ਸ਼ਹੀਦ ਮੇਜਰ ਹਰਮਿੰਦਰਪਾਲ ਸਿੰਘ (ਸ਼ੌ.ਚੱ.ਵਿ.) ਸਰਕਾਰੀ ਕਾਲਜ, ਸਾਹਿਬਜ਼ਾਦਾ ਅਜੀਤ ਸਿੰਘ ਨਗਰ।
SHAHEED MAJOR HARMINDERPAL SINGH (S.C.V.) GOVERNMENT COLLEGE, SAHIBZADA AJIT SINGH NAGAR
Phase-6, Sahibzada Ajit Singh Nagar-160055 Phone No. 0172-2225164 e-mail ID:principal.gcmohali@gmail.com

DEPARTMENT OF PHYSICS

Academic Calendar for session 2022-2023

Note from the Department's Faculty

"Our department strongly believes in creating a vibrant and engaging learning environment, and we strive to achieve 100% participation from our students in all activities. We understand that every student has unique interests and strengths, and that participation in extracurricular activities can help to develop vital skills in leadership, communication, and teamwork. We aim to provide a diverse range of activities that cater to the varied interests of our students, and we encourage them to take an active role in shaping and participating in these activities. By fostering a culture of active participation, we believe that our students will be better equipped to succeed both academically and in their chosen careers."

-Prof. Munisha Mahajan
-Prof. Shilpy Bhullar

Department's Vision: To establish problem-solving attitude among students.
Department's Mission: Inculcate Scientific Temperament.

Time-table

Class	0 8:30-9:00	1 9:00-9:45	2 9:45-10:30	3 10:30-11:15	4 11:15-12:00	5 12:00-12:45	6 12:45-1:30	7 1:30-2:15	8 2:15-3:00	9 3:00-3:45	10 3:45-4:30
B.Sc. I	#RC (1-4) $AL (1,2)							Practical (5,6) (Groups NM & CA in rotation*)			
B.Sc. II	#RC (1,2,5,6) $AL (3,4)				Practical (3,4) (Groups NM & CA in rotation*)						
B.Sc. III	#RC (3,4,5,6) $AL (5,6)	Practical (1,2,5,6) (Groups NM & CA in rotation*)									

*One group attends practical classes for two days.
#Remedial Classes continue from 2nd week to 3rd week in the month of November for odd semesters and from 3rd week to 4th week in the month of April for even semesters.
$Classes for Advance Learners in the fourth week of November for odd semesters and in the first week of May for even semesters.

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Number of Students

S.No.	Class	Strength
1	B.Sc. I (Non-Med. & Computer Appl.)	29
2	B.Sc. II (Non-Med. & Computer Appl.)	26
3	B.Sc. III (Non-Med. & Computer Appl.)	32

Activity Chart

Semester 1,3,5		
Month	**Activity**	**Goals/Learning Outcomes**
July	• Preparing workload for the upcoming session. • Curriculum distribution and preparing Lesson Plans. • To have an introductory session for B.Sc. II and III-year students. • To begin theory and practical classes of B.Sc. II and III-year students.	• To make teaching effective and convenient. • To make teaching-learning effective. • To inform students the syllabus and books to be purchased. • To ensure that syllabus is finished on time.
August	• Orientation day for the entry-class students.	• To familiarize the students with general code of conduct in department as well as in college.
September	• To assign the responsibility of giving a short lecture on any topic of B.Sc. Physics for 15 minutes in the class to the students of B.Sc. III year roll number-wise.	• To enhance their public speaking skills and overall subject-related knowledge.
October	• Paper reading competition on the topic “Volunteering for Blood Donation”.	• To educate students about Blood Donation – Do’s and Don’ts.
November	• Completion of syllabus followed by revision.	• To ensure students have ample time for revision.
December	• To motivate students to participate in poster-making contest on ‘World AIDS Day’. • Continuous doubt-clearing sessions for all the three classes on alternate days. • Commencement of semester examinations.	• To spread awareness about HIV-AIDS. • To ensure effective learning so that students achieve better grades in exams. This benefits both slow and advanced learners.

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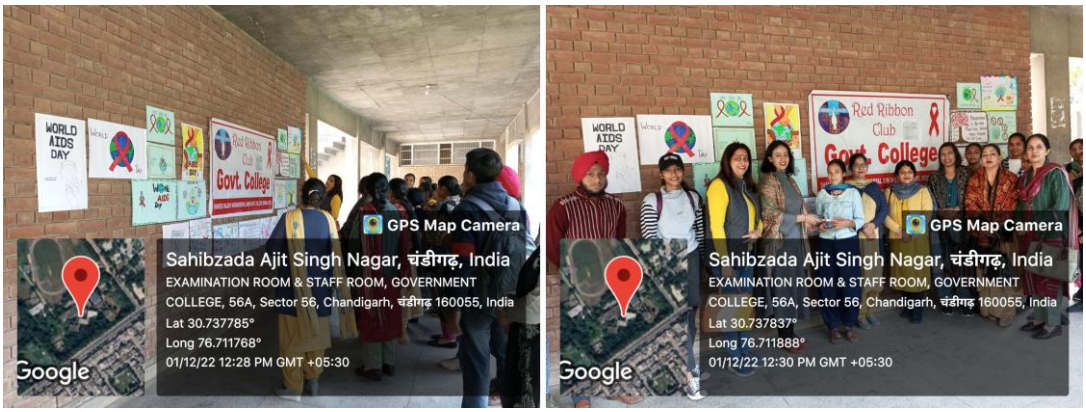
* Monthly test of B.Sc. III, II and I on Mondays, Wednesdays and Fridays of third week, respectively in August, September and October. *Assignment collection of B.Sc.-III, II and I on Tuesday, Thursday and Saturday, respectively of third week of October. *MST of B.Sc. III, II and I on the first Monday, Wednesday and Friday of November, respectively. *Remedial classes in the zero period for the second and third week in the month of November. *Classes for Advanced Learners in the zero period in the fourth week of November.		
Semester 2,4,6		
Month	**Activity**	**Goals/Learning Outcomes**
January	• Commencement of the theory classes and practicals in offline mode. • To make Academic Bank of Credit (ABC) account of students.	• To ensure that syllabus is finished on time. • To aware the students about the benefits of ABC as proposed by NEP-2020.
February	• Open-book test for B.Sc. I, II and III on consecutive days of second week from the syllabus done so far.	• To test the overall understanding and ability to respond answers correctly.
March	• Taking students to daily practice for participating in Sports Day Parade. • To organize paper presentation, power-point presentation, rangoli-making and quiz on the occasion of the "National Science Day" celebration. • Taking students on an educational trip to Rail Coach Factory, Kapurthala.	• To ensure all-round development of students. • To achieve learning-by-doing and establishing a sense of gratitude towards science. • For career guidance and counselling.
April	• To enhance students' participation in Psychometric Test. • Completion of syllabus followed by revision.	• To make students mentally sound and familiarise them with themselves. • To ensure students have ample time for revision.
May	• Continuous doubt-clearing sessions for all the three classes on alternate days. • Commencement of semester examinations.	• To ensure effective learning so that students achieve better grades in exams. This benefits both slow and advanced learners.
June	-----Examinations-----	-----Examinations-----
* Monthly test of B.Sc. III, II and I on Mondays, Wednesdays and Fridays of third week, respectively in February, March and April. *Assignment collection of B.Sc.-III, II and I on Tuesday, Thursday and Saturday, respectively of third week of April.		

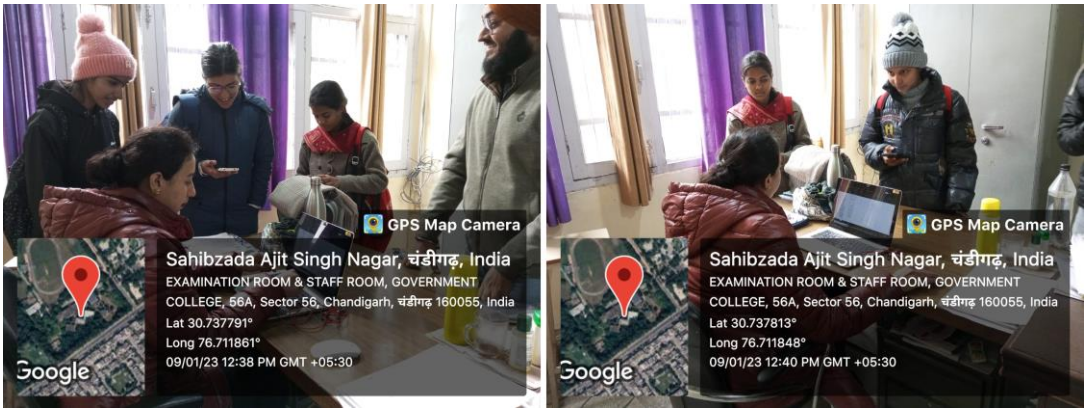
*MST of B.Sc. III, II and I on the first Monday, Wednesday and Friday of April, respectively.
*Remedial classes in the zero period for the third and fourth week in the month of April.
*Classes for Advanced Learners in the zero period in the first week of May.

Pictures

(Paper Reading on Blood Donation)



(World AIDS Day)



(Academic Bank of Credits accounts creation of students)

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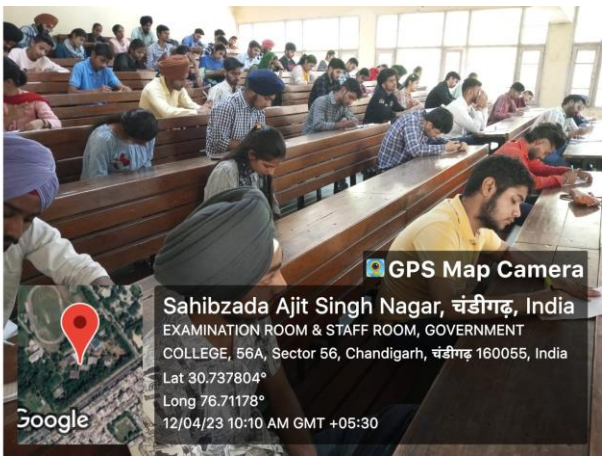
(Open-Book Test of students from key topics)

(Sports Day Parade Practice)



(MST)

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(Science Day Celebration)

(Participation of Science Students in Psychometric Test)

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(Trip to Rail Coach Factory, Kapurthala)

Unitization Plan

B.Sc. I

Mechanics-I

August: Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle, Various forces in Nature(brief introduction), Centre of mass, Equivalent one body problem.

September: Central forces, Equation of motion under central force, Equation of orbit in inverse square, Force field and turning points, Kepler laws and their derivations, Relationship of conservation laws and symmetries of space and time.

October: Inertial frame of reference, Coriolis force and its applications, Variation of acceleration due to gravity with latitude, Focault pendulum (qualitative), Elastic collision in Laboratory and C.M. system, velocities, angels and energies.

November: Cross section of elastic scattering, Rutherford scattering (qualitative).

Mechanics-II

January: Rigid body motion: Rotational motion, principal moments and axe, Euler's equations; precession and elementary gyroscope, Galilean transformation and Invariance, Non-Inertial frames, concept of stationary universal frame of reference and ether.

February: Michelson-Morley experiment and its result, Postulates of special theory of relativity, Lorentz transformations, Observer and viewer in relativity, Relativity of simultaneity.

March: Length, Time, Velocities, Relativistic Doppler effect, Variation of mass with velocity, mass-energy equivalence, rest mass in an inelastic collision.

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April: Relativistic momentum and energy, their transformation, concepts of Minkowski space, four vector formulation.

Vibrations and Waves-I

August: Simple harmonic motion, energy of a Simple Harmonic Oscillation (SHO), Compound pendulum, Electrical oscillations, Transverse vibrations of a mass on a string, composition of two perpendicular SHM of same period and of period ratio 1 : 2, Anharmonic oscillations.
September: Decay of free vibrations due to damping, Differential equation of motion, types of damping, Determination of damping co-efficient-logarithmic decrement, relaxation time and Q-Factor, Electromagnetic damping (Electrical oscillator).
October: Differential equation for forced mechanical and electrical oscillators, Transient and steady state oscillation, Displacement and velocity variation with driving force frequency, variation of phase with frequency resonance.
November: Power supplied to an oscillator and its variation with frequency, Q value of a forced oscillator and band width, Q-value as an amplification factor of low frequency response.

Vibrations and Waves-II

January: Stiffness coupled oscillators, Normal co-ordinates and normal modes of vibration, Inductance coupling of electrical oscillators, Types of waves, Wave equation (transverse) and its solution, The string as a forced oscillator, Characteristic impedance of a string, Impedance matching.
February: Reflection and transmission of energy, Reflection and Transmission Energy, Reflection and transmission of string, wave and group velocity, Standing waves on a string of fixed length, Energy of vibrating energy string, wave and group velocity.
March: Physical interpretation of Maxwell's equations, Electromagnetic waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma=0$, Pointing vector, Impedance of a dielectric to EM waves, EM waves in a conducting medium and skin depth, EM waves velocity in a conductor an anomalous dispersion.
April: Response of a conducting medium of EM waves, Reflection and transmission of EM waves at a boundary of two dielectric media for normal incidence, Reflection of EM waves from the surface of a conductor at normal incidence.

Electricity and Magnetism-I

August: Basic ideas of vector calculus, Gradient, Divergence, curl and their physical significance, Coulomb's law in vector form, long uniformly charged wire, Charged disc. Stokes's theorem and its applications in electrostatic field, curl $E= 0$.
September: Electric field as gradient of scalar potential, Calculation of E due to a point charge and dipole from potential, Potential due to arbitrary charge distribution and multipole moments, Poisson and Laplace's equations and their solutions in Cartesian and concept of electrical images.
October: Calculation of electric potential and field due a point charge placed near an infinitely conducting sheet, Current and current density, equation of continuity, Microscopic form of Ohm's Law, ($J=\sigma E$) and conductivity, Failure of Ohm's Law.
November: Invariance of charge, E in different frames of reference, Field of a point charge moving with constant velocity, Interaction between moving charges and force between parallel currents.

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Electricity and Magnetism-II

January: Behaviour of various substances in magnetic field, Definition of **M** and **H** and their relation to free and bound currents, Permeability and susceptibilities and their inter-relationship, Orbital motion of electrons and diamagnetism, Electron spin and paramagnetism, Ferromagnetism, Domain theory of Ferromagnetism, Hysteresis Loss.
February: Magnetisation curve Ferrites**,** Lorentz's force, Definition of B, Biot-Savart's Law and its applications to long straight wire, circular current loop and solenoid, Ampere's Circuital law and its applications, Divergence and curl of **B**, Hall effect, expression and co-efficient.
March: Vector potential, Definition and derivation of current density and its use in calculation of change in magnetic field at a current sheet, Transformation equations for **E** and **B** from one frame to another, Faraday's Law and EM induction, Displacement current, Maxwell's equations.
April: Mutual inductance and reciprocity theorem, Self-inductance L for solenoid, Coupling of Electrical circuits, Analysis of LCR series and parallel resonant circuits, Q-factor, Power consumed, Power factor.

Sem I Practicals

August:

1. To establish relationship between torque and angular acceleration using fly wheel and hence to find inertia of flywheel.
2. To study one-dimensional collision using two hanging spheres of different materials.

September:

1. Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.
2. To set up CRO for Sine and Square wave and to find their frequency and amplitude.

October:

1. To study the efficiency of an electric kettle/heater element with varying input voltages.
2. To study the working of energy meter.

Sem II Practicals

January:

1. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine
   i) Radius of gyration of bar pendulum about an axis through its Centre of Gravity and perpendicular to its length.
   ii) Value of Centre of Gravity, g.
2. Determination of g by Kater's pendulum.

February:

1. Determination of unknown capacitance by flashing and quenching of neon lamp.
2. To study the resonance in series and parallel LCR circuits for different resistances and calculate Q-value.

March:

1. Determination of modulus of rigidity of material of a wire using Maxwell's needle.
2. Verify laws of electromagnetic induction.

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B.Sc. II

Statistical Physics and Thermodynamics-I

August: Basic ideas of statistical physics, Scope of statistical physics, Basic ideas about probability, distribution of four distinguishable particles in two compartments of equal size. Concept of macro states, microstates, thermodynamic probability, Effects of constraints on the system.

September: Distribution of n particles in two compartments, Deviation from the state of maximum probability, equilibrium state of dynamic system, Distribution of distinguishable n particles in k compartments of unequal sizes, Phase space and its division into elementary cells, Three kinds of statistics, The basic approach in the three statistics.

October: Maxwell Boltzmann (MB) statistics applied to an ideal gas in equilibrium, Experimental verification of Maxwell Boltzmann law of distribution of molecular speeds, Need for quantum statistics-Bose-Einstein (B.E.) statistics, Derivation of Planck's law of radiation.

November: Deduction of Wien's displacement law and Stefan's law from Planck's law, Fermi-Dirac (F.D.) statistics, Comparison of M.B., B.E. and F.D. statistics.

Statistical Physics and Thermodynamics-II

January: Statistical definition of entropy, Change of entropy of a system, Additive nature of entropy, Law of increase of entropy, Reversible and irreversible process and their examples, Work done in a reversible process, Examples of increase of entropy in natural processes, Entropy and disorder, Brief review of terms and laws of thermodynamics.

February: Carnot's cycle, Entropy changes in Carnot cycle, Applications of thermodynamics to thermoelectric effect, Change of entropy along a reversible path in a P.V. diagram, Entropy of a perfect gas, Equation of state of an ideal gas from simple statistical consideration, Heat death of the universe.

March: Derivation of Maxwell's thermodynamical relations, Cooling produced by adiabatic stretching, Adiabatic compression, Change of internal energy with volume, specific heat at constant pressure and constant volume, Expression for Cp-Cv , Change of state and Clapeyron equation.

April: Thermodynamical treatment of Joule-Thomson effect, Use of Joule-Thomson effect, liquefaction of helium, Production of very low temperature by adiabatic demagnetization.

Optics

August: Concept of coherence, Spatial and temporal coherence, Coherence time, Coherence length, Area of coherence, Conditions for observing interference fringes, Interference by wave front division and amplitude division, Michelson's interferometer—working.

September: Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings, Multiple beam interference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

October: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging, resolving power of telescope, The diffraction grating, its use as a spectroscopic element and its resolving power.

November: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Retardation plates, Production and analysis of polarized light (quarter and half wave plates).

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Lasers

January: Derivation of Einstein's relations, Concept of stimulated emission and population inversion, Broadening of spectral lines, natural, collision and Doppler broadening, Line width, Line profile, Absorption and amplification of a parallel beam of light passing through a medium.
February: Threshold condition, Introduction of three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.
March: Types of lasers, Ruby and Nd: YAG lasers, He-Ne and CO_2 lasers-construction, mode of creating population inversion and output characteristics, Semiconductor lasers.
April: Dye lasers, Q-switching, Mode locking, Applications of lasers–a general outline, Basics of holography.

Quantum Mechanics-I

August: Brief introduction to need and development of quantum mechanics, Wave-particle duality, de-Broglie hypothesis, Complementarity and uncertainty principle, Gaussian wave-packet, Schrodinger equation for a free particle, operator correspondence and equation for a particle subject to forces, Normalization and probability.
September: Interpretation of wave function, Super position principle, Expectation value, probability current and conservation of probability, Admissibility conditions on the wave function, Ehrenfest theorem, Fundamental postulates of wave mechanics, Eigen functions and eigen values, Operator formalism, Orthogonal systems, Expansion in eigen functions.
October: Hermitian operators, Simultaneous eigen functions, Equation of motion, Time dependent Schrodinger equation. Application to stationary states for one-dimension, Potential step, Potential barrier, Rectangular potential well, Degeneracy, Orthogonality, Linear harmonic oscillator.
November: Schrodinger equation for spherically symmetric potential, Spherical harmonics. Hydrogen atom energy levels and eigen functions. Degeneracy, Angular momentum.

Quantum Mechanics-II

January: Excitation of atom with radiation, Transition probability, Spontaneous transition, Selection rules and life time, Spectrum of hydrogen atom, Frank Hertz Experiment, Line structure, Normal Zeeman effect, Electron spin.
February: Stern Gerlach experiment, Spin orbit coupling (electron magnetic moment, total angular momentum), Hyperfine structure, Examples of one electron systems, Anomalous, Zeeman effect, Lande's-g factor (sodium D-lines).
March: Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling, Selection rules, Regularities in atomic spectra, Interaction energy, X-ray spectra, Mosley law, Absorption spectra, Auger effect, Molecular bonding.
April: Molecular spectra, Selection rules, Symmetric structures, Rotational, vibrational electronic level and spectra of molecules, Raman spectra.

Sem III Practicals

August:

1. Probability distribution using coloured dice coins.
2. Study the photoelectric effect and determine the value of Planck's constant.
3. To determine the refractive index of liquid using spectrometer.

September:

1. To determine the Cauchy's constants.
2. To study the refractive index of doubly refracting prism.

October:

1. To determine the wave length of a given light using bi-prism.
2. To determine the resolving power of a telescope.

Sem IV Practicals

January:

1. Study of rotation of plane of polarization with a polarimeter.
2. Set up Newton's rings to determine wave length of sodium light.

February:

1. To determine the wave length and dispersive power using plane diffraction grating (Use Hg source).
2. To determine the resolving power of a grating.
3. To determine the ionization potential of mercury.

March:

1. To measure an inaccessible height using sextant.
2. To study the absorption spectra of iodine vapours.
3. Study of variation of light intensity using photovoltaic cell/inverse square law.

B.Sc. III

Condensed Matter Physics-I

August: Crystal Structure, Symmetry operations for a two-dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells.
September: Crystal planes and Miller indices, Diamond and NaCI structure, Packing fraction for Cubic and hexagonal closed packed structure.
October: Bragg's Law, Experimental methods for crystal structure studies, laue equations, Reciprocal lattices of SC, BCC and FCC.
November: Bragg's Law in reciprocal lattice, Brillouin zones and its derivation in two dimensions, Structure factor and atomic form factor.

Condensed Matter Physics -II

January: Lattice vibrations, Concepts of phonons, Scattering of protons by phonons, Vibration of mono-atomic, di-atomic, linear chains, Density of modes.
February: Einstein and Debye models of specific heat, Free electron model of metals, Free electron, Fermi gas and Fermi energy, Band theory, Kronig-Penney Model, Metals and insulators.
March: Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors, superconductivity.
April: Magnetic field effect in superconductors, BCS theory, Thermal properties of superconductors.

Electronics-I

August: Concept of current and voltage sources, p-n junction, Biasing of diode, V-A characteristics. Diode equation, Breakdown diodes: Zener breakdown and avalanche

breakdown, Zener diode. Rectification: half wave, full wave rectifiers and bridge rectifiers, Qualitative analysis of Filter circuits (RC LC and π filters) Efficiency, Ripple factor, Voltage regulation, Voltage multiplier circuits.
September: Structure and working, relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics.
October: Structure, Characteristics, operation of FET, JFET and MOSFET, Pinch off voltage, Enhancement and Depletion mode, Comparison of JFETs and MOSFETs, Difference in field effect transistor and junction type transistor.
November: Photo-conductive devices: Photo-conductive cell, Photodiode, Solar cell, LED, LCD.

Electronics-II

January: Thyristor, SCR, TRIAC, DIAC: Construction, Characteristics and Operation; Comparison between transistors and thyristors; Difference between SCR and TRIAC, UJT: its construction, Equivalent circuit, Characteristics and parameters, uses, Thermistor: Types, Construction, Characteristics, Uses, Advantages over other temperature sensing devices.
February: IMPATT and TRAPATT devices, PIN diode: Construction, Characteristics, Applications, Gunn effect and diodes: Mechanism, Characteristic, Negative differential resistivity and Domain formation, Tunnel diode: Tunnelling Phenomenon, Operation, Applications, Merits and Drawbacks.
March: Transistor biasing: Stabilization of operating point, Fixed bias, Collector to base bias, Bias circuit with emitter resistor, Voltage divider biasing circuit, CE amplifier: Working and analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier: Voltage, Current and Power gain.
April: Feed-back in amplifiers: Types & advantage of negative feedback, Emitter follower as negative feed-back circuit.

Nuclear and Radiation Physics

August: Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge, Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, Wave mechanical properties of nucleus, average binding energy and its variation with mass numbers.
September: Properties of nuclear forces, Non-existence of electrons in the nucleus and neutron-proton model, Liquid drop model and semi empirical mass formula, Conditions of nuclear stability, Fermi gas model, Nuclear shell model, Experimental evidence of magic numbers and its explanation.
October: Radioactivity, Modes of decay and successive radioactivity, Alpha emission, Electron emission, Positron emission, Electron capture, Gamma-ray emission, Internal conversion, Qualitative discussion of alpha, beta and gamma spectra, Geiger-Nuttal rule, Neutrino hypothesis of beta decay, Evidence of existence of neutrino.
November: Qualitative discussion of alpha and beta decay theories, Nuclear reactions, Reaction cross section, Conservation laws, Kinematics of nuclear reaction, Q-value and its physical significance, Compound nucleus, Possible reaction with high energy particles.

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Nuclear and Particle Physics

January: Energy loss due to ionization (Bethe's formula), Energy loss of electrons, Bremsstrahlung, Interactions of gamma rays with matter, Radiation loss by fast electrons, Radiation length, Electron-positron annihilation.
February: Cyclotron, Betatron, Qualitative discussion of Synchrotron, Collider machines and linear accelerator, Ionization chamber, Proportional counter, GM counter, Scintillation counter, Solid state detectors, Elementary particles and their masses.
March: Decay modes, Classification of these particles, types of interactions, Conservation laws and quantum numbers, Concepts of isospin, Strangeness, Parity, Charge conjugation, Antiparticles, Gell-Mann method, Decay and strange particles.
April: Particle symmetry, Introduction to quarks and qualitative discussion of the quark model.

Sem V Practicals

August:

1. Measurement of reverse saturation current in p-n junction diode at various temperatures and to find the approximate value of energy gap.
2. To draw forward and reverse bias characteristics of a p-n junction diode and draw a load line.
3. Study of a diode as clipping element.

September:

1. To show the variation of resistance of a thermistor with temperature.
2. To measure the efficiency and ripple factors for a) Half-wave (b) full wave and (C) bridge rectifier circuits.
3. To draw the characteristics of a Zener diode.

October:

1. To study the stabilization of output voltage of a power supply with Zener diode.
2. To Plot common Emitter Characteristics of a transistor (pnp or npn).
3. To draw output and mutual Characteristics of an FET and determine its parameters.

Sem VI Practicals

January:

1. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
2. Study of a diode as clamping element.

February:

1. To Plot common base Characteristics and determine h-parameters of a given transistor.
2. To study the characteristics of a thermistor and find its parameters.
3. To study the gain of an amplifier at different frequencies and to find band width and gain bandwidth product.

March:

1. To draw the plateau of a GM counter and find its operating voltage.

To study the statistical fluctuations of G.M. Counter to find its standard deviation.

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SHAHEED MAJOR HARMINDERPAL SINGH (S.C.V.) GOVERNMENT COLLEGE, SAHIBZADA AJIT SINGH NAGAR
Phase-6, Sahibzada Ajit Singh Nagar-160055 Phone No. 0172-2225164 e-mail ID:principal.gcmohali@gmail.com

Course Outcomes

Course outcomes are essential components of any academic program, as they clearly define the knowledge, skills, and competencies that students are expected to acquire upon completion of the course. They provide a roadmap for instructors and students alike, outlining the key learning objectives and marking a clear pathway towards successful completion of the course. By setting clear and measurable learning outcomes, instructors ensure that they are teaching what students need to know in order to achieve mastery of the subject matter. This enables students to set goals, track their progress, and understand their performance in relation to the expectations set by the course.

Program Name: B.Sc. Physics	**Program Code:** PHYB3PUP

Program Specific Outcomes:

1. Gain in-depth knowledge about different subjects of Physics.
2. Apply fundamental principles of physics and mathematical tools to describe and explain real-life phenomena.
3. Integrate and utilize concepts and techniques learned in Physics including the essentials of mechanics, electricity and magnetism, vibrations and waves, statistical physics and thermodynamics, quantum mechanics, lasers, optics, condensed matter physics, electronics, nuclear physics, radiation physics and particle physics.
4. Perform well in solving numericals and prepare them for future entrance examinations.
5. Acquire practical skills to conduct wide range of scientific experiments.
6. Identify their area of interest for pursuing future studies.
7. Encourage analytical mind and innovative thinking.

Programme Specific Outcomes

Programme outcomes refer to the key knowledge and skills that students are expected to acquire upon completion of a physics program. Physics-based program outcomes typically include both content-based outcomes and skills-based outcomes, such as the ability to analyze and solve complex problems, work collaboratively, and communicate effectively. By focusing on physics-based program outcomes, instructors ensure that students are well-equipped with the knowledge and skills needed to excel in their chosen careers.

Program Name: B.Sc. Physics-I (Sem-I)	**Course Name:** Mechanics-I

Course Specific Outcomes: On completion of this course, student will be able to

1. This course expands the basic knowledge of different coordinate systems.

2. The students learn the concepts of centre of mass and conversion of two-body problem into equivalent one-body problem.
3. Basic understanding of space and time symmetries.
4. Concepts of elastic collision in laboratory and centre-of-mass frames of reference.

Program Name: B.Sc. Physics-I (Sem-I)	**Course Name:** Vibrations and Waves-I

Course Specific Outcomes: On completion of this course, student will be able to

1. The students gain understanding of simple harmonic motion and how to represent wave motions in the form of equations.
2. The general and advanced concepts of damping are made clear.
3. The students are familiarized with forced mechanical and electrical oscillators.
4. Different quantities associated with forced oscillations are taught.

Program Name: B.Sc. Physics-I (Sem-I)	**Course Name:** Electricity and Magnetism-I

Course Specific Outcomes: On completion of this course, student will be able to

1. The basic understanding of vector calculus is further enhanced with concepts like gradient, divergence and curl based on them.
2. The topics based on electric field followed by Gauss Divergence Theorem and Stoke's Theorem.
3. The students' previous learning based on electric potential is further advanced with concepts involving charged wire, sheet of charges, etc.
4. The concepts of dipoles are taught in conjugation with single charges and group of charges.

Program Name: B.Sc. Physics-I (Sem-I)	**Course Name:** Practicals (Sem-I)

Course Specific Outcomes: On completion of this course, student will be able to

1. The understanding of inertia and moment of inertia is strengthened using flywheel and objects of different shapes.
2. The concepts of elastic collisions and bending of beam are taught.
3. The efficiency of household elements like energy meter and electric kettle are taught which help in enhancing students' concept-based as well as general knowledge.

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Program Name: B.Sc. Physics-I (Sem-II)	**Course Name:** Mechanics-II

Course Specific Outcomes: On completion of this course, student will be able to

1. The students learn the concepts of rigid body motion involving moments of inertia and Euler's equations.
2. The students are familiarized with most important and revolutionary Michelson-Morley experiment which helps them understand how science broke certain misconceptions and led to the beginning of new era of relativity.
3. The students learn the postulates of Special Theory of Relativity, Galilean and Lorentz transformations.
4. Understanding length, time, velocity, momentum and energy in context of relativity.

Program Name: B.Sc. Physics-I (Sem-II)	**Course Name:** Vibrations and Waves-II

Course Specific Outcomes: On completion of this course, student will be able to

1. Understanding coupled oscillators, modes of vibration and coupling mechanism.
2. To familiarize students with different concepts of string-based wave motions.
3. Students understand the significance of Maxwell's equations.
4. Students gain the theoretical as well as practical knowledge of concepts based on electromagnetic waves.

Program Name: B.Sc. Physics-I (Sem-II)	**Course Name:** Electricity and Magnetism-II

Course Specific Outcomes: On completion of this course, student will be able to

1. Students gain the knowledge regarding behaviour of static charges, charges in motion and forces due to currents.
2. The idea of magnetism and magnetic substances, particularly diamagnetism, paramagnetism and ferromagnetism.
3. Students learn to differentiate the effects due to electric force, magnetic force and electromagnetic force.
4. Students learn the postulates and significance of Faraday's laws, self-inductance and mutual inductance.

Program Name: B.Sc. Physics-I (Sem-II)	**Course Name:** Practicals (Sem-II)

Course Specific Outcomes: On completion of this course, student will be able to

1. Students learn the importance of gravity and centre of gravity on the basis of bar pendulum and Kater's pendulum-based experiments.
2. The theoretical knowledge of Faraday' laws is strengthened via experiments such as verifying laws of electromagnetic induction and studying induced emf as a function of velocity.
3. The theoretical knowledge gained in the paper of 'Electricity and Magnetism' is strengthened via experiments based on capacitors and LCR.

Program Name: B.Sc. Physics-II (Sem-III)	**Course Name:** Statistical Physics and Thermodynamics-I

Course Specific Outcomes: On completion of this course, student will be able to

1. Students learn the concepts of statistical physics, microstates, macrostates and thermodynamic probability.
2. The effects of constraints are taught to the students and they understand the mechanism of distributing n particles in k compartments.
3. The basic approach to be followed in three statistics - Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac is taught to the students.
4. The students are familiarized with Maxwell-Boltzmann statistics and its significance.

Program Name: B.Sc. Physics-II (Sem-III)	**Course Name:** Optics

Course Specific Outcomes: On completion of this course, student will be able to

1. The students learn the concepts of spatial and temporal coherence.
2. The basic understanding of interference is further enhanced via different concepts and Michelson and Fabry-Perot interferometers.
3. To teach students the concepts of diffraction through Fresnel and Fraunhofer diffraction.
4. To teach students the concepts of polarization.

Program Name: B.Sc. Physics-II (Sem-III)	**Course Name:** Quantum Mechanics-I

Course Specific Outcomes: On completion of this course, student will be able to

1. To give brief introduction to need and development of quantum mechanics.

2. To familiarize students with popular concepts like Heisenberg's Uncertainty principle, Wave-Particle Duality and Schrödinger equation.
3. To tell students the mathematical and physical significance of different operators in quantum mechanics.
4. To educate students regarding the problems in one and three dimensions.

Program Name: B.Sc. Physics-II (Sem-III)	**Course Name:** Physics Practical Lab (Sem-III)

Course Specific Outcomes: On completion of this course, student will be able to

1. The probability-based experiment is designed to strengthen the students' learning in 'Statistical Physics and Thermodynamics'.
2. The dark room experiments are taught to the students to maximize their knowledge of optics and involves experiments based on refractive index and resolving power. Students learn how to use spectrometer.
3. The learning achieved in 'Quantum Mechanics' is further enhanced via experiment titled, 'photoelectric effect and determine the value of Planck's constant'.

Program Name: B.Sc. Physics-II (Sem-IV)	**Course Name:** Statistical Physics and Thermodynamics-II

Course Specific Outcomes: On completion of this course, student will be able to

1. To teach students the concepts of entropy and different topics based on it.
2. Emphasis is laid on laws of thermodynamics which act like a foundation to understand the concept of Carnot cycle.
3. Students are able to distinguish Maxwell's Electromagnetic equations from Maxwell's thermodynamical relations.
4. To teach the applications of thermodynamics and to ensure that students are able to do the derivations.

Program Name: B.Sc. Physics-II (Sem-IV)	**Course Name:** Lasers

Course Specific Outcomes: On completion of this course, student will be able to

1. To derive the Einstein's relations.
2. To familiarize students with the concepts of spontaneous emission, stimulated emission, population inversion, broadening of spectral lines and threshold condition.

3. To teach the three-level and four-level laser schemes and familiarize students with the working of different lasers.
4. To teach students the applications of lasers, particularly holography.

Program Name: B.Sc. Physics-II (Sem-IV)	**Course Name:** Quantum Mechanics-II

Course Specific Outcomes: On completion of this course, student will be able to

1. The course relies on helping students understand one-electron and many-electron atomic spectra.
2. The students are familiarized with different selection rules which determine the transition probability.
3. To teach Normal Zeeman effect, Anomalous Zeeman effect, Molecular spectra and Raman spectra.
4. To teach students the mechanism in which different shells and subshells are filled.

Program Name: B.Sc. Physics-II (Sem-IV)	**Course Name:** Physics Practical Lab (Sem-IV)

Course Specific Outcomes: On completion of this course, student will be able to

1. To strengthen the concepts of 'Quantum Mechanics' via experiments such as inverse square law, ionization potential of mercury and divergence and wavelength of given laser source.
2. To equip students with the ability to find height of any inaccessible object using sextant.
3. Optics-based topics are further revised via experiments based on Newton's rings, diffraction grating and polarimeter.

Program Name: B.Sc. Physics-III (Sem-V)	**Course Name:** Condensed Matter Physics-I

Course Specific Outcomes: On completion of this course, student will be able to

1. To familiarize students with crystal structure and symmetry operations.
2. Students get to know about two-dimensional and three-dimensional Bravais lattices which are the building blocks of different crystal systems.
3. To tell students about Bragg's law and general concept of X-ray Diffraction which forms the crux of material science-based research.

4. Students learn about reciprocal lattices, crystal planes, Miller indices, Brillouin zones and various concepts associated with them.

Program Name: B.Sc. Physics-III (Sem-V)	**Course Name:** Electronics-I (Electronics and Solid-State Devices)
Course Specific Outcomes: On completion of this course, student will be able to 1. Students get the basic understanding of construction and working of p-n junction, Zener diodes, rectifiers and filter circuits. 2. Students understand the construction, working and characteristics of different configurations of Junction Transistors. 3. Students learn the structure, working and characteristics of Field Effect Transistors. 4. Students get the idea of functioning of commonly used photoconductive devices.	

Program Name: B.Sc. Physics-III (Sem-V)	**Course Name:** Nuclear and Radiation Physics
Course Specific Outcomes: On completion of this course, student will be able to 1. To understand the constituents and various intrinsic properties of nucleus. 2. To familiarize students with Liquid Drop model and semi empirical mass formula, conditions of nuclear stability, Fermi Gas model and Nuclear Shell model. 3. To teach the basic and more advanced concepts of radioactivity. 4. To explain conservation laws and kinematics of nuclear reactions.	

Program Name: B.Sc. Physics-III (Sem-V)	**Course Name:** Practicals (Sem-V)
Course Specific Outcomes: On completion of this course, student will be able to 1. The practicals are designed to strengthen the theoretical understanding received through ‘Electronics’ course. 2. To ensure students are able to draw characteristics of p-n junction diode, Zener diode, common-emitter transistor and field-effect transistor. 3. Some other experiments involve studying diode as clipping element, studying variation of resistance of thermistor with temperature and rectifiers.	

Program Name: B.Sc. Physics-III (Sem-VI)	**Course Name:** Condensed Matter Physics-II

Course Specific Outcomes: On completion of this course, student will be able to

1. To familiarize students with the concepts of lattice vibrations, phonons and vibrations of mono-atomic and di-atomic chains.
2. To teach students Einstein and Debye models of specific heat.
3. To explain band theory of solids, Kronig-Penney model and idea of metals, semi-conductors and insulators.
4. To acquaint students with the concept of superconductivity, magnetic field effect in superconductors, their thermal properties and the famous BCS theory.

Program Name: B.Sc. Physics-III (Sem-VI)	**Course Name:** Electronics-II

Course Specific Outcomes: On completion of this course, student will be able to

1. Students learn about the construction, working, characteristics and applications of Thyristor, DIAC, TRIAC and UJT.
2. Students learn about the construction, working, characteristics and applications of Gunn diode and Tunnel diode.
3. To teach students about transistor biasing and transistor as amplifier. Students learn to analyse h-parameters.
4. To explain the concept of feedback in amplifiers along with the importance of negative feedback.

Program Name: B.Sc. Physics-III (Sem-VI)	**Course Name:** Nuclear and Particle Physics

Course Specific Outcomes: On completion of this course, student will be able to

1. To teach students regarding Bethe's formula, energy loss of electrons, Bremsstrahlung, interactions of gamma rays with matter, Radiation loss by fast electrons, radiation length and electron-positron annihilation.
2. To familiarize students with Cyclotron, Betatron, Synchrotron, Collider machines and linear accelerator.
3. To teach students about Ionization chamber, Proportional counter, GM counter, Scintillation counter and Solid-State detectors.
4. To acquaint students with fundamental forces of nature and elementary particles. They learn the concepts such as conservation laws, isospin, strangeness, parity, colour charge, anti-particles, decay, particle symmetry and quark model.

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Program Name: B.Sc. Physics-III (Sem-VI)	**Course Name:** Practicals (Sem-VI)

Course Specific Outcomes: On completion of this course, student will be able to

1. The experiments are designed in such a way that students get the flavour of electronics and nuclear physics.
2. The students find the characteristics and h-parameters of common-base transistor, characteristics of thermistor, characteristics of thermistor, gain of amplifier and studying diode as clamping element.
3. The concepts of nuclear physics are revived with the experiment based on G.M. counter.