AY 2024-205

Sem- I

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Basic Physics I DSCC 1(Major)

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 **(SDG)**	a) First order	**Mathematical Methods in the Physical Sciences by M.L. Boas**	1	**Chalk & talk**	
	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, divergence		3		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Basic Physics I DSCC 1(Major)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Divergence and Stoke's theorem		2	**Chalk & talk**	
4. Curvilinear Coordinates **(SC)**	a) Plane polar, spherical, cylindrical coordinates, vectors, velocity and acceleration		5		
	b) Vector integrals		1		
	Total		**20**		
(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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Basic Physics I DSCC 1(Major)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Rotational motion		2	**Chalk & talk**	
	d) Problems		2		
2.Work Kinetic energy Theorem **(AS)**	a) Conservative and non conservative forces, potential		2		
	c) potential energy curves and Stability		1		
	d) 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

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

Paper Name & Code: Basic Physics I DSCC 1(Major)

Planned					
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		2		
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	TOTAL		**30**		
TOTAL (A+B)			**50**		

LESSON PLAN

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) SEC 1

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), linetype (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		

LESSON PLAN

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) SEC 1

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 elements from lists, slicing (with discussion on the difference between ll=mm and ll=mm[:], concatenation, list comprehension. built in functions involving lists: range(),		4		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	len(), sum(), min(), max() – list methods: append(), extend(), count(), index(), sort(), insert(), pop(), remove(), reverse()				
	Tuples: Contrast and compare with lists, packing/unpacking using tuples (including a,b=b,a to swap variables) • Sets : set methods: update(), pop(), remove(), 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, len(),indexing, slicing, string concatenation, some string methods: strip(), split(), join(), find(), count(), replace(), string formatting in python (using the % operator	1) Scientific Computing in Python by Abhijit Kar Gupta	2	Computer Practical	
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		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Root finding for a single variable (basic theory and algorithm) using Newton-Raphson andBisection 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 Euler's method only.		6	Computer Practical	
	Matrix Addition, Multiplication and Transpose using List Comprehension.		6		
		Total	60		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Sem-I Basic Physics-I Minor-1

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 **(SDG)**	a) First order	**Mathematical Methods in the Physical Sciences by M.L. Boas**	1	**Chalk & talk**	
	b) Second order		1		
3 Vectors **(SDG)**	a) Vector products	**Vector Analysis (Schaum's outline series) By Spiegel**	2	**Chalk & talk**	
	b) Vector differentiations, gradient , curl, divergence		3		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Sem-I Basic Physics-I Minor-1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Divergence and Stoke's theorem		2	**Chalk & talk**	
4. Curvilinear Coordinates **(SDG)**	a) Plane polar, spherical, cylindrical coordinates, vectors, velocity and acceleration		5		
	b) Vector integrals		1		
	Total		**20**		
(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		

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Department Name: Physics

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Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Rotational motion		2	**Chalk & talk**	
	d) Problems		2		
2.Work Kinetic energy Theorem **(AS)**	a) Conservative and non conservative forces, potential		2		
	c) potential energy curves and Stability		1		
	d) 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		
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Paper Name & Code: Sem-I Basic Physics-I Minor-1

Planned					
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		2		
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	TOTAL		**30**		
TOTAL (A+B)			**50**		

LESSON PLAN

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) SEC 1

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), linetype (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		

LESSON PLAN

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) SEC 1

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 elements from lists, slicing (with discussion on the difference between ll=mm and ll=mm[:], concatenation, list comprehension. built in functions involving lists: range(),		4		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	len(), sum(), min(), max() – list methods: append(), extend(), count(), index(), sort(), insert(), pop(), remove(), reverse()				
	Tuples: Contrast and compare with lists, packing/unpacking using tuples (including a,b=b,a to swap variables) • Sets : set methods: update(), pop(), remove(), 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, len(),indexing, slicing, string concatenation, some string methods: strip(), split(), join(), find(), count(), replace(), string formatting in python (using the % operator	1) Scientific Computing in Python by Abhijit Kar Gupta	2	Computer Practical	
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		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Root finding for a single variable (basic theory and algorithm) using Newton-Raphson andBisection 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 Euler's method only.		6	Computer Practical	
	Matrix Addition, Multiplication and Transpose using List Comprehension.		6		
		Total	60		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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

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

Paper Name & Code: Waves and Optics, DSC-3

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 3) A Treatsie on Oscillations, Waves And Acoustics by Dr. D. Chattopadhyay	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).		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	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, DSC-3

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 Treatsie 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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, DSC-3

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		

LESSON PLAN

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Paper Name & Code: Waves and Optics, DSC-3

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
8. 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**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics I , DSC-4

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 2) Mathematical Physics by H. K. Dass 3) Mathematical Methods for Physics and Engineering by K. F Riley, Michael Paul Hobson, and Stephen John Bence	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	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.		2		
	Applications. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.		1		
	Class test and quiz.		1		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics I , DSC-4

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) Mathematical Physics by H. K. Dass 3) Mathematical Methods for Physics and Engineering by K. F Riley, Michael Paul Hobson, and Stephen John Bence	2	Chalk & talk, PPT, Assignment	
	Inverse Fourier transform, Properties of FT (translation, change of scale, complex conjugation etc.). Parseval's identity.		2		
	Applications of FT in single slit, double slit, rectangular aperture and N-slit grating.		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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics I , DSC-4

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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics I , DSC-4

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)**	*Approximation in numerical computation*: 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	
	Numerical solution of Algebraic equation: Bisection method, Newton-Raphson method.		1		
	Interpolation: Finite difference operators, Newton (Gregory) forward and backward interpolation, Lagrange's Interpolation.		2		
	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule.		1		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics I , DSC-4

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	System of linear algebraic equations: Direct methods: Gaussian elimination; Iterative methods: Gauss-Jacobi method, Gauss-Seidel method. Some qualitative discussion on matrix inversion technique.		2		
	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods (order two and four).		2		
	Curve fitting: 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

Department Name: Physics

Name of Faculty: Dr Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino SEC3

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

Department Name: Physics

Name of Faculty: Dr Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino SEC3

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	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

Department Name: Physics

Name of Faculty: Dr Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino SEC3

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

Department Name: Physics

Name of Faculty: Dr Shinjinee Das Gupta (SDG)

Paper Name & Code: Arduino SEC3

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

Department Name: Physics

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

Paper Name & Code: Sem-III-Basic Physics-I Minor-1

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 **(SDG)**	a) First order	**Mathematical Methods in the Physical Sciences by M.L. Boas**	1	**Chalk & talk**	
	b) Second order		1		
3 Vectors **(SDG)**	a) Vector products	**Vector Analysis (Schaum's outline series) By Spiegel**	2	**Chalk & talk**	
	b) Vector differentiations, gradient , curl, divergence		3		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Sem-III-Basic Physics-I Minor-1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Divergence and Stoke's theorem		2	**Chalk & talk**	
4. Curvilinear Coordinates **(SDG)**	a) Plane polar, spherical, cylindrical coordinates, vectors, velocity and acceleration		5		
	b) Vector integrals		1		
	Total		**20**		
(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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Sem-III-Basic Physics-I Minor-1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	c) Rotational motion		2	**Chalk & talk**	
	d) Problems		2		
2.Work Kinetic energy Theorem **(AS)**	a) Conservative and non conservative forces, potential		2		
	c) potential energy curves and Stability		1		
	d) 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

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

Paper Name & Code: Sem-III-Basic Physics-I Minor-1

Planned					
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		2		
	b) Streamline and turbulent flow		1		
	c) Stokes law, Euler equation,		1		
	d) Bernoulli's Theorem & application		2		
	TOTAL		**30**		
TOTAL (A+B)			**50**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, GCC-3

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 3) A Treatsie on Oscillations, Waves And Acoustics by Dr. D. Chattopadhyay	3	Chalk & talk	
	Transient and steady states, resonance, sharpness of resonance; power dissipation and Quality Factor.		3		
2. Superposition of Harmonic Oscillations **(SC)**	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 **(SC)**	Plane progressive (travelling) waves. Wave equation for travelling waves. Particle and wave velocities.		3	Chalk & talk	
	Velocity of transverse vibrations of stretched strings, standing (stationary) waves in a string.		3		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, GCC-3

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Phase and group velocities. Doppler effect.		1		
	Numerical problems.		1		
5. Geometrical Optics **(SDG)**	Fermat's principle, laws of reflection and refraction at a plane surface,	**1) Optics by B. Ghosh**	2	Chalk & talk	
	refraction at a spherical surface, lens formula. Combination of thin lenses - equivalent focal length. Dispersion and dispersive power.		3		
6. Interference **(AS)**	Huygens principle: explanation of the laws of reflection and refraction.	**1) Wave and Optics by A. B. Gupta** **2) Optics by B. Ghosh**	3	Chalk & talk	
	Division of amplitude and wavefront. Young's double slit experiment. Intensity distribution, conditions of interference,		4		
	Interference in thin films: parallel and wedge shaped films. Fringes of equal inclination (Haidinger fringes); Fringes of equal thickness (Fizeau fringes).		3		
	Newton's Rings: Measurement of wavelength and refractive index.		1		
	Numerical problems.		1		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, GCC-3

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
7. Diffraction **(AS)**	Fraunhofer diffraction: Single slit, double slit and diffraction grating.	**1) Wave and Optics by A. B. Gupta** **2) Optics by B. Ghosh**	3	Chalk & talk	
	Resolving power of grating. 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		
8. Polarization **(SDG)**	Description of linear, circular and elliptical polarization.	**1) Optics by B. Ghosh** **2) Optics by Ajoy Ghatak**	2	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		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Waves and Optics, GCC-3

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Rotatory polarization, Biot's laws for rotatory polarization. Specific rotation.		1		
	Numerical problems and Quiz		1		
	Class test.		1		
		Total	**50**		

LESSON PLAN

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) SEC 1

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), linetype (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		

LESSON PLAN

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) SEC 1

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 elements from lists, slicing (with discussion on the difference between ll=mm and ll=mm[:], concatenation, list comprehension. built in functions involving lists: range(),		4		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	len(), sum(), min(), max() – list methods: append(), extend(), count(), index(), sort(), insert(), pop(), remove(), reverse()				
	Tuples: Contrast and compare with lists, packing/unpacking using tuples (including a,b=b,a to swap variables) • Sets : set methods: update(), pop(), remove(), 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, len(),indexing, slicing, string concatenation, some string methods: strip(), split(), join(), find(), count(), replace(), string formatting in python (using the % operator	1) Scientific Computing in Python by Abhijit Kar Gupta	2	Computer Practical	
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		

LESSON PLAN

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) SEC 1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Root finding for a single variable (basic theory and algorithm) using Newton-Raphson andBisection 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 Euler's method only.		6	Computer Practical	
	Matrix Addition, Multiplication and Transpose using List Comprehension.		6		
		Total	60		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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

Department Name: Physics

Name of Faculty: Dr. Atri Sarkar (AS)

Paper Name & Code: IDC (INTERDISCIPLINARY COURSE): FRONTIERS IN PHYSICS

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**		

Sem - V

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Electromagnetic Theory (Th) CC11

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Maxwell Equations **(MRK)**	Review of Maxwell's equations. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media.	1. Electricity and Magnetism by Chattapadhaya and Rakshit. 2. Electricity and Magnetism by Griffith 3. Electromagnetic Theory by Satya Prakash	3	Chalk-and-Talk	
	Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector.		3	Chalk-and-Talk	
	Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density		3	Chalk-and-Talk	
	Problem Solving		3	Chalk-and-Talk	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Electromagnetic Theory (Th) CC11

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
2. EM Wave Propagation in Unbounded Media **(MRK)**	Plane EM waves through vacuum and isotropic dielectric medium,	1. Electricity and Magnetism by Chattapadhaya and Rakshit. 2. Electricity and Magnetism by Griffith 3. Electromagnetic Theory by Satya Prakash	2	Chalk-and-Talk	
	Transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance.		3	Chalk-and-Talk	
	Propagation through conducting media, relaxation time, skin depth.		3	Chalk-and-Talk	
	Problem Solving		2	Chalk-and-Talk	
3. EM Wave in Bounded Media **(SC)**	Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media.	1. Electromagnetic Theory by Satya Prakash 2. Electromagnetic Theory and	3	Chalk-and-Talk	
	Laws of Reflection & Refraction. Fresnel's formulae for perpendicular		4	Chalk-and-Talk	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Electromagnetic Theory (Th) CC11

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	& parallel polarization cases, Reflection & Transmission coefficients, Brewster's law.	Transmission Line by G. S. N. Raju 3. Classical Electricity and Magnetism by W. K. H. Panofsky and M. Phillips 4. Electricity and Magnetism by Benjamin Crowell			
	Total internal reflection, evanescent waves. Metallic reflection (normal Incidence).		1	Chalk-and-Talk	
	Problem Solving		2	Chalk-and-Talk	
4. Polarization **(SC)**	Description of Linear, Circular and Elliptical Polarization.	1) B. Sc. Physics by C. L. Arora 2) Light by Ajoy kumar Ghatak	4	Chalk-and-Talk	
	Propagation of E.M. Waves in birefringent medium.		3	Chalk-and-Talk	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Electromagnetic Theory (Th) CC11

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
5. Polarization in uniaxial crystals **(SC)**					
	Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction.	1. Electricity and Magnetism by Griffith 2. Electromagnetic Theory by Satya Prakash 3. Light by Ajoy kumar Ghatak	4	Chalk-and-Talk	
	Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices.		4	Chalk-and-Talk	
	Phase Retardation Plates: Quarter Wave and Half-Wave Plates.		4	Chalk-and-Talk	
	Production & analysis of polarized light. Babinet Compensator and its Uses.		3	Chalk-and-Talk	
6. Rotatory polarization **(SC)**	Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation.	1. B. Sc. Physics by C. L. Arora	2	Chalk-and-Talk	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Electromagnetic Theory (Th) CC11

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Calculation of angle of rotation. Experimental verification of Fresnel's theory.	2. Electromagnetic Theory by Satya Prakash 3. Light by Ajoy kumar Ghatak	2	Chalk-and-Talk	
	Specific rotation. Laurent's half-shade and biquartz polarimeters.		2	Chalk-and-Talk	
		Total	60		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Statistical Physics CC12 (Th)

Planned				After implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Classical Statistical Mechanics	a) Microsatate, Macrostate, phase space, concept of ensemble	**Statistical Mechanics by U. Nandi** **Statistical Mechanics by R.K. Pathria** **Statistical Physics by F. Reif**	4	Chalk and Talk	
	b) Microcanonical ensemble its properties, thermodynamic probability,		3	PPT	
	c) Canonical ensemble , Partition function, thermodynamic functions of ideal gas		6	Chalk and Talk	
	d) Sackur Tetrode equation, Two level system, specific heat negative temperature		3	PPT	
	e) Grand Canonical ensemble, thermodynamic functions of ideal gas, Chemical potential		4	Chalk and Talk	
	f) Numerical problems g)		4		
2.System of Identical Particles	a) Classical and Quantum approach		1	Chalk and Talk	
	b) MB distribution		3	Chalk and Talk	
	c) Fermions and Bosons		1	Chalk and Talk	

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Statistical Physics CC12 (Th)

Planned				After implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	d) Numerical problems		1		
2. BE Statistics	a) BE distribution Law		3	Chalk and Talk	
	b) Strongly degenerate Bose gas		3	Chalk and Talk	
	c) BE condensation, Helium IV		3	PPT	
	d) Numerical problems		3		
3. Radiation	a) Classical laws of Radiation		3	PPT	
	b) Planck's Theory , Photon gas		3	Chalk and Talk	
	c) Numerical problems		1		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Statistical Physics CC12 (Th)

Planned				After implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
5.. F.D. Statistics	a) FD distribution Law		3	Chalk and Talk	
	b) Strongly degenerate Fermi gas		2	PPT	
	c) Electron gas in metals		2	PPT	
	d) Specific heat of metals		1	Chalk and Talk	
	e) Numerical problems		2		
		Total	60		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Laser and Fiberoptics (Th) DSEA1(b)

Planned					
Unit/Group/Module/ Article	**Topics**	**ReferenceBooks**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks/ Comments**
1.Einstein's Coefficients and Rate equation **(SDG)**	a) Stimulated light amplification and Einstein's Coefficients	**Lasers: Theory & application by A. Ghatak& K. Thyagrajan**	4	Chalk and Talk, PPT, study material from NPTEL course	
	b) Population inversion, threshold conditions, pumping power		3		
	c)Rate equations for2,3,and 4 level lasers		6		
	d)Numericalproblems		2		
2.Basiclaserproperties **(SDG)**	a)Coherence, directionality	**Lasers: Theory & application by A. Ghatak& K. Thyagrajan**	2	ChalkandTalk	
	b)Mono-chromaticity, brightness		2	ChalkandTalk	
3.Resonators **(SDG)**	a)Opticalresonatorsandtheir different configurations		3	ChalkandTalk, PPT, study material from NPTEL course	
	b)Stabilityconditionand stability diagram		2		
	c)Cavitylifetime,quality factor		2		
	d)Numericalproblems		2		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Laser and Fiberoptics (Th) DSEA1(b)

Planned					
Unit/Group/Module/ Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks/ Comments**
4.Transient effects **(SDG)**	a)Transverse and longitudinal modes	**Lasers: Theory & application by A. Ghatak& K. Thyagrajan**	3	Chalk and Talk, PPT, study material from NPTEL course	
	b) Different methods of Q-switching,		2		
	c) Mode locking, pockelscell		2		
	d) Numerical problems		1		
5.BasicLaser systems **(SDG)**	a) Gas lasers, He–Ne and CO_2	**Lasers: Theory & application by A. Ghatak& K. Thyagrajan**	2	Chalk and Talk, PPT, study material from NPTEL course	
	b) Solid state lasers, Ruby, Nd: YAG and semiconductor		3		
	c)Liquid laser, Dye laser		1		
	d) Numerical problems		1		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Laser and Fiberoptics (Th) DSEA1(b)

Planned					
Unit/Group/Module/ Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks/ Comments**
6. Practical properties and uses of laser **(KB)**	(a) The Line-shape function. Various Line broadening mechanisms: collisional broadening , Natural broadening, Doppler broadening.	**Lasers: Theory and Applications, A. Ghatak& K. Thyagarajan**	**3**	**Chalk and talk, ppt presentation, Google classroom**	
	(b) Basic idea of Laser cooling and trapping.		**2**		
7. Fiber optics **(KB)**	(a) Optical fiber, coherent bundle, Numerical aperture. Attenuation of optical fibers.	**Introduction to Fiber Optics, A. Ghatak, 1998, Cambridge University Press**	**2**	**Chalk and talk, ppt presentation, Google classroom**	
	(b) Ray paths , Ray paths in a homogeneous medium, in square law media. Pulse dispersion in parabolic index medium and in planar step index waveguide.		**3**		

	(c) Modes of a planar waveguide: TE and TM modes. Physical understanding of modes, Optical fibers: Guided modes of step-index and graded index fibers.		**5**		
	(d) Applications of optical fibers in Communication and Sensing.		**1**		
	(e) Numerical problem discussion		**1**		
8. Holography **(KB)**	(a) Principle of Holography. Recording and Reconstruction Method.	**Optics, E. Hecht & A. Ganesan, 2009, Pearson Prentice Hall**	**2**	**Chalk and talk, Google classroom**	
	(b) Theory of Holography between two plane waves. Point source holograms.		**1**		
	(c) Problem discussion		**1**		
9. Introductory Nonlinear Optics **(KB)**	(a) Origin of nonlinearity, susceptibility tensor, phase matching, second harmonic generation, Sum frequency generation, Difference	**Nonlinear Optics, R. Boyd, 2008, Academic Press**	**6**	**Chalk and talk, Google classroom**	

	frequency generation, Sum and Difference Frequency generation, for second-order nonlinear optical medium.				
	(b) Nonlinear susceptibility of a classical anharmonic oscillator in case of noncentrosymmetric medium.		**2**		
	(c) Numerical problems discussion		**2**		
Total			**75**		

LESSON PLAN

Department Name: Physics

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

Dr. Atri Sarkar (AS)

Paper Name & Code: Nuclear and Particle Physics (Th) DSE B1(b)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction **(AS)**	Recapitulation of general properties of nuclei, nuclear models and radioactivity.	1) Nuclear Physics by S. N. Ghoshal 2) Nuclear Physics by Satadal Bhattacharya	4	Chalk and Talk	
	Problem Solving		1		
2. Nuclear Reactions **(AS)**	Types of Reactions, Conservation Laws,		1	Chalk and Talk, Study Material, Assignment	
	kinematics of reactions, Q value, reaction rate, reaction cross section,		3		
	Concept of compound and direct Reaction,		2		
	resonance reaction, Coulomb scattering (Rutherford scattering).		2		
	Problem Solving and quiz		1		
	Class Test		1		

LESSON PLAN

Department Name: Physics

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

Dr. Atri Sarkar (AS)

Paper Name & Code: Nuclear and Particle Physics (Th) DSE B1(b)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
3. Interaction of Nuclear Radiation with matter (AS)	Energy loss due to ionization (Bethe- Block formula), energy loss of electrons,	1) Nuclear Physics by S. N. Ghoshal 2) Nuclear Physics by Satadal Bhattacharya 3) Radiation detection and measurement, G.F. Knoll	3	Chalk and Talk, Study Material, Assignment	
	Cerenkov radiation		1		
	Gammaray interaction through matter, photoelectric effect, Compton scattering, pair production		4		
	neutron's interaction with matter.		4		
	Problem Solving		2		
	Class Test		2		

LESSON PLAN

Department Name: Physics

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

Dr. Atri Sarkar (AS)

Paper Name & Code: Nuclear and Particle Physics (Th) DSE B1(b)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
4. Detector for Nuclear Radiations **(SDG)**	Gas detectors: estimation of electric field, mobility of particle, ionization chamber and GM Counter.	1) Nuclear Physics by S. N. Ghoshal 2) Nuclear Physics by Satadal Bhattacharya 3) Radiation detection and measurement, G.F. Knoll 4) Techniques for Nuclear and Particle Physics Experiments by W. R. Leo	4		
	Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT).		2	Chalk and Talk, PPT, Tutorial Assignment	
	Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility),		3		
	neutron detector.		1		
	Peer Teaching		2		
	Problem Solving		2		
	Class Test		1		

LESSON PLAN

Department Name: Physics

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

Dr. Atri Sarkar (AS)

Paper Name & Code: Nuclear and Particle Physics (Th) DSE B1(b)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
5.Particle Accelerators **(SDG)**	Accelerator facility available in India, Different type of accelerators Van-de Graaf generator (Tandem accelerator)	1) Nuclear Physics by S. N. Ghoshal 2) Nuclear Physics by Satadal Bhattacharya	2	Chalk and Talk, PPT, Study Material	
	Linear accelerator		2		
	Cyclotron		2		
	Betatron Synchrotrons		3		
	Peer Teaching		2		
	Tutorial		3		
	Class Test and quiz		1		

LESSON PLAN

Department Name: Physics

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

Dr. Atri Sarkar (AS)

Paper Name & Code: Nuclear and Particle Physics (Th) DSE B1(b)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
6. Particle Physics **(KB)**	Fundamental particles and their families. Fundamental particle-interactions and their basic features. Gellmann Nishijima formula	1) Nuclear Physics by S. N. Ghoshal	2		
	Quark structure of hadrons and mesons		3		
	Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm.		3		
	Concept of quark model, color Quantum number and gluons		2		
	Tutorial		3		
	Class Test and quiz		2		
		Total	75		