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Teacher's name	Paper name with code	Topic	Time period	Subtopic
Shyamal Mondal	Electronics 1 PHS-DSCC 5-1	Circuits and network (DC)	3rd week of November	Discrete components, active and passive components, ideal constant voltage and constant current sources. Network analysis: Kirchhoff's laws, Thevenin's and Norton's theorem, Superposition theorem. Maximum power transfer theorem.
		Semiconductor diodes and applications	1st week and 2nd week of December	P and N type semiconductors. Energy level diagram. Conductivity and mobility, concept of drift velocity. PN junction fabrication (simple idea only). Barrier formation in PN junction diode. Static and dynamic resistance. Current flow mechanism in forward and reverse biased diode. Drift velocity. Rectifier diode: Half-wave rectifiers. Centre-tapped and Bridge full-wave rectifiers, Calculation of Ripple Factor and Rectification Efficiency, L and C filter. Circuit and operation of clipping and clamping circuit.
			3rd week of December	Principle and structure of LEDs, photodiode, solar cell.
		Field Effect transistors	1st week of January	JFET and MOSFET (both depletion and enhancement type) as a part of MISFET. Basic structure and principle of operations and their characteristics. Pinch off, threshold voltage and short channel effect.
Sanchayita Mondal		Bipolar junction transistors and biasing	1st week of November,2025	n-p-n and p-n-p transistors. Characteristics of CB, CE and CC configurations. Physical mechanism of current flow. Relations between the current gains of the three modes. Active, cut-off and saturation regions.
			2nd week of November,2025	DC load line and Q-point; Transistor biasing and stabilization circuits. Fixed bias, collector to base bias, emitter or self-bias, voltage divider bias.

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			3rd week of November,2025	Transistor as 2-port network. *h*-parameter equivalent circuit. Analysis of a single-stage CE amplifier using hybrid model. Input and output impedance.
		Regulated power supply	4th week of November,2025	Load regulation and line regulation. Zener diode as a voltage regulator. Problem with the Zener regulator circuit. Requirement of feedback and error amplifier. Study of series regulated power supply using pass and error transistor assisted by Zener diode as a reference voltage supplier.
		Amplifiers	1st week of December,2025	Transistor amplifier; CB, CE and emitter follower circuit and their uses. Load Line analysis of transistor amplifier. Classification of class A, B and C amplifiers with respect to placement to Q point.
			2nd week of December,2025	Frequency response of a CE amplifier. Role of series and parallel capacitors for cut off frequencies
		Feedback amplifiers and OPAMP	2nd week of December,2025	Effects of positive and negative feedback. Voltage series, current series, voltage shunt and current shunt feedback and uses for specific amplifiers. Estimation of input impedance, output impedance, gain, stability;
			3rd week of December,2025	Operational Amplifiers (black Box approach): Characteristics of ideal and practical OP-AMP (IC 741), Open-loop and closed-loop voltage gain. Frequency response. CMRR. Slew rate and concept of virtual ground. Application of OP-AMP: DC application–inverting and non-inverting amplifiers, inverting and noninverting adder,
			1st week of January,2026	Application of OP-AMP: DC application–differentiator as subtractor, error amplifier, comparator, Schmidt trigger. AC applications: differentiator, integrator.
		Multivibrator	2nd and 3rd week of January,2026	Transistor as a switch, Explanation using CE output characteristics. Construction and operation using wave shapes of collector coupled Bistable, Monostable and astable multivibrator circuits, Expression for time period.

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		Oscillators	3rd week of January,2026	Sinusoidal oscillators: Barkhausen's criterion for self-sustained oscillations. RC phase shift oscillator,
			4th week of January,2026	Wien bridge oscillator, determination of feedback factor and frequency of oscillation. Relaxation oscillator using OP-AMP
	Quantum Mechanics PHS-DSCC-5-3	Systems of identical particles	1st week of December,2025	Collection of non-interacting identical particles. Classical approach and quantum approach: distinguishability and indistinguishability. Composite system postulate and symmetry postulate of quantum mechanics (for a pair of particles only).
			2nd week of December,2025	Bosons and fermions. Symmetric and antisymmetric wave functions. Pauli Exclusion Principle for fermions. Derivation of Bose-Einstein and Fermi-Dirac distribution function using grand canonical ensemble.
		Bose-Einstein statistics	3rd week of December,2025	Thermodynamic functions of a strongly degenerate Bose gas. Bose derivation of Planck's law. Radiation as a photon gas and thermodynamic functions of photon gas.
			1st week of January,2026	Chemical potential of photon gas. Bose-Einstein condensation and properties of liquid He-4 (qualitative description only).
		Fermi-Dirac statistics	1st and 2nd week of January,2026	Thermodynamic functions of strongly degenerate Fermi gas, Fermi energy, electron gas in a metal, Specific heat of metals due to electrons (qualitative discussions).
	Thermal Physics and Statistical Mechanics PHS-DSCC-5-4	Classical Statistical Mechanics Macrostate and Microstate	1st week of November,2025	Elementary Concept of Ensemble and Ergodic Hypothesis (statement only). Phase space. Microcanonical ensemble, Postulate of equal *a priori* probability. Boltzmann hypothesis: Entropy and thermodynamic probability.
		Canonical ensemble	2nd week of November,2025	Partition function, Thermodynamic properties of an ideal gas. Thermodynamic properties of classical and quantum harmonic oscillator in one dimension using canonical ensemble.
			3rd week of November,2025	Classical entropy expression, Gibbs paradox. Equivalence of microcanonical and canonical ensembles. Sackur-Tetrode equation, Law of equipartition of energy (with proof) and its applications.

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			4th week of November,2025	Thermodynamic functions of a two-energy Level system. Negative temperature. Idea of chemical potential and grand canonical ensemble. Application of ideal gas using grand canonical ensemble.
Sonali Chakrabarti	PHS-DSCC-5-4 Thermal Physics	Kinetic theory of Gases	1st week of November	Transport phenomena , viscosity, thermal conductivity, diffusion, Brownian motion.
			2nd week of November	Conduction of heat , Fourier equation.
			3rd week of November	Real gas, Virial equation, Andrew's experiment, Critical constants, Boyle temperature.
			4th week of November	Vander Waal's equation, Law of corresponding states.
Shyamal Mondal		Thermodynamics	3rd week and 4th week of November	Classification of phase transitions; First order phase transitions: Clausius-Clapeyron equation, Second latent heat equation; Continuous phase transitions: Ehrenfest's equation.
			1st week of December	Spectral distribution of black-body radiation. Rayleigh-Jeans law and the ultraviolet catastrophe, Planck's quantum postulates.
			2nd and 3rd week of December	Planck's law of black-body radiation. Deduction of Rayleigh-Jeans law, Stefan-Boltzmann law, Wien's displacement law from Planck's law.
Antara Mitra Datta	Quantum Mechanics **PHS-DSCC-5-3**	Formulation of Quantum Mechanics in vector space language	1st week of November, 2025	State as a vector in a complex vector space, inner product, its properties using Dirac bra ket notation.
			2nd week of November, 2025	Physical observables as Hermitian operators on state space; eigenvalues, eigenvectors and completeness property of the eigenvectors–matrix representation of Hermitian operators. Unitary time evolution.
			3rd week of November,2025	Wavefunction as the probability amplitude distribution of a state for the observables with continuous eigenvalues.

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			4th week of November,2025	Position representation and momentum representation of wave-functions and operators. Interpretation of $\psi(\boldsymbol{r}) = \langle \boldsymbol{r} \mid \psi \rangle$
			1st Week of December,2025	One dimensional harmonic oscillator by raising and lowering operator method. Matrix representations of position and momentum operators.
		Angular momentum algebra using Ladder operators	2nd and 3rd week of December, 2025	Construction of matrix representation of *Lx* ,*Ly* ,*Lz* for $\ell = 1$. Algebra with Ladder operators. Addition of angular momenta $\ell 1 + \ell 2$, and their projections. Spin as an intrinsic angular momentum and its relation with the Pauli matrices for spin-12.
Sonali Chakrabarti	PHS-DSCC-5-3	2 and 3 D problems in cartesian coord	1st week of December	Particle in 2D and 3D box, Degeneracy of energy levels.
		Concept of symmetry and accidental degeneracy	2nd week of December	Isotropic and anisotropic harmonic oscillator, its degeneracy in 2D and 3D
		Hydrogen-like atoms	3rd week of December	Reduction of two body problem to one body problem, Schrodinger equation for a particle under central force.
		Spherical polar coordinates.	4th week of December	Separation of variables, angular equation and orbital angular momentum, spherical harmonics
		Hydrogen atom	1st week of January	Solution of radial wave equations for Hydrogen atom.
			2nd week of January	Sketch of probability densities, orbital angular momentum quantum numbers l and m, s, p, d, f shells.
Shyamal Mondal	Nuclear and Particle Physics **PHS-DSCC-5-2**	Rutherford scattering	3rd week of November	Calculation of differential cross-section.

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		Nuclear properties and structure	4th week of November and 1st week of December, 2025	Mass, charge, size, B.E, spin and magnetic moment of the nucleus; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle; Isotopes, isobars, isotones. Bainbridge Mass Spectrograph. Nature of nuclear force between nucleons, Stability and binding, *N-Z* plot.
			2nd week of December, 2025	Nuclear models: Liquid Drop model. Bethe-Weizsacker semi-empirical mass formula and binding energy. Some applications: explanation of α decay by heavy nuclei, mass parabola, explanation of β decay by mirror nuclei.
			3rd week of December	Nuclear shell model and magic numbers, ground state spin parity, Nordheim's Rule (qualitative discussion on phenomenology with examples).
Hurmal Saren		Interaction with and within the nucleus	1st week of November,2025	Introduction to Radioactivity, Concept of nuclear stability, Types of radioactive decay (α, β, γ), Activity, decay constant, half-life,Basic kinematics of α-decay, Range–energy relationship Geiger–Nuttall Law, Barrier penetration idea (qualitative)
			2nd week of November,2025	Beta Decay: Fundamentals, β^- and β^+ decay mechanisms, Continuous spectrum, Pauli's neutrino hypothesis, Energy released (Q-value), Beta Decay: Selection Rules, Energy levels & decay schemes, Fermi vs Gamow–Teller transitions, Electron capture process
			3rd week of November,2025	Gamma Emission, De-excitation of nuclei, Multipole transitions, Nuclear isomerism, Internal conversion (brief), γ Processes & Momentum Conservation, Electron–positron pair creation, Momentum conservation in γ interactions, Threshold conditions
			4th week of November,2025	Nuclear Energy Levels, Shell model level picture (qualitative), Decay schemes and examples,Metastable states, Problem-Solving Session, α-decay, β-decay energy calculations, Simple Q-value problems for decay

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			1st week of December,2025	Positron emission vs electron capture, Forbidden transitions Comparative half-lives, Short theory questions, Numerical problems
		Nuclear reaction	2nd week of December, 2025	Introduction to Nuclear Reactions, Types of nuclear reactions Conservation laws (energy, momentum, nucleon number, charge) Reaction kinematics
			2nd week of December, 2025	Q-Value and Reaction Rate, Q-value derivation, Exoergic vs endoergic reactions,Reaction rate equation, Reaction cross-section Compound & Direct Reactions, Bohr's compound nucleus, Lifetime of compound nucleus, Direct reaction: stripping, pickup Ghoshal's experiment
			3rd week of December, 2025	Resonance Reactions, Breit-Wigner formula (qualitative), Intermediate states, Cross-section peaks, Fission Basics, Liquid drop model concept, Mass defect & energy release, Spontaneous vs induced fission
			1st week of January, 2025	Fission Products & Chain Reaction, Fission products distribution, Neutron multiplication factor (k), Chain reaction in nuclear reactors, Slow vs fast neutrons
			2nd week of January, 2025	Basics of Nuclear Reactors, Components of a reactor: moderator, control rods, fuel, Principle of U-235 fission, Safety features
			3rd week of January, 2025	Nuclear Fusion, Fusion in terms of liquid drop model, Coulomb barrier Solar fusion reactions, Thermonuclear fusion basics
			4th week of January, 2025	Problem-Solving Session II, Q-value problems, Cross-section calculations, Reaction classification
			1st week of February	Final Revision + Unit Test, Quick summary of Expected short questions

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Sanchayita Mondal		Particle accelerators and detectors	3rd week of January,2026	Linear accelerator, cyclotron, betatron, gas detectors – GM Counters. Semiconductor detectors.
		Particle physics	4th week of January,2026	Elementary particles and their families, interactions and basic features. Symmetry and conservation laws: energy and momentum, angular momentum, parity, baryon number, lepton number, isospin, hypercharge, and strangeness. Wu's experiment and basic idea of parity violation. Gell-Mann–Nishijima formula. The baryon and meson octet and baryon decuplet diagrams. Quark structure of hadrons. Concept of quark model, color quantum number and gluons (qualitative discussion only).
		Nuclear Astrophysics	1st Week of February,2026	Energy production in stars, *p*-*p* chain, CNO cycle. Production of heavier elements (qualitative discussion).

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