Lesson Plan - Honours (AY 2018-19)

Name: Dr. Pratibha Pal

Department: Physics

Year	Paper	Unit	Topic	No. of lectures	Session
Sem I (CBCS)	CC2		**6. Elasticity** a) Relation between Elastic constants. Twisting Torque on a cylinder or wire. Bending of a beam. Internal bending moment. Elastic Potential Energy. **7. Fluid Motion** a) Kinematics of Moving Fluids: Idea of compressible and incompressible fluids, equation of Continuity; Streamline and Turbulent Flow, Reynold's Number.	**8 Lectures** **6 Lectures**	**July to Pre-Puja**
			7. Fluid Motion (Contd.) Euler's equation. The special case of Fluid statistics F = grad P. Simple applications. b) Poiseuille's equation for flow of a viscous liquid through a Capillary Tube.	**4 Lectures** **3 Lectures**	**Post-Puja to End Sem**
Sem II (CBCS)	CC4		***1.Oscillations*** a) SHM: Simple Harmonic Oscillations. Differential Equation of SHM and its solution. Kinetic energy, Potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality factor. ***2. Superposition of Harmonic Oscillations*** a) Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having 1) equal frequencies and 2) different frequencies(Beats). Superposition of N collinear oscillations having 1) equal phase difference and 2) equal frequency difference. ***3. Wave motion*** a) Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane progressive waves. Wave equation. Particle and wave velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. b) Water Waves: Ripple and Gravity Waves. ***4. Velocity of Waves*** a) Velocity of Transverse Vibrations of Stretched Strings. b) Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. ***5. Superposition of Harmonic Waves*** a) Standing waves in a String. Fixed and Free Ends. Analytical Treatment. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. b) Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. c) Superposition of N Harmonic Waves. Phase and Group Velocities.	**8 Lectures** **8 Lectures** **7 Lectures** **5 Lectures** **8 Lectures**	**Jan-June**

Year	Paper	Unit	Topic	No. of lectures	Session
II (1+1 +1)	**IVA**	**I**	**THERMAL PHYSICS II** ***1. Basic Concepts*** Microscopic and macroscopic points of view : thermodynamic variables of a system, State function, exact and inexact differentials. ***2. First Law of Thermodynamics*** Thermal equilibrium, Zeroth law and the concept of temperature. Thermodynamic equilibrium, internal energy, external work, quasistatic process, first law of thermodynamics and applications including magnetic systems, specific heats and their ratio, isothermal and adiabatic changes in perfect and real gases.	**3+ 1 (Tutorial)** **6+2 (Tutorial)**	**July to Pre-Puja**
			3. Second Law of Thermodynamics Reversible and irreversible processes, indicator diagram. Carnot's cycles-efficiency, Carnot's theorem. Kelvin's scale of temperature, relation to perfect gas scale, second law of thermodynamics – different formulations and their equivalence, Clausius inequality, entropy, change of entropy in simple reversible and irreversible processes, entropy and disorder; equilibrium and entropy principle, principle of degradation of energy.	**10+2 (Tutorial)**	**Post-Puja to Winter vacation.**
			4. Thermodynamic Functions Enthalpy, Helmholtz and Gibbs' free energies; Legendre transformations, Maxwell's relations and simple deductions using these relations; thermodynamic equilibrium and free energies. ***5. Change of State*** Equilibrium between phases, triple point : Gibbs' phase rule (statement only) and simple applications. First and higher order phase transitions, Ehrenfest criterion. Clausius-Clapeyron's equation. Joule-Thomson effect.	**3+1 (Tutorial)** **6+2 (Tutorial)**	**Post-Winter Vacation to Test examination**

Year	Paper	Unit	Topic	No. of lectures	Session
III (1+1+ 1)	**VI**	**I**	**NUCLEAR & PARTICLE PHYSICS I** ***1.Bulk properties of nuclei*** Nuclear mass, charge, size, binding energy, spin and magnetic moment. Isobars, isotopes and isotones; mass spectrometer (Bainbridge). ***2. Nuclear structure*** Nature of forces between nucleons, nuclear stability and nuclear binding, the liquid drop model 11 (descriptive) and the Bethe-Weizsacker mass formula, application to stability considerations, extreme single particle shell model (qualitative discussion with emphasis on phenomenology with examples). ***3. Unstable nuclei*** **(a) Alpha decay** : alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. **(b) Beta decay** : nature of beta ray spectra, the neutrino, energy levels and decay schemes, positron emission and electron capture, selection rules, beta absorption and range of beta particles, Kurie plot.	**5+ 1(Tutorial)** **9 + 2 (Tutorial)** **3+1 (Tutorial)** **4 + 1 (Tutorial)**	**July to Pre-Puja**
			(c)Gamma decay : gamma ray spectra and nuclear energy levels, isomeric states. Gamma absorption in matter – photoelectric process, Compton scattering, pair production (qualitative).	**4+ 1(Tutorial)**	
			NUCLEAR & PARTICLE PHYSICS II ***1. Nuclear reactions*** Conservation principles in nuclear reactions. Q-values and thresholds, nuclear reaction cross-sections, examples of different types of reactions and their characteristics. Bohr's postulate of compound nuclear reaction, Ghoshal's experiment. ***2. Nuclear fission and fusion*** Discovery and characteristics, explanation in terms of liquid drop model, fission products and energy release, spontaneous and induced fission, transuranic elements. Chain reaction and basic principle of nuclear reactors. Nuclear fusion: energetics in terms of liquid drop model. ***3. Elementary particles*** (a) Four basic interactions in nature and their relative strengths, examples of different types of interactions. Quantum numbers – mass, charge, spin, isotopic spin, intrinsic parity, hypercharge. Charge conjugation. Conservation laws. (b) Classifications of elementary particles – hadrons and leptons, baryons and mesons, elementary ideas about quark structure of hadrons – octet and decuplet families.	**5 + 1 (Tutorial)** **5 + 1 (Tutorial)** **3 + 1 (Tutorial)** **4 + 1 (Tutorial)**	**Post-Puja to Winter vacation.**

Year	Paper	Unit	Topic	No. of lectures	Session
III	**VI**	**I**	**NUCLEAR & PARTICLE PHYSICS II** ***4. Particle Accelerator and Detector*** Cyclotron – basic theory, synchrotron, GM counter ***5. Nuclear Astrophysics*** Primordial nucleosynthesis, energy production in stars, pp chain, CNO cycle. Production of elements (qualitative discussion)	**3 + 1 (Tutorial)** **6 + 1 (Tutorial)**	**Post-Winter Vacation to Test examination**

Lesson Plan - General

Name:

Dr. Pratibha Pal

Department: Physics

Year	Paper	Unit	Topic	No. of lectures	Session
1st Sem (CBCS)	**GE1/CC1**		**Elasticity** a) Hooke's Law: Stress-Strain diagram. Elastic moduli-relation between elastic constants- Poisson's Ration-expression for Poisson's ratio in terms of elastic constants. b) Twisting couple on a cylinder - determination of Rigidity modulus by static torsion. Torsional pendulum. c) Bending of beam. d) Work done in stretching and work done in twisting a wire.	**7 Lectures** **4 Lectures** **3 Lectures** **3 Lectures**	**July to Pre-Puja** **Post Puja to End Sem**
2nd Sem (CBCS)	**GE2/CC2**		**Electrostatics** a) Coulomb's law. Principle of Superposition, Electrostatic Field. b) Divergence of the electrostatic field. Flux, Gauss's theorem of electrostatics, Application of Gauss theorem to find electric field due to point charge, infinite line of charge.	**2 Lectures** **3 Lectures**	**Jan -June**

Year	Paper	Unit	Topic	No. of lectures	Session
2nd Sem (CBCS)	**GE2/CC2**		**Electrostatics contd.** b) uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. c) Curl of the electrostatic field. Electrostatic potential as line integral of electric field. Potential for a uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Electric field and potential due to an electric dipole. Electric Dipole moment. Force and Torque on a dipole.	**4 Lectures** **4 Lectures**	**Jan - June**
2 **(1+1+1)**	**IIIA** **IIB**	**I**	***1.Light as an electromagnetic wave :***Full electromagnetic spectrum, properties of electromagnetic waves, Huygens' principle --- explanation of the laws of reflection and refraction. ***2. Interference of light :*** Young's experiment, intensity distribution, conditions of interference,interference in thin films, Newton's ring. ***3. Diffraction :*** Fresnel andFraunhofer class, Fresnel's half-period zones, zone plate. Fraunhofer diffraction due to a single slit and plane transmission grating (elementary theory), resolving power. ***4. Polarisation :*** Differentstates of polarisation, Brewster's law, double refraction, retardation plate, polaroid, optical activity. ***Electrostatics :*** 1.Quantisation of chargeand Millikan's *oil drop* experiment, Coulomb's law, intensity and potential ---example of point charge, Gauss' theorem --- simpleapplications, potential and field due to anelectric dipole, mechanical force on the surface of a charged conductor. 2. Dielectric medium, polarization, electric displacement. 3. *Capacitor:* Parallel- plates and cylindrical, energy stored in parallel plate capacitor.	**5** **5** **5** **5** **8**	**July to Pre-Puja** **Post-Puja to Winter vacation**. **Post-Winter Vacation to Test examination**

Year	Paper	Unit	Topic	No. of lectures	Session
III (1+1+1)	**IVA**	**II**	**1. Conventional energy sources *:*** thermal power plant, relevance of Rankinecycle (qualitative discussion), steam turbine, hydro-electric power plant -- basic principle.	6	**July to Pre-Puja**
			2. Non-conventional energy sources: solar, wind, tidal, geothermal,and biogas sources, elementary idea of production and uses.	6	**Post-Puja to Winter vacation.**

Lesson Plan - Honours

(AY 2018-2019)

Name: GAYATRI PAL

Department: PHYSICS

Year	Paper	Unit	Topic	No. of lectures	Session
1st Sem (CBCS)	CC2		**1. Fundamentals of Dynamics** **a) Review of Newton's Laws**: Mechanistic view of the Universe. Concepts of Inertial frames, force and mass. Solution of the equations of motion (E.O.M.) in simple force fields in one, two and three dimensions using Cartesian, cylindrical polar and spherical polar coordinate systems.	**5**	
			b) Dynamics of systems of particles: Difficulty of solving the E.O.M. for systems of particles. Newton's third Law. External and Internal forces. Momentum and Angular Momentum of a system. Torque acting on a system. Conservation of Linear and Angular Momentum. Centre of mass and its properties. Two-body problem.	**5**	**July to Pre-Puja**
			c) Variable- mass system: motion of rocket.	**2**	
			2. Work and Energy a) **Work - Kinetic Energy Theorem**. Conservative Forces: Force as the gradient of a scalar field - concept of Potential Energy. Other equivalent definitions of a Conservative Force. Conservation of Energy.	**5**	
			b) **Qualitative study of one dimensional** motion from potential energy curves. Stable and Unstable equilibrium.	**3**	
			c**) Energy of a system of particles**.	**2**	
			3. Gravitation and Central Force Motion a)Central Force. Reduction of the two body central force problem to a one-body problem. Setting up the E.O.M. in plane polar coordinates.	**4**	**Post-Puja to End Sem**
			b)Differential equation for the path. Motion under an Inverse-square force. Newton's Law of Gravitation. Inertial and gravitational mass. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).	**5**	
			c)Gravitational potential energy. Potential and field due to spherical shell and solid sphere.	**3**	

Year	Paper	Unit	Topic	No. of lectures	Session
2nd Sem (CBCS)	**CC3**		**The Magnetostatic Field** a) Biot-Savart's law. Force on a moving point charge due to a magnetic field: Lorentz force law. Application of Biot-Savart's law to determine the magnetic field of a straight conductor, circular coil. Force between two straight current carrying wires. b) Divergence of the magnetic field - its solenoidal nature. Magnetic vector potential. c) Curl of the magnetic field. Ampere's circuital law. Its application to Infinite straight wire, (2) Infinite planar surface current, and (3) Solenoid. **Magnetic properties of matter.** a) Potential and field due to a magnetic dipole. Magnetic dipole moment. Force and torque on a magnetic dipole in a uniform magnetic field. b) Magnetization. Bound currents. The magnetic intensity - H. Relation between B, H and M. Linear media. Magnetic Susceptibility and Permeability. Brief introduction of dia-, para- and ferro-magnetic materials. B-H curve and hysteresis. **Electro-magnetic induction** a) Ohms law and definition of E.M.F. Faraday's laws of electromagnetic induction, Lenz's law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Introduction to Maxwell's Equations. Charge conservation. Displacement current and resurrection of Equation of Continuity. b) Energy stored in magnetic field.	**5** **2** **4** **4** **5** **5** **2**	**Jan - June**

Year	Paper	Unit	Topic	No. of lectures	Session
2 Hons	III	I	**Amplifier** Voltage and current gain, principle of feedback, positive and negative feedback, advantages of negative feedback, multistage amplifier, frequency response of a two stage R-C coupled amplifier, gain and band width and their product, operating point of class A, amplifier, analysis of single tuned voltage amplifier, requirement of power amplifiers	10 2 Tutorials	July to Pre-Puja
			Oscillators Barkhausen criterion for sustained oscillation, L-C, Weinbridge and crystal oscillators, relaxation oscillators- monostable, bistable and astable multivibrators. **Operational amplifier** Properties of ideal OP-AMP, differential amplifiers, CMRR, inverting and non-inverting amplifiers, mathematical operations. **Combinational logic** Half adder, full adder, digital comparator, decoder, encoder (ROM), multiplexer	3 3 3 2 Tutorials	post-Puja to Winter vacation.
			Sequential logic Flip-flops- RS, D, JK, JKMS flip-flops, edge triggering. Shift register, ripple counter(binary and decade). **Communication principles** Modulation and demodulation – elementary theory of AM, FM and PM, demodulation of AM (diode detector) and FM (slope detector) waves.	4 5 2 Tutorials	post-Winter Vacation to Test examination

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**5**	**II**	**ATOMIC PHYSICS** **Atomic Spectrum** Good quantum numbers, and selection rules. Stern-Gerlach experiment andspin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Bohr-Sommerfeld model. Fine structure. Study of fine structure by Michelson interferometer. **Vector atom model** Magnetic moment of the electron, Lande g factor. Vector model – space quantization. Zeeman Effect : Explanation from vector atom model. **Many electron model** Pauli exclusion principle, shell structure. Hund's rule, spectroscopic terms of many electron atoms in the ground state. **Molecular spectroscopy** Diatomic molecules – rotational and vibrational energy levels. Basic ideas about molecular spectra.Raman effect and its application to molecular spectroscopy (qualitative discussion only). **Laser Physics** Population inversion, Einstein's A and B coefficients; feedback of energy on a resonator; 3-level and 4-level systems.	**8** **5** **3** **4** **3**	**July to Pre-Puja**

Year	Paper	Unit	Topic	No. of lectures	Session
3rd year	**7A**	**I**	**STATISTICAL MECHANICS** **Microstates and macrostates** Classical description in terms of phase space and quantum description in terms of wave functions. Hypothesis of equal apriori probability for microstates of an isolated system in equilibrium. Interactions between two systems – thermal, mechanical and diffusive. Statistical definition of temperature, pressure, entropy and chemical potential. Partition function of a system in thermal equilibrium with a heat bath. **Classical statistical mechanics** Maxwell-Boltzmann distribution law. Calculation of thermodynamic quantities for ideal monoatomic gases. **Motivations for quantum statistics** Gibbs' paradox. Identical particle and symmetry requirement. Derivation of MB, FD and BE statistics as the most probable distri - butions (micro-canonical ensemble). Classical limit of quantum statistics. **Quantum statistical mechanics** Bose-Einstein statistics: Application to radiation – Planck's law. Rayleigh Jeans and Wien laws as limiting cases, Stefan's law. Fermi-Dirac statistics: Fermi distribution at zero and non-zero temperature Fermi energy and its expression in terms of particle density. Degenerate and non- degenerate Fermi gas. Electron specific heat of metals at low temperature. Saha equation for thermal ionization and its application to astrophysics.	**8** **3** **3** **6**	**Post-Puja to Test examination)**

General

Name: Dr. Gayatri Pal

Department: Physics

Year	Paper	Unit	Topic	No. of lectures	Session
1st Sem (CBCS)	**GE1**		**Laws of Motion:** a) Laws of Motion: Frames of reference. Newtow's laws of motion. Dynamics of system of particles. Conservation of momentum. Center of Mass.	**8**	**July to Pre-Puja**
			Work and Energy: Work- energy theorem. Conservative forces. Concept of potential energy. Conservation of Energy.	**5**	**Post-Puja to End Sem**
2nd Sem (CBCS)	**GE2**		**Magnetism** Biot-Savart's law and the Lorentz force law. Application of Biot-Savart's law to determine the magnetic eld of a straight conductor, circular coil, solenoid carrying current. Force between two straight current carrying wires. Divergence of the magnetic field. Magnetic vector potential. Curl of the magnetic field. Ampere's circuital law. Determination of the magnetic field of a straight current carrying wire. Potential and field due to a magnetic dipole. Magnetic dipole moment. Force and torque on a magnetic dipole. Magnetic fields inside matter: Magnetization. Bound currents. The magnetic intensity - H. Linear media. Magnetic susceptibility and Permeability. Brief introduction of dia-, para- and ferro-magnetic materials. **Electromagnetic Induction** **Ohms law and definition of E.M.F.** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.	**10** **2** **4**	**Jan - June**

Year	Paper	Unit	Topic	No. of lectures	Session
2	2		Varying currents : growth and decay of currents in L-R circuit; charging and discharging of capacitor in C-R circuit. Numerical problem discussion Alternating current : Mean and r.m.s. values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit --- power factor, vector diagram, resonance in a series LCR circuit, Q-factor, principle of ideal transformer. Numerical problem discussion	5 5	**post-Puja to Winter vacation.**
	3A	**II**	Diodes and Transistors : P-N junction diode, bridge rectifier, capacitance input filter, Zener diode, voltage regulator, Transistors --- α and β and their interrelations; output characteristics in CE mode, single stage CE amplifier --- approximate expressions of current and voltage gain with the help of 'Load Line'. ***Digital circuits*** *:* binary systems, binary numbers. Decimal to binary	**2** **2** **5** **5**	**July to Pre-Puja**

			and reverse conversions; binary addition and subtraction. ***. Logic gates :*** OR, AND, NOT gates --- truth tables. Statement of de Morgan's theorem, NOR and NAND universal gates.		

Year	Paper	Unit	Topic	No. of lectures	Session
3	**4A**	**III**	***Feedback :*** Basic principle, positive and negative feedback, Barkhausen criterion, oscillator,	**2**	**July to Pre-Puja**
			OPAMP : characteristics, uses of OPAMP as amplifier, oscillator, and filter;	**5**	
			light-emitting diodes, 7-segment display, SCR, diac and triac.	**2**	
			. Digital electronics : combinational circuits --- adder and subtractor, multiplexer, demultiplexer, encoder, decoder, sequential circuits --- flip-flop, D and J-K, registers and counters.	**5**	
		III	***Instruments :*** cathode-ray oscilloscope, digital multimeter, L and C measurements.	**3**	**post-Puja to Test examination)**

Lesson Plan (AY 2018-2019)
Name:Dr. Subhendu Chandra
Department: Physics
Honours Course

Semester	Paper	Unit	Topic	No. of lectures	Session
1Hons	PHS-A-CC-1-1-TH		**Vector Algebra and Vector Calculus:** **(a)** Recapitulation of Vector Algebra. Idea of linear independence, completeness, basis and representation of vectors. Properties of vectors under rotations. Scalar product and its invariance under coordinate rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively **(b)** Vector Differentiation: Scalar and Vector fields. Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities. **(c)** Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).	**6** **7** **7**	**July to Pre-Puja**
			Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.	**5**	**post-Puja to End Sem**
2Hons	PHS-A-CC-2-3-TH		**Electrical circuits**: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit **Network theorems:** Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem,	**5** **5**	**January to June**

			Maximum Power Transfer theorem. Applications to dc circuits		
2 Hons	PHS-A-CC-2-4-TH		**Holography** Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms.	**4**	

Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
2Hons	**IVA**	**I**	**Old quantum theory:** Planck's formula of black-body radiation. Photoelectric effect. Bohr atom and quantization of energy **Basic quantum mechanics:** de Broglie hypothesis. Electron double-slit experiment. Compton effect, Davisson-Germer experiment, Heisenberg's uncertainty principle (statement) with illustrations. Concept of wave function as describing the dynamical state of a single particle. Group and phase velocities, classical velocity of a particle and the group velocity of the wave representing the particle.	**5** **7**	**August to Pre-Puja**
			Basic quantum mechanics (Continued): Principle of superposition. Schrodinger equation.Probabilistic interpretation; equation of continuity, probability current density. Boundary conditions onthe wave function. **Basic postulates of quantum mechanics:** Dynamical variables as linear hermitian operators and eigenvalue equations, Momentum, energy andangular momentum operators. Measurement of observables, expectation values.	**3** **5**	**post-Puja to Winter vacation.**
			Basic postulates of quantum mechanics (Continued): Commutation relations between operators. Compatible observables and simultaneous measurements, Ehrenfest theorem.	**5**	**Post winter to Test**

Year	Paper	Unit	Topic	No. of lectures	Session
3Hons	**VI**	**II**	**Crystal Structure:** Crystalline and amorphous solids, translational symmetry. Elementary ideas about crystal structure, lattice and bases, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, lattice planes, simple cubic, f.c.c. and b.c.c. lattices. Laue and Bragg equations. Determination of crystal structure with X-rays. **Structure of solids:** Different types of bonding- ionic, covalent, metallic, van der Waals and hydrogen. Band theory of solids,Periodic potential and Bloch theorem, Kronig-Penny model, energy band structure. Band structure inConductors, direct and indirect semiconductors and insulators (qualitative discussions); free electron theory of metals, effective mass, drift current, mobility and conductivity, Wiedemann-Franz law. Hall effect in metals: Phenomenology and implication.	**10+3** **10+2**	**July to Pre-Puja**
			Dielectric properties of materials: Electronic, ionic and dipolar polarizability, local fields, induced and oriented polarization– molecular field in a dielectric; Clausius-Mosotti relation. **Magnetic properties of materials:** Dia, para and ferro-magnetic properties of solids. Langevin's theory of diamagnetism and paramagnetism. Quantum theory of paramagnetism, Curie's law. Ferromagnetism: spontaneous magnetization and domain structure; temperature dependence of spontaneous magnetisation;Curie-Weisslaw, explanation of hysteresis. **Lattice vibrations:** Elastic and atomic force constants; Dynamics of a chain of similar atoms and chain of two types of atoms; optical and acoustic modes; interaction of light with ionic crystals. Einstein's and Debye's theories of specific heats of solids. **Superconductivity:** Introduction (Kamerlingh-Onnes experiment), effect of magnetic field, Type-I and type-II superconductors, Isotope effect. Meissner effect. Heat capacity. Energy gap. Ideas about High-Tc superconductors.	**4** **11+3** **5** **5+2**	**Post-Puja to Test examination**

General Course

Semester	Paper	Unit	Topic	No. of lectures	Session
1 General	PHS-G-CC-1-1-TH		**Mathematical Methods** (a) Vector Algebra: Vectors as directed line segments. Addition of vectors and multiplication by a scalar. Scalar and vector products. Basis and representation of vectors. (b) Vector Analysis: Derivatives of a vector with respect to a parameter. Gradient, divergence and Curl.	**5** **5**	**July to Pre-Puja**
			Vector Analysis (Continued) Vector integration, line, surface and volume integrals of vector fields. Gauss'-divergence theorem and Stoke's theorem of vectors (Statement only)	**5**	**Post Puja to End Sem**
2 General	PHS-G-CC-2-2-TH		Ohms law and definition of E.M.F. Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.	**5**	**August to Pre-Puja**
			Linear Network Impedance of L, C, R and their combinations. Thevenin& Norton's Theorem. Maximum power transfer theorem and superposition theorem. Anderson's bridge.	**5**	**Post Puja to End Sem**
Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
2 General	**IIB**	**II**	**Steady Current:** Network analysis --- Kirchoff's laws, Thevnin and Norton's theorem,Wheatstone bridge, potentiometer. Numerical problem discussion	**6** **2**	**July to Pre-Puja**
	IIB	**II**	**Thermoelectricity:**Seebeck, Peltier, and Thomson effects, laws of thermoelectricity, thermoelectric curve neutral and inversion temperature, thermoelectric power. Numerical problem discussion	**6** **2**	**Post-Puja to Winter vacation.**
	IIIA	**III**	**Special Theory of Relativity:**Postulates of STR, formulae of (i) Length contraction; (ii) Time dilation; (iii) Velocity addition; (iv) Mass variation, and (v) Mass-energy equivalence. Numerical problem discussion	**5** **1**	**post-Winter to Test**

			Quantum theory of radiation: Planck's concept radiation formula (statement only) qualitative discussion of photo-electric effect and Compton effect in support of quantum theory; Raman effect. Numerical problem discussion **Basic Quantum Mechanics:**Wave nature of material particles, wave-particle duality, wavelengthof de Broglie waves, Heisenberg uncertainty principle, Schroedinger equation, particle in a one dimensional infinite well energy eigenvalues, wavefunction and its probabilistic interpretation.Bohr's theory of hydrogen spectra, concept of quantum number, Pauli exclusion principle. Numerical problem discussion **Solid State Physics:**Crystalline nature of solid, diffraction of X-ray, Bragg's law; Moseley's law explanation from Bohr's theory. **Nuclear Physics:**Binding energy of nucleus, binding energy curve and stability; Radioactivity, successive disintegration, radioactive equilibrium, radioactive dating, radioisotopes and their uses, nuclear transmutation, fission and fusion, nuclear reactor.	**4** **1** **4** **1** **2** **4**	
Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
3 General	**IVA**	**IV**	**Communications:** Propagation of electromagnetic waves in atmosphere, various layers of atmosphere, ground andsky waves. **Transmission of electromagnetic waves:**Amplitude and frequency modulation, calculation ofpower in amplitude modulation, sideband generation in frequency modulated wave; demodulation, linear diode detector, detection of FM waves, signal-to-noise ratio.	**2** **5**	**July to Pre-Puja**
		IV	**Transmission through media:** coaxial cables, optical fibre --- cladding, energy loss, band width and channel capacity, information carrying capacity of lightwaves (qualitative); satellitecommunication, microwave link --- modem and internet.	**5**	**post-Puja to Test**

Lesson Plan - Honours (AY 2018-19)
Name: Dr. Shinjinee Das Gupta
Department: Physics

Year/ Semester	Paper	Unit	Topic	No. of lectures	Session
Ist Sem (CBCS)	PHS-A-CC-1-1-TH		**First Order and Second Order Differential equations:** First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral. **Calculus of functions of more than one variable:** Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **Matrices** Addition and Multiplication of Matrices. Null Matrices. Diagonal, Scalar and Unit Matrices. Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew- Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix. Inner Product. Eigen-values and Eigenvectors. Cayley- Hamiliton Theorem.	**Lectures 10** **Lectures 8** **Lectures 12**	**July to Pre-Puja**
Ist Sem (CBCS)	PHS-A-CC-1-1-TH		**Matrices contd.** Diagonalization of Matrices. Solutions of Coupled Linear Ordinary Differential Equations. Functions of a Matrix.	**Lectures 6**	**Post-Puja to End Sem Exam**

Year	Paper	Unit	Topic	No. of lectures	Session
IInd Sem (CBCS)	**PHS-A-CC-2-4-TH**		**Wave Optics:** Electromagnetic Nature of Light. Definition and properties of wavefront. Huygen's Principle. Temporal and Spatial coherence. **Interference** Division of amplitude and wavefront. Young's double slit experiment. Llyod's mirror and Fresenl's Biprism. Phase change on reflection and Stokes' treatment. Interference in Thin Films: parallel and wedge shaped films. Fringes of equal inclination and fringes of equal thickness. Newton's rings: measurement of wavelength and refractive index. **Interferometer** a) Michelson Inteferometer: 1) Idea of form of fringes, 2) Determination of wavelength, 3) Wavelength difference, 4) Refractive Index and 5) Visibility of fringes. b) Fabry-Perot interferometer. **Diffraction** a) Fraunhofer diffraction: Single slit. Circular apertures. Resolving power of a Telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. b) Fresnel Diffraction : Fresnel's Assumptions. Fresnel's Half-period zone for plane wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple foci of a Zone Plate, Fresnel's Integrals, Fresnel's diffraction pattern of a straight edge, a slit and a wire.	**Lectures 3** **Lectures 10** **Lectures 6** **Lectures 10** **Lectures 10**	**Jan - June**

Year	Paper	Unit	Topic	No. of lectures	Session
II (1+1+ 1)	**III**	**II**	**WAVES & OPTICS II** . **1.Interference of light waves** Young's experiment; spatial and temporal coherence; intensity distribution; Fresnel's biprism, interference in thin film; fringes of equal inclination and equal thickness; Newton's ring. Michelson's interferometer. Multiple beam interference – reflected and transmitted pattern. Fabry-Perot interferometer.	**Lectures 12+ 4 (Tutorial)**	**Aug to Pre-Puja**
II	**III**	**II**	**2. Diffraction of light waves** Fresnel and Fraunhofer class, Fresnel's half period zones; explanation of rectilinear propagation of light; zone plate. Fraunhofer diffraction due to a single slit, double slit and circular aperture (qualitative). Plane diffraction grating (transmission). Rayleigh criterion of resolution; resolving power of prism, telescope, microscope and transmission grating.	**Lectures 11+ 5 (Tutorial)**	**Post-Puja to Winter vacation**
II (1+1+ 1)	**III**	**II**	**3. Polarisation** Different states of polarisation; double refraction, Huygen's construction for uniaxial crystals; polaroids and their uses. Production and analysis of plane, circularly and elliptically polarised light by retardation plates and rotatory polarisation and optical activity; Fresnel's explanation of optical activity; Biquartz and half shade polarimeter.	**Lectures 8+ 3 (Tutorial)**	**Post-Winter Vacation to Test examination**

Year	Paper	Unit	Topic	No. of lectures	Session
III (1+1+ 1)	**V**	**II**	**1. Time dependent and time independent Schrodinger equation** Eigenstates, normalization and orthonormality. **2. Simple applications of Quantum Mechanics** One dimensional potential well and barrier, boundary conditions, bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension – explanation of alpha decay. Free particle in one dimensional box, box normalization, momentum eigenfunctions of a free particle. Linear harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state, parity of wave function. **3. Schrodinger equation in spherical polar coordinates** Angular momentum operators and their commutation relations; eigenvalues and eigenfunctions of L^2 and Lz; theorem of addition of angular momenta [statement with examples]. The hydrogen atom problem – stationary state wavefunctions as simultaneous eigenfunctions of H, L^2, and Lz; radial Schrodinger equation and energy eigenvalues [Laguerre polynomial solutions to be assumed]; degeneracy of the energy eigenvalues.	**Lectures 6+ 2 (Tutorial)** **Lectures 15+ 3 (Tutorial)** **Lectures 13+ 3 (Tutorial)**	**July to Pre-Puja**

Year	Paper	Unit	Topic	No. of lectures	Session
III (1+1+ 1)	**V**	**I**	**SPECIAL THEORY OF RELATIVITY** 1. Introduction Galilean transformation and invariance of Newton's laws of motion, non-invariance of Maxwell's equations. Michelson-Morley experiment and explanation of the null result. 2. Special Theory of Relativity Concept of inertial frame. Postulates of special theory; simultaneity; Lorentz transformation along one of the axes – length contraction, time dilatation and velocity addition theorem, Fizeau's experiment. Four vectors. Relativistic dynamics : variation of mass with velocity; energy momentum relationship. 3. Vectors and Tensors Covariant and contravariant vectors. Contraction. Covariant, contravariant, and mixed tensors of rank-2, transformation properties. The metric tensor (flat space-time only). Raising and lowering of indices with metric tensors. (Consistent use of any one convention --- diag (-1,1,1,1) or diag (1,-1,-1,-1).) Example of common four-vectors: position, momentum, derivative, current density, four-velocity. 4. Invariant intervals Concept of space-time: Euclidean and Minkowski. Invariant intervals in 1+1 and 3+1 dimensions (use Minkowski space-time). Space like, time-like and light like four vectors. Light cone. Causality and simultaneity in different frames.	**Lectures 4 + 1 (Tutorial)** **Lectures 10+ 2 (Tutorial)** **Lectures 6+ 1 (Tutorial)** **Lectures 5+1 (Tutorial)**	**Post-Puja to Winter vacation/Test**

General Course

Year/ Semester	Paper	Unit	Topic	No. of lectures	Session
Ist Sem (CBCS)	PHS-G-CC-1-1-TH		**Viscosity** (a) Rate ow of liquid in a capillary tube - Poiseuille's formula. **Surface Tension** Synclastic and anticlastic surface - Excess of pressure - Application to spherical drops and bubbles - variation of surface tension with temperature. **Gravitation** (a) Motion of a particle in a central force eld. Conservation of angular momentum leading to restriction of the motion to a plane and constancy of areal velocity. Newton's Law of Gravitation. Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits.	**Lectures 12**	**July to Pre-Puja**
Ist Sem (CBCS)	PHS-G-CC-1-1-TH		**Gravitation contd.** Basic idea of global positioning system (GPS). Weightlessness.	**Lectures 2**	**Post-Puja to End Sem Exam**
IInd Sem (CBCS)	PHS-G-CC-1-1-TH		**d) Conductors:** Electric field and charge density inside and on the surface of a conductor. Force per unit area on the surface. capcitance of a conductor, capacitance of an isolated spherical conductor, parallel plate, spherical and cylindrical condenser. Energy per unit volume in elctrostatic field. e) **Electric filed inside matter** : Electric Polarisation, bound charges, Displacement vector. Gauss's theorem in dielectrics. Linear dielectric medium. Electric susceptibility and permittivity. Parallel plate capacitor completely filled with dielectric.	**Lectures 6** **Lectures 6**	**Jan-June**

Year/ Semester	Paper	Unit	Topic	No. of lectures	Session
II (1+1+1)	**IIB**		**<u>Electricity and Magnetism</u>** 1. **Steady Current** : Network analysis --- Kirchoff's laws, Thevnin and Norton's theorem, Wheatstone bridge, potentiometer. 2. **Thermoelectricity** : Seebeck, Peltier, and Thomson effects, laws of thermoelectricity, thermoelectric curve --- neutral and inversion temperature, thermoelectric power.	**Lectures 4+ 1 (Tutorial)** **Lectures 4+ 1 (Tutorial)**	**Aug to Pre-Puja**
II (1+1+1)	**IIB**		3. **Magnetic effect of current** : Biot and Savart's law, ampere's circuital law (statement only), magnetic field due to a straight conductor, circular coil, solenoid, endless solenoid, Magnetic field due to a small current loop --- concept of magnetic dipole, Ampere's equivalence theorem. 4. **Lorentz force** : Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field.	**Lectures 5+1 (Tutorial)** **Lectures 5+1 (Tutorial)**	**Post-Puja to Winter vacation**
II (1+1+1)	**IIB**		7. **Magnetic materials** : Intensity of magnetization, relation between B, H, and M --- illustration in the case of bar magnet, magnetic susceptibility --- dia, para and ferromagnetic materials, statement of Curie's law. Hysteresis in a ferromagnetic material, hysteresis loss. 8. **Electromagnetic induction** : Self and mutual inductances in simple cases, energy stored in inductance.	**Lectures 4+ 1 (Tutorial)** **Lectures 3+ 1 (Tutorial)**	**Post-Winter Vacation to Test examination**
III (1+1+1)	**IVA**	**I**	**<u>Pumps, gauges</u>** 1. **Production and measurement of high vacuum** : Rotary and diffusion pump, Mcleod, Pirani, and Penning gauges.	**Lectures 8 + 2 (Tutorial)**	**July to Pre-Puja**

Lesson Plan - Honours
(AY2018-19)
Name: Kathakali Biswas
Department:Physics

Honors Course

Year /Semester	paper	Unit	Topic	No. oflectures	Session
Ist Sem (CBCS)	PHS-A-CC-1-1-TH		**Recapitulation:** Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves.	**Lectures 8**	**July to Pre-Puja**
	PHS-A-CC-1-1-TH		**Recapitulation contd. :** Approximation:Taylor and binomial series (statements only).	**Lectures 2**	**Post-Puja to End Sem Exam**
	PHS-A-CC-1-2-TH		**Rotational Dynamics:**(a) The Rigid Body: Constraints defining the rigid body. Degrees of freedom for a rigid body; (b) Relation between Angular momentum and Angular Velocity - Moment of Inertia Tensor. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. (c) E.O.M for rotation about a fixed axis.	**Lectures 3**	**July to Pre-Puja**
	PHS-A-CC-1-2-TH		**Rotational DynamicsContd. :** (d) Principal Axes transformation. Transformation to a body fixed frame. E.O.M for the rigid body with one point fixed (Euler's equations of motion). General motion of a rigid body - translation plus rotation. Kinetic energy of rotation	**Lectures 9**	**Post-Puja to End Sem Exam**
IInd Sem (CBCS)	PHS-A-CC-2-3-TH		**Electrostatic Field:** (a) Coulombs law and Principle of superposition leading to the de_nition of Electrostatic Field. Field lines. (b) Divergence of the Electrostatic _eld. Flux, Gauss's theorem of electrostatics. Applications of Gauss theorem to _nd Electric _eld due	**Lectures 12**	**Jan-June**

			to charge con_gurations with spherical, cylindrical and planar symmetry. (c) Curl of the Electrostatic Field and its conservative nature. Electric potential. Potential for a uniformly charged spherical shell and solid sphere. Calculation of electric _eld from potential. (d) Laplace's and Poisson equations. Uniqueness Theorems. Method of Images and its application to: (1) Plane In_nite Sheet and (2) Sphere. (e) Conductors: Electric _eld and charge density inside and on the surface of a conductor. Conductors in an electrostatic _eld. Force per unit area on the surface. Capacitance of a conductor. Capacitance an isolated spherical conductor. Parallel plate condenser. (f) Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. (g) Energy per unit volume in electrostatic _eld. **Dielectric properties of matter:** (a) Electric potential and _eld due to an electric dipole. Electric dipole moment. Force and torque on a dipole. (b) Electric Fields inside matter: Electric Polarization. Bound charges. Displacement vector. Relations between E, P and D. Gauss's theorem in dielectrics. Linear Dielectric medium. Electric Susceptibility and Permittivity. Capacitor (parallel plate, spherical, cylindrical) _lled with dielectric.	**Lectures 13**	

Year	paper	Unit	Topic	No. of lectures	Session
II (1+1+1)	**III**	**II**	**Units and dimensions:** CGS, Gaussian and SI units; conversion between Gaussian and SI units; dimension of various quantities **Gauss' law:** Coulomb's law of electrostatics, intensity and potential; Gauss' theorem – its application; Poisson and Laplace's equations; Superposition theorem (statement only). Application of Laplace's equation to simple cases of symmetric spherical charge distribution. **Multipole expansion:** Multipole expansion of scalar potential – monopole, dipole and quadrupole terms; potential and field due to a dipole; work done in deflecting a dipole;	**Lectures 13**	**Aug to Pre-Puja**
			Multipole expansioncontd. : dipole-dipole interaction (for both electric and magnetic dipoles); force on dipole in a non-homogeneous field. **Dielectrics:** Polarisation, electric displacement vector (D); Gauss's theorem in dielectric media; boundary conditions; electrostatic field energy; computation of capacitance in simple cases (parallel plates); spherical and cylindrical capacitors containing dielectrics – uniform and non-uniform.	**Lectures 8+3(Tutorial)**	**Post-Puja to Winter vacation**
			Electrical Images: Solution of field problems in case of a point charge near a grounded conducting infinite plane. Boundary value problem : in uniform external field for (i) conducting spherical shell and (ii) dielectric sphere.	**Lectures 4+2(Tutorial)**	**Post-Winter Vacation to Test examination**
III (1+1+1)	**V**	**II**	**Central force problem:** Motion under central force; Nature of orbits in an attractive inverse square field; Kepler's laws of planetary motion. Rutherford scattering as an example of repulsive potential.	**Lectures 13+3(Tutorial)**	**July to Pre-Puja**

			Mechanics of Ideal Fluids: Streamlines and flowlines; Equation of continuity; Euler's equation of motion; Streamline motion - Bernoulli's equation and its applications. Definition of Newtonian and non-Newtonian fluids.		
III (1+1+1)	**VIIA**	**I**	**Generalization of Ampere's Law:** Displacement Current, Maxwell's Field Equations, Wave equation for electromagnetic (EM) field and its solution – plane wave and spherical wave solutions, transverse nature of field, relation between E and B; energy density of field, Poynting vector and Poynting's theorem, boundary conditions. **EM Waves in an isotropic dielectric**: Wave equation, reflection and refraction at plane boundary, reflection and transmission coefficients, Fresnel's formula, change of phase on reflection, polarization on reflection and Brewster's law, total internal reflection. **EM waves in conducting medium:** Wave equation in conducting medium, reflection and transmission at metallic surface – skin effect and skin depth, propagation of E-M waves between parallel and conducting plates – wave guides (rectangular only).	**Lectures 19**	**July to Pre-Puja**
			Dispersion: Equation of motion of an electron in a radiation field : Lorentz theory of dispersion – normal and anomalous; Sellmeier's and Cauchy's formulae, absorptive and dispersive mode, half power frequency, band width. **Scattering:** Scattering of radiation by a bound charge, Rayleigh's scattering (qualitative ideas), blue of the sky, absorption.	**Lectures 6+5(Tutorial)**	**Post-Puja to Winter vacation/Test**

General Course

Year/ Semester	paper	Unit	Topic	No. of lectures	Session
Ist Sem (CBCS)	**PHS-G-CC-1-1-TH**		**Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Forced oscillations with harmonic forces. Compound pendulum.	**Lectures 9**	**July to Pre-Puja**
			Rotational Motion: Rotation of a rigid body about a fixed axis. Angular velocity and angular momentum. Moment of Inertia. Torque. Conservation of angular momentum.	**Lectures 10**	**Post-Puja to End Sem Exam**
IInd Sem (CBCS)	**PHS-G-CC-2-2-TH**		Maxwell's equations and Electromagnetic Wave Propagation a) Equation of continuity of current, Displacement Current, Maxwell's equations, Poynting Vector, energy density in electromagnetic field, elecromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarisation of EM waves.	**Lectures 10**	**Jan - Jun**

Year	paper	Unit	Topic	No. of lectures	Session
III (1+1+1)	**IVA**	**I**	**Engines :** Heat engines, thermal efficiency, indicated Horse-power and brake Horse-power, Otto 22 cycle and Diesel cycle, four-stroke petrol and diesel engines, calculation of efficiency and comparison.	**Lectures** 10	**Post-Puja to Winter vacation/Test**

Lesson Plan (AY 2018-2019)
Name : Guest Lecturer
Department: Physics
Honours Course

Semester	Paper	Unit	Topic	No. of lectures	Session
1Hons	PHS-A-CC-1-2-TH		**Non-Inertial Systems:** (a) Galilean transformations and Galilean invariance. (b) Non-inertial frames and idea of fictitious forces. E.O.M with respect to a uniformly accelerating frame.	**4**	**July to Pre-Puja**
			Non-Inertial Systems (Continue): E.O.M with respect to a uniformly rotating frame - Centrifugal and Coriolis forces. Laws of Physics in a laboratory on the surface of the earth.	**4**	**post-Puja to End Sem**
Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
2Hons	**III**	**I**	**Magnetic effect of steady current:** Lorentz force and concept of magnetic induction; force on linear current element; Biot-Savart's law. $\nabla . B=0$; magnetic vector potential; calculation of vector potential and magnetic induction in simple cases – straight wire, magnetic field due to small current loop; magnetic dipole; field due to a dipole; magnetic shell; Ampere's theorem; Ampere's circuital law – simple illustrations; force between long parallel current carrying conductors; $\nabla x B = \mu J$; comparison between static electric and magnetic fields.	**8**	**July to Pre-Puja**
			Field and magnetic materials: Free current and bound current; surface and volume density of current distribution; magnetisation; nonuniformmagnetisation of matter; $J_b = \nabla x M$; Ampere's law in terms of free current density and introduction of H; line integral of H in terms of free current; boundary conditions for B and H; permanently magnetized body; magnetic scalar potential; application of Laplace's equation to the problem of a magnetic sphere in uniform magnetic field; hysteresis and energy loss in ferromagnetic material; magnetic circuit; energy stored in magnetic field.	**9**	

			Electromagnetic induction: Faraday's and Lenz's law; motional e.m.f.-simple problems; inductances in series and parallel; reciprocity theorem LR, CR and LCR circuits- transient and sinusoidal emf cases, calculation of self and mutual inductance in simple cases.	**8**	**Post winter to Test**

Year	Paper	Unit	Topic	No. of lectures	Session
3Hons	**V**	**I**	**Lagrangian and Hamiltonian formulation of Classical Mechanics:**Generalised coordinates, constraints and degrees of freedom; D'Alembart's principle; Lagrange's equation for conservative systems (from D'Alembert's principle; variational principle not required) and its application to simple cases;	**6**	**July to Pre-Puja**
			Lagrangian and Hamiltonian formulation of Classical Mechanics (Continue): Generalized momentum; Idea of cyclic coordinates, its relation with conservation principles; Definition of Hamiltonian, Hamilton's equation (derivation by Legendre transformation) and its application to simple cases.	**6**	**Post-Puja to Test examination**