry postulate of quantum mechanics (for a pair particles only). Bosons and Fermions. Symmetric and antisymmetric wave functions.		2		
	Pauli Exclusion principle for Fermions. Derivation of Bose-Einstein and Fermi-Dirac distribution function using grand canonical ensemble.		4		
	Numericals		1		
6. Bose-Einstein statistics (GP)	Thermodynamic functions of a strongly degenerate Bose gas. Bose derivation of Planck's law.		3	Chalk & talk, Assignment	
	Radiation as a photon gas. Bose-Einstein condensation and properties of liquid He-4 (qualitative description only).		2		
	Numericals		1		

Subject Name/Code: Physics Major, PHSM

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP) , Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Quantum Mechanics, PHS-DSCC-5-3, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
7. Fermi-Dirac statistics (GP)	Thermodynamic functions of a strongly degenerate Fermi gas	1) Statistical Mechanics: Theory, Problems, and Solutions by Dr. Upendranath Nandi	3	Chalk & talk, Assignment	
	Fermi energy, electron gas in a metal, Specific heat of metals due to electrons (qualitative discussions).		2		
	Numericals	2) Statistical Mechanics R.K.Patharia	1		
		Total	50		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Thermal Physics and Statistical Mechanics, PHS-DSCC-5-4, Sem - V

Planned					
Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
Kinetic Theory of Gases 1. Transport phenomenon in ideal gas (SDG)	Viscosity, thermal conductivity and diffusion.	1) Thermal Physics by Roy and Gupta	2	Chalk & talk, PPT, Assignment	
	Brownian motion and its significance (Langevin approach)		2		
	Quiz and peer teaching		1		
2. Conduction of heat	Thermal conductivity and diffusivity. Variable and steady state; Fourier's equation for heat conduction and its solution for rectilinear flow of heat.	2) Thermal Physics by Garg, Bansal and Ghosh	2	Chalk & talk, PPT, Assignment	
	Numericals		1		
3. Real Gas	Behavior of real gases: Deviations from the ideal gas Equation. Andrew's experiments on CO ₂ . Critical constants. Continuity of liquid and gaseous state. Vapour and gas. Boyle temperature. Van der Waals' equation of state. Critical const. Law of corresponding states. Comparison with expt. P-V		4	Chalk & talk, PPT, Assignment	

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Thermal Physics and Statistical Mechanics, PHS-DSCC-5-4, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
Thermodynamics	Generic conditions of stable equilibrium for (V,T) and (P,T) systems. Internal energy, enthalpy, Helmholtz free energy, Gibbs free energy	1) Thermal physics by A.B. Gupta and H.P. Roy 2) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill	4	Chalk & talk	
1. Thermodynamic Potentials (KB)	Use of Legendre transform in these cases. Properties and applications.		2		
2. Maxwell's thermodynamic relations (KB)	Derivation and applications: (i) T dS equations, (ii) Difference of specific heats, (iii) Variation of specific heats, (iv) Ratios of volume expansivity, pressure coefficients, compressibility.		3	Chalk & talk	
	Change of temperature during Adiabatic process; Joule-Thomson effect. Porous plug experiment: Throttling process. Joule-Thomson effect for ideal and real gases. Temperature of inversion. Joule-Thomson cooling.		4		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Thermal Physics and Statistical Mechanics, PHS-DSCC-5-4, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
3 . Phase transition (KB)	Classification of phase transitions; First order phase transitions: Clausius-Clapeyron equation, Second latent heat equation; Continuous phase transitions: Ehrenfest's equation.	1)Thermal physics by A.B. Gupta and H.P. Roy	3	Chalk & talk	
4. Radiation (KB)	Classical and quantum aspects: Properties of thermal radiation. Black-body radiation. Temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: thermodynamic proof.	2)Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw- Hill	3	Chalk & talk	
	Calculation of energy density and pressure of radiation from thermodynamics. Spectral distribution of black-body radiation.		2		
	Rayleigh-Jeans law and the ultraviolet catastrophe, Planck's quantum postulates. Planck's law of black-body radiation. Deduction of Rayleigh-Jeans law, Stefan-Boltzmann law, Wien's displacement law from Planck's law.		2		

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Thermal Physics and Statistical Mechanics, PHS-DSCC-5-4, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
Classical Statistical Mechanics 1. Macrostate and Microstate (GP)	Elementary Concept of Ensemble and Ergodic Hypothesis (statement only).	1) Statistical Mechanics: Theory, Problems, and Solutions by Dr. Upendranath Nandi	1	Chalk & talk	
	Phase space. Microcanonical ensemble, Postulate of equal a priori probability. Boltzmann hypothesis: Entropy and thermodynamic probability.		2	Chalk & talk	
	Numericals		1	Chalk & talk	
2. Canonical ensemble (GP)	Partition function,		1	Chalk & talk	
	Thermodynamic properties of an ideal gas. Thermodynamic properties of classical and quantum harmonic oscillator in one dimension using canonical ensemble.	2) Statistical Mechanics by R.K. Patharia	3		
	Classical entropy expression, Gibbs paradox. Equivalence of microcanonical and canonical ensembles. Sackur-Tetrode equation, Law of equipartition of energy (with proof) and its applications.		3	Chalk & talk	

LESSON PLAN

Department Name: Physics, AY 2026-27

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG), Dr. Kathakali Biswas (KB)

Paper Name & Code: Thermal Physics and Statistical Mechanics, PHS-DSCC-5-4, Sem - V

Unit/Group/ Module/ Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks/ Comments
2. Canonical ensemble (GP)	Thermodynamic functions of a two-energy level system. Negative temperature.	1) Statistical Mechanics: Theory, Problems, and Solutions by Dr. Upendranath Nandi 2) Statistical Mechanics by R.K. Patharia	1	Chalk & talk	
	Idea of chemical potential and grand canonical ensemble. Application of ideal gas using grand canonical ensemble.		2	Chalk & talk	
	Numericals		1	Chalk & talk	
TOTAL			50		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Waves and Optics, PHS-Minor4/1-5-1, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Oscillations (GP)	Differential equation of simple harmonic oscillation and its solution. Kinetic energy, potential energy, total energy and their time average values.	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit	3	Chalk & talk, Assignment	
	Damped and forced oscillations: Transient and steady states, resonance, sharpness of resonance; power dissipation and Quality Factor.		3		
2. Superposition of Harmonic Oscillations (SDG)	Superposition of two collinear Harmonic oscillations having equal frequencies and different frequencies (beats).		1	Chalk & talk, Assignment	
	Superposition of two Perpendicular Harmonic Oscillations for phase difference $\delta = 0, \pi, 2\pi$:		2		
3. Wave motion (GP)	Plane progressive (travelling) waves. Wave equation for travelling waves. Particle and wave velocities.		2	Chalk & talk	

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Waves and Optics, PHS-Minor4/1-5-1, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Velocity of transverse vibrations of stretched strings; standing (stationary) waves in a string.	1) Waves and Oscillations, Brij Lal & N Subrahmanyam Vikas Publishing 2) Vibrations, Waves and Acoustics by Dr. D. Chattopadhyay & Dr. P. C. Rakshit	3	Chalk & talk	
	Phase and group velocities, Doppler effect.		2		
	Numerical problems		1		
4. Geometrical Optics (GP)	Fermat's principle. Laws of reflection and refraction at a plane surface, refraction at a spherical surface, lens formula.	1) Optics by Ajoy Ghatak 2) Optics by B. Ghosh	2	Chalk & talk, PPT	
	Combination of thin lenses-equivalent focal length. Dispersion and dispersive power.		2		
	Numerical problems		1		
5. Interference (SDG)	Huygens principle: explanation of the laws of reflection and refraction.	1) Optics by Ajoy Ghatak 2) Optics by B. Ghosh	2	Chalk & talk	
	Division of amplitude and wavefront. Young's double slit experiment. intensity distribution, conditions of interference.		3		

Subject Name/Code: Physics Minor 1/ Minor 2 for 4 year Major

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Waves and Optics, PHS-Minor4/1-5-1, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Interference in thin films: parallel and wedge shaped films: parallel and wedge shaped films.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	3		
	Fringes of equal inclination (Haidinger fringes); Fringes of equal thickness (Fizeau fringes). Newton's Rings: Measurement of wavelength and refractive index.		3		
	Numerical problems.		1		
6. Diffraction (SDG)	Fraunhofer diffraction: Single slit, double slit and diffraction grating. Resolving power of grating.	1) Wave and Optics by A. B. Gupta 2) Optics by Ajoy Ghatak 3) Optics by B. Ghosh	3	Chalk & talk	
	Rayleigh criterion for resolution. Circular aperture (qualitative discussion only).		2		
	Fresnel diffraction: Fresnel's half-period zones for plane wave. Theory of a Zone Plate: Multiple foci of a Zone Plate.		2		
	Class test		1		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Shinjinee Das Gupta (SDG)

Paper Name & Code: Waves and Optics, PHS-Minor4/1-5-1, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
7. Polarization (SDG)	Description of linear, circular and elliptical polarization.	1) Optics by E. Hecht 2) Optics by Ajoy Ghatak 3) Introduction to Optics by E. L. Pedrotti	1	Chalk & talk, PPT, Assignment	
	Propagation of electromagnetic waves in birefringent medium, polarization in uniaxial crystals. Double refraction. Polarization by double refraction. Ordinary and extraordinary refractive indices.		2		
	Phase Retardation plates: Quarter-wave and Half-wave plates.		1		
	Rotatory polarization, Biot's laws for rotatory polarization. Specific rotation.		2		
	Numerical problems		1		
	Class test.		1		
		Total	50		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics, PHS-Minor4/1-5-2, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Special Theory of Relativity (AS)	Postulates of STR, Lorentz Transformation (Derivation not required). Derivation of i) length contraction, ii) time dilation, iii) velocity addition for velocities in same direction.	1) Special Theory of Relativity by Robert Resnick	5	Chalk & talk, Assignment	
	Energy-momentum dispersion relation. Mass-energy equivalence.		3		
2. Quantum theory of Radiation (AS)	Planck's concept, radiation formula (statement only).	1) Modern Physics by R. Murugesan	1	Chalk & talk, Assignment	
	Photoelectric effect. Bohr's theory. Effect of finite nuclear mass. Compton effect.		6		
	Numerical		1		
3. Basic Quantum Mechanics (AS)	Wave nature of material particle, wave-particle duality, wavelength of de-Broglie waves, Heisenberg Uncertainty principle.	1) Modern Physics by R. Murugesan	7	Chalk & talk	

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics, PHS-Minor4/1-5-2, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Schrodinger equation, time-dependent and time-independent Schrodinger wave-function and its probabilistic interpretation. Normalization.	1) Modern Physics by R. Murugesan	2	Chalk & talk	
	Introduction to linear operators. Calculation of various commutation relations.		1		
	Particle in a one dimensional infinite potential well: energy eigen values. Schrodinger equation for one dimensional harmonic oscillator. Energy eigenvalues and energy eigenfunctions. (only first three wavefunctions, no need to introduce Hermite polynomial).		5		
4. Crystal Structure (AS)	Crystalline structure of solid, Miller indices, lattice planes, simple cubic, FCC and BCC lattices.	1) Solid State Physics by Puri and Babbar	3	Chalk & talk, PPT	
	Diffraction of X-ray, Bragg's law, Moseley's Law: explanation from Bohr's theory. Continuous and characteristic X-ray.		3		
	Numerical problems		1		

LESSON PLAN, AY 2026-2027

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics, PHS-Minor4/1-5-2, Semester - V

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Structure of Solids (AS)	Different types of bonding: ionic, covalent, metallic, Van der Waals and hydrogen.	1) Solid State Physics by Puri and Babbar	3	Chalk & talk	
	Elementary ideas about band structure in conductors, direct and indirect semiconductors and insulators (qualitative discussions) .		3		
6. Magnetic properties of material (AS)	Dia, para and ferro-magnetic properties of solids. Origin of dia-magnetism.	1) Solid State Physics by Puri and Babbar	2	Chalk & talk	
	Langevin theory of paramagnetism and Curie's law.		2		
	Domain structure of ferromagnetic materials. B-H loop and hysteresis.		2		
		Total	50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC)

Paper Name & Code: Mathematical Methods III, PHS-DSCC-7-1, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Group Theory (SC)	Discrete groups: Definition; Multiplication table; Rearrangement theorem; Subgroups; Invariant subgroup; Isomorphism and homomorphism; Reducible and irreducible representation of groups; Illustration with Z_n ($n \leq 4$) and S_3 .	1) Elements of Group Theory for Physicists by A. W. Joshi	7	Chalk and Talk, Assignment, PPT	
	Continuous groups: Lie groups and Lie algebra with $U(1)$, $SU(2)$ and $SO(3)$ as examples. Fundamental, adjoint, and complex conjugate representations.		6		
	Problems		1		
Complex analysis (SC)	Cauchy-Riemann conditions, Cauchy's theorem, Cauchy's integral formula;	1) Complex variables and Applications by R V Churchill and J. W. Brown	3	Chalk and Talk, Assignment, PPT	
	Liouville's theorem; Taylor and Laurent expansion of a complex function; Analytic continuation;		5		
	Classification of singularities; Branch point and branch cut; Residue theorem and evaluation of real integrals using this theorem.		7		
	Problems		1		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC)

Paper Name & Code: Mathematical Methods III, PHS-DSCC-7-1, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Theory of second order linear homogeneous differential equations (SC)	Sturm-Liouville theory; Adjoint, self-adjoint, and Hermitian operators, and their properties; Gram-Schmidt orthogonalization of linearly independent functions.	1) Mathematical Methods for Physicists by G. Arfken, H. Weber, F. Harris 2) Differential Equations by J. L. Ross	3	Chalk and Talk, Assignment	
Inhomogeneous differential equations: Green's functions (SC)	General theory in 1-D, Solution of ODE with Dirichlet, Neumann and mixed boundary conditions;.		4		
	Eigenfunction expansion of Green's function. Green's function for the Laplacian in 2-D and 3-D; Green's function for quantum mechanical scattering		3		
	Problems		1		
Integral transforms (SC)	Laplace and inverse Laplace transforms, Bromwich integral (use of partial fractions in calculating inverse Laplace transforms); Transform of derivative and integral of a function; Solution of differential equations using Laplace and Fourier transforms.	1) Mathematical Methods for Physics and Engineering by K. F. Riley, M. P. Hobson, S. J. Bence	2	Chalk and Talk, Assignment	
	Problems		1		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Subhendu Chandra (SC)

Paper Name & Code: Mathematical Methods III, PHS-DSCC-7-1, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Statistics (GP)	Bayes' theorem;	1) Mathematical Methods for Physicists by G. Arfken, H. Weber, F. Harris	1	Chalk and Talk, Assignment	
	Parameter estimation in frequentist approach-maximum likelihood and χ^2 estimation		3		
	Linear least square fit.		2		
		Total	50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: PHS-DSCC-7-2 : Advanced Classical Mechanics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Lagrangian formulation (GP)	Application of Lagrange's formalism for some cases, <i>e.g.</i> (i) double pendulum, (ii) pendulum with moving support, (iii) particles connected by massive chain moving under gravity, (iv) point particle slipping off a sphere, (v) charged particle in electromagnetic field.	1) Classical Mechanics by H.Goldstein	3	Chalk & Talk	
	Noether's theorem in particle mechanics.		1		
2. Small oscillations (GP)	Normal modes and frequencies for small oscillation.	2) Classical Mechanics by N. C. Rana and P. S. Joag	3	Chalk & Talk	
3. Canonical transformations (GP)	Generating functions; Canonical transformations—examples and group property;	3) Classical Mechanics - A Course of Lectures by A. K. Raychaudhuri	2	Chalk & Talk	
	Poisson brackets; Infinitesimal canonical transformations; Conservation theorem in Poisson bracket formalism;		2		
	Jacobi's identity; Angular momentum Poisson bracket relations.		2		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: PHS-DSCC-7-2 : Advanced Classical Mechanics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Rigid bodies (GP)	Euler’s equations;	1) Classical Mechanics by H.Goldstein 2) Classical Mechanics by N. C. Rana and P. S. Joag 3) Classical Mechanics - A Course of Lectures by A. K. Raychaudhuri	2	Chalk & Talk, Assignment	
	Heavy symmetrical top with precession and nutation.		2		
5. Fluid dynamics (GP)	Different types of derivatives; Equation of continuity and equation of motion for an ideal fluid; Bernoulli’s theorem; Concept of streamlines and vortex lines;		2		Chalk & Talk, Assignment
	Gravity waves and shallow waves;		1		
	Non-ideal fluids and Navier-Stokes equation.		2		
6. Classical fields (GP)	Fields as generalised coordinates; Euler-Lagrange equation for the fields from extremisation of $S=L \int d^4x$;		2	Chalk & Talk, Assignment	
	Conjugate momentum and Hamiltonian density; Symmetries and		2		
	Noether’s theorem with Schrödinger field as example.		1		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: PHS-DSCC-7-2 : Advanced Classical Mechanics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
7. Nonlinear dynamics (GP)	Dynamical systems, Idea of Autonomous and non-autonomous system through examples: free, forced and damped oscillators.	1) Classical Mechanics by H.Goldstein	3	Chalk and Talk, Assignment	
	Idea of fixed points in one dimensional problem. Flows. Linear stability analysis.	2) Classical Mechanics by N. C. Rana and P. S. Joag	2		
	Classification of fixed points in 1-D and 2-D through simple examples. x - p phase diagrams, with physical examples for simple 1-D potentials.	3) Classical Mechanics - A Course of Lectures by A. K. Raychaudhuri	3		
8. Special theory of relativity (AS)	Lorentz transformations; vectors and tensors in Minkowski space-time, Transformation properties,.	1) Matrices and Tensors in Physics by A. W. Joshi 2) Special Relativity by A. P. French	4	Chalk and Talk, PPT	
	Metric tensor, Raising and lowering of indices, Contraction, Symmetric and antisymmetric tensors; 4-velocity and 4-momentum;		4		
	Covariant equations of motion; Relativistic kinematics ($1 \rightarrow 2$ decay, elastic scattering and Mandelstam variables,		5		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Gayatri Pal (GP), Dr. Atri Sarkar (AS)

Paper Name & Code: PHS-DSCC-7-2 : Advanced Classical Mechanics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	inelastic scattering and threshold energy);				
	Lagrangian of a free relativistic particle		2		
		Total	50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG), Dr. Atri Sarkar (AS)

Paper Name & Code: Advanced Quantum Mechanics I, PHS-DSCC-7-3, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Basic concepts (SDG)	i) Wavepacket: Fourier Transforms of δ , sine, and Gaussian functions.	1. Quantum Mechanics: Concepts and Applications by N. Zettili 2. Modern Quantum Mechanics by J. J. Sakurai 3. A Text Book of Quantum Mechanics by P. M. Mathews, K. Venkatesan	2	Chalk and Talk, PPT, Assignment	
	ii) Eigenvalues and eigenfunctions; Momentum and parity operators; Commutativity and simultaneous eigenfunctions; Complete set of eigenfunctions; expansion of wave function in terms of a complete set.		3		
	iii) Generalised uncertainty principle		1		
2. One-dimensional problems (SDG)	Delta function potential, double- δ potential		2		
	Multiple well potential, Kronig-Penney model.		2		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG), Dr. Atri Sarkar (AS)

Paper Name & Code: Advanced Quantum Mechanics I, PHS-DSCC-7-3, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Problems		1		
3. Quantum theory of measurement and time evolution (SDG)	Double Stern-Gerlach experiment for spin-1/2 system; Schrödinger, Heisenberg and interaction pictures.	4. Introduction to Quantum Mechanics by K. Sengupta and P. B. Pal	3	Chalk and Talk, PPT, Assignment	
	Time evolution of a two state system, spin-1/2 particle in magnetic field, Larmor's precession.		3		
	Peer Teaching		1		
4. Approximation methods : (i) Time independent perturbation theory (AS)	First and second order corrections to the energy eigenvalues; First order correction to the eigenvector.	1) Introduction to Quantum Mechanics by D. J. Griffiths	4	Chalk and Talk, PPT	
	Convergence of the non-degenerate perturbation theory; Degenerate perturbation theory;		4		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG), Dr. Atri Sarkar (AS)

Paper Name & Code: Advanced Quantum Mechanics I, PHS-DSCC-7-3, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Application to one-electron system– Stark Effect		4		
5. Approximation methods: (ii) Variational method (SDG)	Estimation of the ground state energy by variational method, Particle in a box and Helium atom as examples;	1. Quantum Mechanics: Concepts and Applications by N. Zettili	3	Chalk and Talk, PPT, Assignment	
	First order perturbation; Exchange degeneracy; Ritz principle for excited states for Helium atom.	2. Modern Quantum Mechanics by J. J. Sakurai	2		
	Class Test	3. A Text Book of Quantum Mechanics by P. M. Mathews, K. Venkatesan	1		
6. Addition of angular momenta (SDG)	Introduction to direct product space, Addition of two angular momenta — Clebsch-Gordan coefficients and their properties.		3		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG), Dr. Atri Sarkar (AS)

Paper Name & Code: Advanced Quantum Mechanics I, PHS-DSCC-7-3, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
6. Addition of angular momenta (SDG)	Explicit calculation of Clebsch-Gordan coefficients (for $j_1, j_2 \leq 1$). Recursion relation for Clebsch-Gordan coefficients	4. Introduction to Quantum Mechanics by K. Sengupta and P. B. Pal	2	Chalk and Talk, PPT, Assignment	
	Problems		1		
7. Quantum entanglement and foundational issues (SDG)	Entanglement in pure bipartite states; EPR argument; Bell's theorem: statement and relation to the Copenhagen interpretation;	1. Quantum Computation and Quantum Information by M. Nielsen and I. Chuang	1		
	Impossibility of superluminal communication by entanglement; Mixed states and density matrix; Reduced density matrix of (one) part of a Bell state.		2		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Shinjinee Das Gupta (SDG), Dr. Atri Sarkar (AS)

Paper Name & Code: Advanced Quantum Mechanics I, PHS-DSCC-7-3, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	Peer teaching		1		
8. Introduction to quantum computation (SDG)	Scope and purview of quantum computation; Bits versus qubits; Quantum gates: single-qubit and two-qubit (only CNOT) gates; No-cloning theorem; Quantum circuit for generating the Bell states; Quantum teleportation; Deutsch algorithm	1. Quantum Computation and Quantum Information by M. Nielsen and I. Chuang	3	Chalk and Talk, PPT, Assignment	
	Problems		1		
		Total	50		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: PHS-DSCC-7-4 : Classical Electrodynamics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Electrostatics and magnetostatics (AS)	Gauge transformations; Multipole expansion of vector potential due to a linear stationary current distribution.	1. J.D. Jackson: Classical Electrodynamics	4	Chalk & Talk	
	Electrostatic and magnetostatic energy. Poynting's theorem. Maxwell's stress tensor.	2. D.J. Griffiths: Introduction to Electrodynamics	4		
2. Radiation from time dependent sources of charges and currents (KB)	Inhomogeneous wave equations and their solutions using time-dependent Green's function.	1. D.J. Griffiths: Introduction to Electrodynamics	3	Chalk & Talk	
	Radiation from a localised electric dipole.		2		
3. Maxwell's equations and covariant formulation (KB)	Maxwell's equations in covariant form, Electromagnetic field tensor, Lorentz transformation law for the electromagnetic fields and the fields due to a point charge in uniform motion	1. J.D. Jackson: Classical Electrodynamics	4	Chalk & Talk	
	Field invariants; Covariance of Lorentz force equation and the equation of motion of a charged particle in an electromagnetic field; The generalised momentum; Energy-momentum tensor and the conservation laws for the electromagnetic field; Relativistic Lagrangian and Hamiltonian of a charged particle in an electromagnetic field.	2. D.J. Griffiths: Introduction to Electrodynamics 3. W.K.H. Panofsky and M. Phillips: Classical Electricity and Magnetism	6		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: PHS-DSCC-7-4 : Classical Electrodynamics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Radiation from moving point charges (KB)	Lienard-Wiechert potentials; Fields due to a charge moving with uniform velocity	1. J.D. Jackson: Classical Electrodynamics 2. D.J. Griffiths: Introduction to Electrodynamics 3. W.K.H. Panofsky and M. Phillips: Classical Electricity and Magnetism	3	Chalk & Talk	
	Qualitative discussion of radiation from a uniformly moving charge through a medium: Cerenkov radiation (qualitative treatment only); Fields due to an accelerated charge		4		
	Radiation at low velocity; Larmor's formula and its relativistic generalisation; Radiation when velocity (relativistic) and acceleration are parallel, Bremsstrahlung		4		
	Radiation when velocity and acceleration are perpendicular, Synchrotron radiation. Thomson scattering.		4		
5. Radiation reaction (KB)	Radiation reaction from energy conservation; Problem with Abraham-Lorentz formula		4	Chalk & Talk	
	Limitations of Classical Electrodynamics		2		
6. Introduction to Plasma Physics (KB)	Definition of plasma, occurrence in nature, plasma parameters (density, temperature, Debye length, plasma frequency), criteria for being a plasma (Debye shielding, collective behavior, plasma parameter $ND \gg 1$)	1. J.D. Jackson: Classical Electrodynamics	2	Chalk & Talk	
	Motion of charged particles in uniform electric and magnetic fields, drift velocity. Fluid description of plasmas: fluid equations — continuity equation, momentum equation,		2		

LESSON PLAN, AY 2026-27

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS), Dr. Kathakali Biswas (KB)

Paper Name & Code: PHS-DSCC-7-4 : Classical Electrodynamics, Semester- VII

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	pressure closure (rigorous derivation not needed), Poisson's equation, electrostatic Langmuir waves in unmagnetised plasma	2. D.J. Griffiths: Introduction to Electrodynamics			
	Thermonuclear fusion, overview of magnetic confinement, MHD instabilities (sausage and kink), basic idea of ITER	3. W.K.H. Panofsky and M. Phillips: Classical Electricity and Magnetism	2		
		Total	50		