AY 2024-25

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: DSCC-2, Basic Physics-II, Sem - II

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Basic Electricity and Magnetism (KB)	Electrostatics: Coulomb's law, Electric field, Electric field lines. Superposition Principle. Electric flux. Idea of charge density (linear, surface, volume) and continuous charge distributions. Gauss' Law (in integral form) with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Introduction to electrostatic potential, Equipotential surfaces. Calculation of potential for linear, surface and volume charge distributions: simple cases (e.g.: uniform line charge, disc, spherical shell, sphere etc.). Potential and field due to a physical dipole; Torque, force and Potential Energy of an electric dipole in a uniform electric field.		4		
	Electrostatic energy of system of charges, a charged sphere. Conductors in an electrostatic Field. Mechanical force on the surface of a charged conductor. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Capacitance for parallel-plate, cylindrical, spherical capacitors (without dielectrics). Energy stored in Electrostatic field.		4		

Subject Name/Code: Physics Major

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: DSCC-2, Basic Physics-II, Sem - II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Basic Electricity and Magnetism (GP)	Lorentz force: Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field. Trajectory of charged particles in uniform electric field, crossed uniform electric and magnetic fields. Basic principle of cyclotron.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Magnetostatics: Concept of current density (linear, surface, volume). Equation of continuity. Biot and Savart's law, magnetic field due to a straight conductor, circular coil, Helmholtz coil, solenoid. Ampere's circuital law with applications (Infinite long wire, infinite solenoid, infinite current sheet). Magnetic field due to a small current loop - concept of magnetic dipole. Torque and force on magnetic dipole in a uniform magnetic field.		8		

Subject Name/Code: Physics Major

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: DSCC-2, Basic Physics-II, Sem - II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (AS)	Kinetic theory: Macroscopic and microscopic description of matter, Postulates of molecular kinetic theory of an ideal gas, Relation between microscopic and macroscopic state variables, Maxwell's velocity distribution, Concept of pressure and temperature.	Thermal physics by A.B. Gupta and H.P. Roy Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	3	Chalk and Talk	
	Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables. Thermodynamic equilibrium, zeroth law of Thermodynamics & concept of temperature. Concept of work & heat, State Functions, internal energy and first law of Thermodynamics, its differential form, first law & various processes. Applications of first law: General relation between CP and CV, work done during isothermal and adiabatic processes, compressibility and expansion coefficient.		9		

Subject Name/Code: Physics Major

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: DSCC-2, Basic Physics-II, Sem - II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (SC)	Second Law of Thermodynamics: Reversible and irreversible process with examples. Interconversion of work and heat. Heat engines. Carnot's cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Kelvin-Planck and Clausius statements for the second law and their equivalence. Carnot's Theorem. Applications of second law of Thermodynamics: Thermodynamic scale of temperature and its equivalence to perfect gas scale.	Thermal physics by A.B. Gupta and H.P. Roy	10	Chalk and Talk	
	Entropy: Concept of Entropy, Clausius theorem. Clausius inequality, Second law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of increase of Entropy. Entropy changes in reversible and irreversible processes with examples. Entropy of the universe. Principle of increase of Entropy. Temperature- Entropy diagrams for different cycles. Third law of Thermodynamics. Un-attainability of absolute zero.	Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	6		
Total			**50**		

Subject Name/Code: Physics Major

AY: 2024-25

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Scientific Writing Skills (LATEX) , SEC 2

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction to LATEX	The difference between WYSIWYG and WYSIWYM. Preparing a basic LATEX file. Compiling LATEX file.	1) https://www.latex-project.org/ 2) http://mirror.iopb.res.in/tex archive/info/lshort/english/l short.pdf 3) Walking with LATEX, Suman Bandyopadhyay, Techno World 4) https://tug.org/texlive/	**2**	LATEX software	
2. Document classes	Different type of document classes, e.g.. article, report, book and beamer.		**5**		
3. Page Layout	Titles, Abstract, Chapters, Sections, subsections, paragraph, verbatim		**4**		
	References, Equation references, citation		**4**		
4. List structures	Itemize, enumerate, description etc		**3**		
5. Representation of mathematical equations	Inline math, Equations, Fractions, Matrices		**4**		
	Trigonometric, logarithmic, exponential functions		**3**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Scientific Writing Skills (LATEX) , SEC 2

Unit / Group / Module / Article		Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Representation of mathematical equations	Scaling of Parenthesis, brackets etc.	) https://www.latex-project.org/ 2) http://mirror.iopb.res.in/tex archive/info/lshort/english/l short.pdf 3) Walking with LATEX, Suman Bandyopadhyay, Techno World 4) https://tug.org/texlive/	**2**	LATEX software	
6. Customization of fonts	Bold fonts, emphasize, mathbf, mathcal etc, Changing sizes, Large, Larger, Huge, tiny etc.		**3**		
7. Writing tables	Creating tables with different alignments, placement of horizontal, vertical lines		**3**		
8. Figures	Changing and placing the figures, alignment Packages: amsmath, amssymb, graphics, graphicx, Geometry, algorithms, color, Hyperref etc. Use of different LATEX commands and environments, changing the type style, symbols from other languages. Special characters.		**7**		
	Preparing projects (writing report, CV, article etc)		**20**		
		Total	**60**		

AY 2024-25

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Minor-2, Basic Physics-II Sem - II

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Basic Electricity and Magnetism (KB)	Electrostatics: Coulomb's law, Electric field, Electric field lines. Superposition Principle. Electric flux. Idea of charge density (linear, surface, volume) and continuous charge distributions. Gauss' Law (in integral form) with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Introduction to electrostatic potential, Equipotential surfaces. Calculation of potential for linear, surface and volume charge distributions: simple cases (e.g.: uniform line charge, disc, spherical shell, sphere etc.). Potential and field due to a physical dipole; Torque, force and Potential Energy of an electric dipole in a uniform electric field.		4		
	Electrostatic energy of system of charges, a charged sphere. Conductors in an electrostatic Field. Mechanical force on the surface of a charged conductor. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Capacitance for parallel-plate, cylindrical, spherical capacitors (without dielectrics). Energy stored in Electrostatic field.		4		

Subject Name/Code: Physics Minor

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Basic Electricity and Magnetism (GP)	Lorentz force: Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field. Trajectory of charged particles in uniform electric field, crossed uniform electric and magnetic fields. Basic principle of cyclotron.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Magnetostatics: Concept of current density (linear, surface, volume). Equation of continuity. Biot and Savart's law, magnetic field due to a straight conductor, circular coil, Helmholtz coil, solenoid. Ampere's circuital law with applications (Infinite long wire, infinite solenoid, infinite current sheet). Magnetic field due to a small current loop - concept of magnetic dipole. Torque and force on magnetic dipole in a uniform magnetic field.		8		

Subject Name/Code: Physics Minor

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (AS)	Kinetic theory: Macroscopic and microscopic description of matter, Postulates of molecular kinetic theory of an ideal gas, Relation between microscopic and macroscopic state variables, Maxwell's velocity distribution, Concept of pressure and temperature.	Thermal physics by A.B. Gupta and H.P. Roy	3	Chalk and Talk	
	Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables. Thermodynamic equilibrium, zeroth law of Thermodynamics & concept of temperature. Concept of work & heat, State Functions, internal energy and first law of Thermodynamics, its differential form, first law & various processes. Applications of first law: General relation between CP and CV, work done during isothermal and adiabatic processes, compressibility and expansion coefficient.	Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	9		

Subject Name/Code: Physics Minor

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (AS)	Second Law of Thermodynamics: Reversible and irreversible process with examples. Inter-conversion of work and heat. Heat engines. Carnot's cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Kelvin-Planck and Clausius statements for the second law and their equivalence. Carnot's Theorem. Applications of second law of Thermodynamics: Thermodynamic scale of temperature and its equivalence to perfect gas scale.	Thermal physics by A.B. Gupta and H.P. Roy Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	10	Chalk and Talk	
	Entropy: Concept of Entropy, Clausius theorem. Clausius inequality, Second law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of increase of Entropy. Entropy changes in reversible and irreversible processes with examples. Entropy of the universe. Principle of increase of Entropy. Temperature- Entropy diagrams for different cycles. Third law of Thermodynamics. Un-attainability of absolute zero.		6		
Total			**50**		

Subject Name/Code: Physics Minor

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS), Ms. Kathakali Biswas (KB)

Paper Name & Code: **Introduction to Computer Programming and Graph Plotting** (Pr) SEC2 (MDC)

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), line type (lt),line width (lw). Using the set command for samples, xrange, yrange, xlabel ,ylabel, title etc. The using option	1) Gnuplot 5, Lee Phillips, Alogus Publishing, edition 2012 2) Gnuplot in Action understanding data and Graphs, Phillipp K. Janert	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 without using GUI)		3		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS), Ms. Kathakali Biswas (KB)

Paper Name & Code: **Introduction to Computer Programming and Graph Plotting** (Pr) SEC2 (MDC)

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): **(KB)**	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, keyword arguments), 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		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS), Ms. Kathakali Biswas (KB)

Paper Name & Code: **Introduction to Computer Programming and Graph Plotting**(Pr) SEC2 (MDC)

Planned					
Unit/Group/Module/ Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks/ Comments**
	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. builtin functions involving lists: range(), len(),sum(),min(),max()–list methods: append(),extend(),count(),index(),sort(), insert(),pop(),remove(),reverse()		4	Computer Practical, Study material	
	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		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS), Ms. Kathakali Biswas (KB)

Paper Name & Code: **Introduction to Computer Programming and Graph Plotting** (Pr) SEC2 (MDC)

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

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS), Ms. Kathakali Biswas (KB)

Paper Name & Code: **Introduction to Computer Programming and Graph Plotting** (Pr) SEC2 (MDC)

Planned					
Unit/Group/Module/ Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks/ Comments**
	Places (Sine, Cosine, Exponential etc.)				
	Simulation of motion of a particle in 1Dunder 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)

AY : 2024-25

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**		

AY 2024 - 25

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics , DSC-5 Sem - IV

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Radiation and its nature **(AS)**	Black body Radiation, Planck's quantum hypothesis, Planck's constant (derivation of Planck formula is not required).	1) Perspective of Quantum Mechanics by S.P. Kuila 2) Quantum Physics by Eisberg and Resnick 3) Introduction to Quantum Mechanics by David. J. Grifiths	**3**	Chalk and Talk, Assignment	
	Photoelectric effect and Compton scattering — light as a collection of photons. Davisson-Germer experiment.		**2**		
	Bohr-Sommerfeld quantization of the form $pdq=nh$. De Broglie wavelength and matter waves. Wave-particle duality.		**2**		
	Wave description of particles by wavepackets. Group and Phase velocities and relation between them.		**2**		
	Probability interpretation: Normalized wavefunctions as probability amplitudes. Two-slit experiment with photons and electrons. Linear superposition principle as a consequence.		**3**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics , DSC-5

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Radiation and its nature**(AS)**	Position measurement, γ-ray microscope thought experiment. Heisenberg uncertainty principle (Statement with illustrations). Impossibility of a trajectory of a particle.		**3**		
2. Basics of Quantum Mechanics**(SC)**	Quantum measurements- Deterministic vs probabilistic view points. Description of a particle using wave packets. Spread of the Gaussian wave-packet for a free particle in one dimension. Fourier transforms and momentum space wavefunction. Position- Momentum uncertainty. Simultaneous measurements: Compatible and incompatible observables and their relation to commutativity	1) Elements Of Quantum Mechanics by Singh Kamal, Singh S.P	**10**	Chalk and Talk, Assignment	
3. Schrödinger Equation **(SC)**	Schrödinger equation as a first principle.Probabilistic interpretation of wave function and equation of continuity (in 1-dimension). Time evolution of wavefunction. Stationary states. Time independent Schrödinger equation as an eigenvalue equation.	1) Quantum Mechanics by A. N. KONAR	**8**	Chalk and Talk, Assignment	

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC), Dr. Atri Sarkar (AS)

Paper Name & Code: Modern Physics , DSC-5

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Application to one dimensional systems **(SC)**	General discussion of bound states in an arbitrary potential:continuity of wave function, boundary conditions on wave functions and emergence of discrete energy levels. Particle in an infinitely rigid box: energy eigenvalues and eigenfunctions ,normalization. Quantum mechanical tunnelling across a step potential and rectangular potential barrier, calculation of reflection and transmission probabilities.α-decay as an example.Application to one dimensional square well potential of finite depth (for bound states only).	1) Quantum Mechanics by A. N. KONAR	**12**	Chalk and Talk, Assignment	
5. Quantum mechanics of simple harmonic oscillator **(SC)**	Setting up the eigenvalue equation for the Hamiltonian. Energy levels and energy eigenfunctions in terms of Hermite polynomials (Solution to Hermite differential equation may be assumed). Ground state, zero-point energy and uncertainty principle.	1) Quantum Mechanics by Aruldhas G	**5**	Chalk and Talk, Assignment	
	Total		**50**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1.Alternating current **(GP)**	Mean and r.m.s. values of current and emf with sinusoidal wave form; LR, CR series and parallel LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit-power factor	Fundamentals of Electricity and Magnetism by B. Ghosh	2	Chalk and Talk, Assignment	
	Resonance in a series and parallel LCR circuit, Q-factor.		1		
	Class test / Assignment		1		
2. Electrostatics **(KB)**	Gauss' theorem of electrostatics: differential form. Multipole expansion in electrostatics. Dipole and quadrupole moment.	1) Introduction to Electrodynamics by D.J. Griffiths	**2**	Chalk and Talk, Assignment	
	Problem solving	2) Fundamentals of Electricity and Magnetism by B. Ghosh	**1**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
3. Dielectric properties of matter **(KB)**	Dielectric in an external electric field. Electric Fields inside matter, Electric Polarisation, bound charges, displacement density vector, relation between E , P and D. Gauss's theorem in dielectrics, linear Dielectric medium, electric susceptibility and permittivity.	1) Introduction to Electrodynamics by D.J. Griffiths 2) Fundamentals of Electricity and Magnetism by B. Ghosh	**4**	Chalk and Talk, Assignment	
	Electrostatic boundary conditions for E and D.		**1**		
	Problem solving		**1**		
4. Laplace's and Poisson equations **(KB)**	Laplace's and Poisson equations. Uniqueness Theorems. Earnshaw's theorem. Dirichlet Boundary value problems in electrostatics.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**2**	Chalk and Talk, Assignment	
	Problem solving		**1**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Method of Images and its applications **(KB)**	Plane Infinite metal sheet, Semi-infinite dielectric medium and metal Sphere.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**3**	Chalk and Talk, Assignment	
	Problem solving		**1**		
5.Magnetostatics **(GP)**	Derivation of $\nabla.B = 0$, $\nabla \times B = \mu 0$ J. Magnetic vector potential and magnetic dipole.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**1**	Chalk and Talk, Assignment	
	Multipole expansion of vector potential for line currents. Magnetic field for magnetic dipole.		**1**		
	Calculation for vector potential in simple cases (i) infinite straight wire (ii) Infinite Solenoid . Magnetic dipole moment for rotating rod, sphere, ring. Gyromagnetic ratio		**2**		
	Problem solving		**1**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
6. Magnetic properties of matter **(GP)**	(a) Potential and field due to a magnetic dipole. Magnetic dipole moment. Force and torque on a magnetic dipole in a uniform magnetic field.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**2**	Chalk and Talk, Assignment	
	(b) Magnetization, bound currents. Magnetic intensity H. Relation between B , H and M. Linear media. Magnetic Susceptibility and Permeability. Boundary conditions for B and H.		**2**		
	Problem solving		**1**		
8.Electromagnetic induction **(GP)**	Non-conservative nature of electric field. Faraday's law of induction: simple examples (e.g.: Motional EMF, Faraday disc); Lenz's law. Self and mutual inductances in simple cases, energy stored in inductors.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**2**	Chalk and Talk, Assignment	
	Problem solving		**1**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
9. Maxwell's equations **(MRK)**	Maxwell's equations. Gauge transformations: Lorenz and Coulomb Gauge.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**2**	Chalk and Talk, Quiz, Problem solving	
	Wave equations. Poynting Theorem and Poynting vector. Electromagnetic (EM) Energy Density.		**2**		
10. EM Wave Propagation in unbounded media **(MRK)**	Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh	**2**	Chalk and Talk, Quiz, Problem solving	
	Propagation through conducting media, relaxation time, skin depth.		**2**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Principal Madam (MRK) Dr. Gayatri Pal (GP), Ms . Kathakali Biswas (KB)

Paper Name & Code: Electromagnetism DSC-*6*

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
11. EM Wave in Bounded Media **(MRK)**	Boundary conditions at a plane interface between two media. Reflection and Refraction of plane waves at plane interface between two dielectric media. Laws of reflection and refraction.	1)Introduction to Electrodynamics by D.J. Griffiths 2)Fundamentals of Electricity and Magnetism by B. Ghosh 3) Electromagnetic Waves and Radiating Systems by E. C. Jordan and K. G. Balmain 4)Engineering Electromagnetics by W. H. Hayt, J. A. Buck and M. J. Akhtar	**3**	Chalk and Talk, Quiz, Problem solving	
	Fresnel's formulae for perpendicular and parallel polarization cases, Reflection and transmission coefficients, Brewster's law. Total internal reflection, evanescent waves. Metallic reflection (normal incidence).		**3**		
	Assignment		**1**		
	Total		**50**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics II , DSC-7

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Solution of 2nd order linear differential equations (SDG)	Second order inhomogeneous differential equation; Linear independence of solutions: Wronskian, second solution.	1) Mathematical Methods for Physics and Engineers by Riley, Hobson and Bence 2) Differential equation by Ross	**3**	Chalk and Talk, PPT, Class test, Assignment	
	Singularity analysis at finite points. Power series solution of 2nd order differential equation. Frobenius method and its applications to differential equations.		**4**		
	Legendre, Hermite Differential Equations. Properties of Legendre and Hermite Polynomials: Rodrigues Formula, Generating Function, Orthogonality and completeness relation (Statement only.)		**3**		
	Simple recurrence relations. Expansion of function in a series of Legendre Polynomials.		**3**		
	Class Test		**2**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics II , DSC-7

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Linear Vector Space (LVS) (SDG)	Idea of LVS with 2-d and 3-d cartesian vectors. Introduction to bra and ket vectors.	1) Vector spaces and Matrices in Physics by M.C. Jain 2) Matrices and Tensors in Physics by A. W. Joshi	**1**	Chalk and Talk, PPT, Assignment, Quiz	
	Definition of LVS with examples: 2-d, 3-d vectors, complex numbers, sinusoidal waveforms. Dual space.		**1**		
	Inner product, Norm (defined in terms of inner product), Cauchy-Schwarz inequality, metric space.		**1**		
	Linear independence and dependence of vectors. Completeness of a set of vectors. Dimension and basis. Orthogonality. Gram-Schmidt method for orthogonalization.		**1**		
	Quiz and assignment		**1**		
3. Vectors (SDG)	Vectors and scalars under rotation.	1) Mathematical Methods for Physics and Engineers by Riley, Hobson and Bence	**1**	Chalk and Talk, Quiz, Assignment	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics II , DSC-7

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
3. Vectors (SDG)	Orthogonal curvilinear coordinates: Jacobian of transformation and its application to gradient, divergence, curl and Laplacian operators.	2) Mathematical Physics by H. K. Dass	**3**	Chalk and Talk, Quiz, PPT, Assignment	
	Class Test		**1**		
4. Introduction to Tensor analysis (SDG)	Definition of cartesian tensors in 3 dimensions. Transformation properties.	1) Matrices and Tensors in Physics by A. W. Joshi	**2**	Chalk and Talk, Quiz, Assignment	
	Contraction of tensors in 3 dimensions.		**1**		
	Peer teaching		**1**		
5. Matrices (SDG)	Representation of linear operator in terms of matrices. Addition and multiplication of matrices. Null matrices. Diagonal, scalar and unit matrices.	1) Matrices and Tensors in Physics by A. W. Joshi 2) Mathematical Physics by H. K. Dass 3) Mathematical methods in the physical sciences by Boas	**2**	Chalk and Talk, Quiz, PPT, Assignment	
	Transpose of a matrix. Symmetric and skew-symmetric matrices. Conjugate of a matrix. Hermitian and skew-hermitian matrices.		**2**		
	Singular and non-singular matrices. Orthogonal and unitary matrices. Trace of a matrix. Similarity transformation.		**2**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics II , DSC-7

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Matrices (SDG)	Invariance of trace and determinant under similarity transformation. Transformation of basis. Eigenvalues and eigenvectors (degenerate and non-degenerate).	1) Matrices and Tensors in Physics by A. W. Joshi 2) Mathematical Physics by H. K. Dass 3) Mathematical methods in the physical sciences by Boas	**2**	Chalk and Talk, Quiz, PPT, Assignment	
	Commuting operators and simultaneous eigenvectors for non-degenerate and degenerate eigenvalues.		**1**		
	Cayley-Hamilton Theorem. Diagonalization of matrices.		**2**		
	Solutions of coupled linear ordinary differential equations.		**1**		
	Functions of a matrix, e.g., exponential and trigonometric functions.		**1**		
	Peer Teaching + Class test		**2**		
6. Numerical Analysis II (KB)	Partial differential equation: Finite difference approximations to partial derivatives ($O(h^2)$). Solution of one dimensional heat conduction equation by explicit method. Qualitative idea of explicit and implicit methods.	1) Mathematical Methods for Physicists by Arfken	**2**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Mathematical Physics II , DSC-7

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
6. Numerical Analysis II (KB)	Laplace equation (2-d) using standard five point formula. Successive relaxation technique. Solution of 1-d Wave equation. Stability criterion-CFL condition (qualitative).	2) Numerical Methods for Engineers by D. V. Griffiths and I. M. Smith	**3**		
	Class Test		**1**		
	Total		**50**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Classical Mechanics and Special Theory of Relativity , DSC-8

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Non-inertial Systems **(GP)**	Non-inertial frames and idea of fictitious forces. Equation of motion (EOM) with respect to a uniformly accelerating frame. EOM with respect to a uniformly rotating frame: Centrifugal and Coriolis forces . Applications: Surface of rotating liquid, deflection of falling mass, cyclone. Numerical solving	Classical Mechanics by A.B. Gupta	**1** **3** **1** **2** **1**	Chalk and Talk, Assignment	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Classical Mechanics and Special Theory of Relativity , DSC-8

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
2. Rotational Dynamics **(GP)**	The rigid body: Constraints defining the rigid body. Degrees of freedom for a rigid body; Relation between angular momentum and angular Velocity: Moment of inertia tensor. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Equation of motion for rotation about a fixed axis. Principal Axes transformation. Transformation to a body fixed frame. EOM for the rigid body with one point fixed (Euler's equations of motion). Torque-free motion. Kinetic energy of rotation.	Classical Mechanics by A.B. Gupta	**1** **1** **2** **2** **2**	Chalk and Talk, Assignment	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Classical Mechanics and Special Theory of Relativity , DSC-8

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Numericals solving		**1** **1**		
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
3. Variational calculus in Physics **(KB)**	Basic ideas of functionals. Extremization of action as a basic principle in mechanics. Generalized coordinates, Constraint. Lagrangian formulation.	Classical Mechanics by S.L. Gupta , V. Kumar, H.V. Sharma	**3**	Chalk and Talk, PPT, Assignment	
	Euler-Lagrange equations of motion for simple systems: harmonic oscillators, simple pendulum, spherical pendulum. Motion under Central force.		**5**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Classical Mechanics and Special Theory of Relativity , DSC-8

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Cyclic coordinates. Symmetries and conservation laws. Legendre transformations and the Hamiltonian formulation of mechanics. Canonical equations of motion.		**6**		
	Applications to simple systems.		**4**		
	Assignment		**2**		
4. Special theory of Relativity **(AS)**	Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity.	1) Introduction to Special Relativity by R. Resnick 2) The special theory of relativity by Banerjee and Banerjee	**2**	Chalk and Talk, Assignment	
	Invariance of space-time interval. Derivation of Lorentz transformation equations. Length contraction. Time dilation.		**3**		
	Simultaneity and order of events. Concept of causality.		**2**		
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Classical Mechanics and Special Theory of Relativity , DSC-8

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
4. Special theory of Relativity **(AS)**	Relativistic transformation of velocity. Velocity addition. Relativistic dynamics.	1) Introduction to Special Relativity by R. Resnick 2) The special theory of relativity by Banerjee and Banerjee	**2**	Chalk and Talk, Assignment	
	Energy-momentum dispersion relation. Mass less particles. Mass-energy equivalence. Transformation of energy and momentum.		**2**		
	Minkowski space-time [(ct,x,y,z) or (x,y,z,ct)] diagram.		**1**		
	Total		**50**		

AY 2024-25

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: Minor-2, Basic Physics-II Sem-IV

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Basic Electricity and Magnetism (KB)	Electrostatics: Coulomb's law, Electric field, Electric field lines. Superposition Principle. Electric flux. Idea of charge density (linear, surface, volume) and continuous charge distributions. Gauss' Law (in integral form) with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Introduction to electrostatic potential, Equi-potential surfaces. Calculation of potential for linear, surface and volume charge distributions: simple cases (e.g.: uniform line charge, disc, spherical shell, sphere etc.). Potential and field due to a physical dipole; Torque, force and Potential Energy of an electric dipole in a uniform electric field.		4		
	Electrostatic energy of system of charges, a charged sphere. Conductors in an electrostatic Field. Mechanical force on the surface of a charged conductor. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Capacitance for parallel-plate, cylindrical, spherical capacitors (without dielectrics). Energy stored in Electrostatic field.		4		

Subject Name/Code: Physics Minor

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: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Basic Electricity and Magnetism (GP)	Lorentz force: Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field. Trajectory of charged particles in uniform electric field, crossed uniform electric and magnetic fields. Basic principle of cyclotron.	Introduction to Electrodynamics by D.J. Griffiths Electricity and Magnetism by D. Chattopadhyay and P.C. Rakshit Foundations of Electricity & Magnetism by B. Ghosh	3	Chalk and Talk	
	Magnetostatics: Concept of current density (linear, surface, volume). Equation of continuity. Biot and Savart's law, magnetic field due to a straight conductor, circular coil, Helmholtz coil, solenoid. Ampere's circuital law with applications (Infinite long wire, infinite solenoid, infinite current sheet). Magnetic field due to a small current loop - concept of magnetic dipole. Torque and force on magnetic dipole in a uniform magnetic field.		8		

Subject Name/Code: Physics Minor

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: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (AS)	Kinetic theory: Macroscopic and microscopic description of matter, Postulates of molecular kinetic theory of an ideal gas, Relation between microscopic and macroscopic state variables, Maxwell's velocity distribution, Concept of pressure and temperature.	Thermal physics by A.B. Gupta and H.P. Roy	3	Chalk and Talk	
	Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables. Thermodynamic equilibrium, zeroth law of Thermodynamics & concept of temperature. Concept of work & heat, State Functions, internal energy and first law of Thermodynamics, its differential form, first law & various processes. Applications of first law: General relation between CP and CV, work done during isothermal and adiabatic processes, compressibility and expansion coefficient.	Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	9		

Subject Name/Code: Physics Minor

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: Minor-2, Basic Physics-II

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Introduction to Thermodynamics (SDG)	Second Law of Thermodynamics: Reversible and irreversible process with examples. Inter-conversion of work and heat. Heat engines. Carnot's cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Kelvin-Planck and Clausius statements for the second law and their equivalence. Carnot's Theorem. Applications of second law of Thermodynamics: Thermodynamic scale of temperature and its equivalence to perfect gas scale.	Thermal physics by A.B. Gupta and H.P. Roy Heat and Thermodynamics by M.W. Zemansky and Richard Dittman	10	Chalk and Talk	
	Entropy: Concept of Entropy, Clausius theorem. Clausius inequality, Second law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of increase of Entropy. Entropy changes in reversible and irreversible processes with examples. Entropy of the universe. Principle of increase of Entropy. Temperature- Entropy diagrams for different cycles. Third law of Thermodynamics. Un-attainability of absolute zero.		6		
Total			**50**		

Subject Name/Code: Physics Minor

LESSON PLAN

AY: 2024-25

Department Name: Physics

Sem - VI

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Digital Systems & Applications CC13 (Th)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Integrated Circuits	Principle and design of monolithic IC	Digital circuits Part I & II by D. Roychoudhury Digital Principles & applications by A.P. Malvino, D.P. Leach	1	PPT	
	Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI		2		
2. Number System	Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers		2	Chalk and Talk	
	Singed & unsigned numbers, 1's & 2's complement, subtraction using 2's complement		1	Chalk and Talk	
3.Digital Circuits	Difference between Analog and Digital Circuits. Switching algebra, Huntington postulates, combinational logic		2	Chalk and Talk	
	AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers.		4	Chalk and Talk	
	Different logic families DTL , TTL ,CMOS		2	PPT	

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Digital Systems & Applications CC13 (Th)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
3 (contd)	MOS & CMOS inverter NAND/NOR using MOS logic		2	PPT	
	De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.		4	Chalk and Talk	
4. Implementation of different circuits	Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. IC 7483		2	Chalk and Talk	
	Combinational logic circuits using PLA/PAL		2	PPT	
5. Data processing circuits	Basic idea of Multiplexers, De-multiplexers,		2	Chalk and Talk	
	Decoders, Encoders.		1	Chalk and Talk	
6. Sequential circuits	SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations.	Digital circuits Part I & II by D. Roychoudhury	3	Chalk and Talk	

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr Gayatri Pal

Paper Name & Code: Digital Systems & Applications CC13 (Th)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
		Digital Principles & applications by A.P. Malvino, D.P. Leach			
	Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. D –FF, T -FF	Digital circuits Part I & II by D. Roychoudhury Digital Principles & applications by A.P. Malvino, D.P. Leach	2	Chalk and Talk	
7. Registers & Counters	Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).		3	Chalk and Talk	
	Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter		3	Chalk and Talk	
8. Computer organisation	I/O devices, Data Storage (RAM, ROM,EPROM)		2	PPT	
	Memory organisation& addressing, interfacing , Memory Map		3	PPT	
9. Data Conversion	Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion		2	PPT	
	D/A conversion		2	PPT	
		Total	60		

AY: 2024-25

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Solid State Physics , CC14

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Crystal Structure **(AS)**	Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis; Central and Non-Central Elements.	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	**2**	Chalk and Talk, Assignment	
	Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones.		**2**		
	Diffraction of X-rays by Crystals. Laue and Bragg's Law and their equivalence.		**2**		
	Atomic and Geometrical Structure Factor.		**2**		
	Basic idea of crystal indexing: examples with SC, BCC, FCC structure.		**3**		
	Problems		**1**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Solid State Physics , CC14

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Elementary Lattice Dynamics **(AS)**	Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains.	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	**3**	Chalk and Talk	
	Acoustical and Optical Phonons.		**1**		
	Qualitative Description of the Phonon Spectrum in Solids.		**1**		
	Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law.		**4**		
	Problems		**1**		
3. Magnetic Properties of Matter (AS)	Dia, Para, Ferri and Ferromagnetic Materials.	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	**1**	Chalk and Talk	
	Classical Langevin Theory of Dia and Paramagnetic Domains.		**2**		
	Quantum Mechanical Treatment of Paramagnetism (using parition function).		**2**		
	Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.		**3**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Solid State Physics , CC14

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Dielectric Properties of Materials **(AS)**	Polarization. Local Electric Field at an Atom. Depolarization Field	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	**1**	Chalk and Talk, Assignment	
	Electric Susceptibility. Polarizability. Clausius Mosotti Equation.		**2**		
	Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion		**2**		
	Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant.		**2**		
	Problems		**1**		
5. Drude's theory **(AS)**	Free electron gas in metals, effective mass, drift current, mobility and conductivity, Hall effect in metals.	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	3	Chalk and Talk, Assignment	
	Thermal conductivity. Lorentz number, limitation of Drude's theory		1		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Solid State Physics , CC14

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
6. Elementary band theory **(SDG)**	Kronig Penny model. Band Gap. effective mass and effective mass tensor	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by Harald Ibach and Hans Lüth	**3**	Chalk and Talk, Assignment	
	Conductor, Semiconductor (P and N type) and insulator.		**1**		
	Conductivity of Semiconductor, mobility		**2**		
	Hall Effect. Measurement of conductivity (4 probe method) & Hall coefficient.		**3**		
	Problems and quiz		**1**		
	Peer teaching		**1**		
	Class Test		**1**		
7. Superconductivity **(AS)**	Experimental Results. Critical Temperature. Critical magnetic field.	1) Introduction to Solid State Physics by C. Kittel, 2) Solid State Physics by R K Puri and V K Babbar	**1**	Chalk and Talk	
	Meissner effect. Type I and type II Superconductors,		**2**		
	London's Equation and Penetration Depth. Isotope effect.		**2**		
	Class test		**1**		
		Total	**60**		

AY 2024-25

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Nanomaterials and Applications , DSEA2(a)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Nanoscale Systems **(SDG)**	Length scales in physics, Nanostructures:1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods)	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana 2) Introduction to Nanoscience and Nanotechnology by Kuno. M	**2**	Chalk and Talk, PPT, Quiz, Assignment, peer teaching	
	Band structure and density of states of materials at nanoscale		**2**		
	Size Effects in nano systems,		**1**		
	Quantum confinement: Applications of Schrodinger equation: Infinite potential well, potential step, potential box		**3**		
	quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.		**2**		
2. Synthesis of Nanostructure Materials **(KB)**	(a) Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation.	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana	**4**	Chalk and Talk, PPT	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Nanomaterials and Applications , DSEA2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Synthesis of Nanostructure Materials **(KB)**	(b) Vacuum deposition ,Physical vapor deposition (PVD), Thermal evaporation, Electron beam evaporation, Pulsed Laser deposition, Chemical vapor deposition (CVD), MBE growth of quantum dots	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana	**5**	Chalk and Talk, PPT	
	(c) Chemical Synthesis, Chemical bath deposition, Electro deposition, Spray pyrolysis, Hydro thermal synthesis, Sol-Gel synthesis, Preparation through colloidal methods		**5**		
	Assignment		**1**		
3.Characterization **(KB)**	X-Ray Diffraction. Optical Microscopy	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana	**3**	Chalk and Talk, PPT	

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Nanomaterials and Applications , DSEA2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Characterization **(KB)**	Scanning Electron Microscopy (SEM). Transmission Electron Microscopy (TEM).	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana	**3**	Chalk and Talk, PPT	
	Atomic Force Microscopy (AFM). Scanning Tunneling Microscopy (STM).		**3**		
	Assignment		**1**		
4. Optical Properties **(SDG)**	Coulomb interaction in nanostructures	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana 2) Introduction to Nanoscience and Nanotechnology by Kuno. M	**1**	Chalk and Talk, PPT, Assignment, Quiz	
	Concept of dielectric constant for nanostructures and charging of nanostructure.		**2**		
	Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals.		**2**		
	Quantitative treatment of quasi-particles and excitons, charging effects..		**3**		
	Radiative processes: General formalization, absorption, emission and luminescence		**2**		
	Optical properties of heterostructures and nanostructures.		**2**		
	Tutorial Problems + Class Test		**2+1=3**		

LESSON PLAN

Department Name: Physics

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

Paper Name & Code: Nanomaterials and Applications , DSEA2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Electron Transport **(SDG)**	Carrier transport in nanostrucutures. Coulomb blockade effect.	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana 2) Introduction to Nanoelectronics by Vladimir Mitin et. al.	2	Chalk and Talk	
	thermionic emission, tunneling and hoping conductivity		**3**	Chalk and Talk, Quiz, PPT, Assignment	
	Defects and impurities: Deep level and surface defects.		**2**		
	Peer teaching		**1**		
	Tutorial Problems and Quiz		**1 +1=2**		
6.Applications **(KB)**	Applications of nanoparticles, quantumdots ,nanowires and thin films for photonic devices (LED, solar cells).	1) Nanomaterials: Theory, Problem and Solutions by U. N. Nandi and D. Jana	**4**	Chalk and Talk, PPT	
	Single electron transfer devices (no derivation). CNT based transistors.		**3**		
	Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage.		**3**		
	Magnetic quantum well; magnetic dots- magnetic data storage.		**2**		
	Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems(NEMS).		**3**		
		Total	**75**		

AY:2024-25

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC)

Paper Name & Code: Communication Electronics , DSEB2(a)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Electronic communication	Introduction to communication means and modes. Need for modulation.	1. Introduction to communication Electronics-B. P. Lathi 2. Communication Electronics-Kenedy	2	Chalk and Talk, Assignment	
	Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI).		2		
	Electro- magnetic communication spectrum, band designations and usage.		2		
	Channels and base-band signals.		2		
	Concept of Noise, signal-to-noise (S/N) ratio		2		
2. Analog Modulation	Amplitude Modulation, mathematical analysis for modulation index, frequency spectrum and power in AM Generation of AM (Emitter Modulation)	3. Electronic Communication Systems: Fundamentals Through Advanced Author: Tomasi 4. Communication Systems-Simon S. Haykin	4	Chalk and Talk, Assignment	
	Diode/square law modulator, Amplitude Demodulation (diode detector) Balanced modulator for DSB, Concept of Single sideband generation and detection, concept of vestigial sideband.		4		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC)

Paper Name & Code: Communication Electronics , DSEB2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
2. Analog Modulation	Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, Transistor/FET reactance modulator, equivalence between FM and PM, Generation of FM using VCO		4	Chalk and Talk, Assignment	
	FM detector : slope detector ,Balanced slope detector, Idea of Phase discriminator and ratio detector, Qualitative idea of IF and Super heterodyne receiver		**3**		
3. Analog Pulse Modulation	Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM	5. Digital Communications: Fundamentals And Applications- Bernard Sklar	**4**	Chalk and Talk, Assignment	
	modulation and detection technique for PAM only, Multiplexing – FDM and TDM and its application in communication		**4**		
	Problem solving class		**2**		

LESSON PLAN

Department Name: Physics

Name of Faculty: Dr. Subhendu Chandra (SC)

Paper Name & Code: Communication Electronics , DSEB2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Digital Pulse Modulation	Need for digital transmission, Sampling and Shanon's criteria, Quantization and Encoding, Quantisation error,	6. Pulse Code Modulation Techniques: With Applications in Communications and Data Recording-**William M. Waggener (Author)**	3	Chalk and Talk, PPT, Assignment, Quiz	
	non-uniform quantisation, Impulse sampling, Natural sampling and flat top sampling,		3		
	Pulse Code Modulation (PCM), Differential PCM , Digital Carrier Modulation Techniques, Concept of		3		
	Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK).		2		
	Idea of 8-PSK, QPSK, BPSK, use of Constellation diagram (idea only), Delta modulation. Concept of companding-		2		
	A law and μ law. Line Coder: Unipolar and bipolar RZ& NRZ, Manchester format.		2		

LESSON PLAN

Department Name: Physics

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Paper Name & Code: Communication Electronics , DSEB2(a)

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Introduction to communication and Navigation systems:	Satellite Communication: Introduction, need, Geo synchronous satellite orbits geostationary satellite advantages of geostationary satellites.	7. Satellite Communications- Varsha Agrawal Anil K. Maini 8. Wireless and Mobile Communication- Rishabh Anand	5	Chalk and Talk, PPT, Assignment, Quiz	
	Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.		5		
	Mobile Telephony System: Basic concept of mobile communication, frequency bands used in mobile communication,		3		
	concept of cell sectoring and cell splitting, SIM number, IMEI number,		3		
	need for data encryption, architecture (block diagram) of mobile communication network,		3		
	idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset,		4		
	2G, 3G and 4G concepts (qualitative only).GPS navigation system (qualitative idea only).		2		
		Total	**75**		

LESSON PLAN

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Paper Name & Code: Communication Electronics , DSEB2(a)