GDC Memorial College, Bahal (Bhiwani)

NAAC Accredited Grade 'B'

Department of Physics

Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Programme Outcomes (PO)

After successful completion of two year degree program in physics a student should be able to;

PO1: Solve the eigen values and eigen vectors of special matrices.

PO2: Find out the Laplace transform of derivative, multiple/division by t etc. and inverse of Laplace transform by partial fractions method.

PO3: Solve the differential equations of second order with constant coefficients.

PO4: Determine the Generating function, Recurrence relations and Rodrigue's formula of various polynomials.

PO5: Evaluate singular points and the residue using residue theorem.

PO6: Evaluate definite integrals using Cauchy's residue theorem.

Programme Specific Outcomes (PSO)

After completion of these courses students will able to:

PSO1: Students will demonstrate competence with the basic ideas of linear algebra including concepts of linear systems, independence, theory of matrices, linear transformations, eigenvalues, eigenvectors and Diagonalization.

PSO2: Students will Gain the knowledge of Mathematical Physics through theory and practical's.

PSO3: The students will Develop research oriented skills in terms of Mathematical Physics.

PSO4: Students will realize and develop an understanding of the impact of Mathematical Physics on society.

PSO5: Students are also expected to develop written and oral communication skills in communicating physics-related topics.

PSO6: Will Make aware and handle the sophisticated instruments/equipments/models for programming as theoretical research.

PSO7: Students will be capable of presentation on the topic assigned; use of board or power point presentation.

M.Sc.(Physics) 1st Sem.

Subject: Mathematical Physics **Subject Code:** 19PHY-101

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about special type of matrices that are relevant in physics and its properties.

CO2: Learn the fundamentals and applications of Fourier series, Fourier and Laplace transforms, their inverse transforms etc.

CO3: Learn different ways of solving second order differential equations and familiarized with singular points and Frobenius method.

CO4: Get introduced to Special functions like Bessel function, Legendre function, Hermite function, Laguerre function, Generating functions, Rodrigue's formula and their recurrence relations.

CO5: Understand the complex function and its properties, Cauchy-Riemann conditions, Singularities and evaluation of residues.

CO6: Learn about the Evaluation of definite integrals using Cauchy's residue theorem.

Subject: Classical Mechanics **Subject Code:** 19PHY-102

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Survey of Elementary Principles and Lagrangian Formulation, conservation laws.

CO2: Learn the Newtonian mechanics of one and many particle systems, generalized coordinates and momenta, constraints, their classification.

CO3: Learn symmetries of space and time and their connection with conservation laws; invariance under Galilean transformation.

CO4: Get introduced to Hamilton's principle, Principle of Least Action and its Applications, Cyclic Coordinates etc.

CO5: Understand the Canonical Transformation; Derivation of Generating functions, properties.

CO6: Learn about the Poisson bracket, Poisson theorem, Poisson bracket and canonical transformation, the angular momenta and Poisson bracket.

CO7: Learn about the Theory of small oscillations, Reduction to the equivalent one body problem.

CO8: Learn about the classification of orbits, the Virial theorem, scattering in central force field, the Kepler's problem of central force.

CO9: Understand Hamilton-Jacobi (HJ) Theory, use of H-J method for the solution of harmonic oscillator problem.

Subject: Quantum Mechanics-I **Subject Code: 19PHY-103**

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: After taking this course students will be able to appreciate the beauty of quantum mechanics. They will be knowing all types of representations of operators and ways to apply them in different problems

CO2: The most important thing students learned form this course was how to solve the hydrogen atom problem by using quantum mechanics

CO3: Students learned about time independent degenerate and non degenerate perturbations and to apply them in harmonic oscillator.

CO4: Students got an idea of Pauli spin matrices which are very important in nuclear and particle physics as well as atomic and molecular physics.

Subject: Electronic Devices and circuits -I **Subject Code:** 19PHY-104

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about basics of semiconductor devices and their types.

CO2: Learn the characteristics and VI relationship of semiconductor devices like diode, BJT.

CO3: Learn the characteristics and VI relationship of semiconductor devices like FET, MOSFET, JFET.

CO4: Learn about the network theorems like node, mesh, Millman, Thevenin and superposition theorem

CO5: Understand the concept of feedback in amplifiers.

CO6: Learn about the power amplifiers and their applications.

CO7: Learn about the various electronic voltage regulators.

Subject: Communication skills **Subject Code:** 19PHY-105

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

1. Students will be able to understand and apply knowledge of human communication and language processes as they occur across various contexts, e.g., interpersonal, intrapersonal, small group, organizational, media, gender, family, intercultural communication, technologically mediated communication, etc. from multiple perspectives.

2. Students will be able to understand and evaluate key theoretical approaches used in the interdisciplinary field of communication. I.e., students will be able to explain major theoretical frameworks, constructs, and concepts for the study of communication and language, summarize the work of central thinkers associated with particular approaches, and begin to evaluate the strengths and weaknesses of their approaches.

3. Students will be able to understand the research methods associated with the study of human communication, and apply at least one of those approaches to the analysis and evaluation of human communication.

4. Students will be able to find, use, and evaluate primary academic writing associated with the communication discipline.

5. Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others. Such skills could include communication competencies such as managing conflict, understanding small group processes, active listening, appropriate self-disclosure, etc.

6. Students will be able to communicate effectively orally and in writing.

Subject: IT Fundamentals **Subject Code: 19PHY-106**

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Understand the meaning and basic components of a computer system.

CO2: To learn generation, classification and application of computers.

CO3: Knowledge of computer equipment, including both hardware and software.

CO4: Use word-processing software (MS-Word), spreadsheet software (MS-Excel) and presentation software (MS-PowerPoint) to solve basic information systems problems.

CO5: Evaluating the competitive and operational impacts of adopting new information technologies.

CO6: Understand the MATLAB environment with basic exercise.

CO7: Understand the Implications of information Technology and Social Media.

M.Sc.(Physics) 2nd Sem.

Subject: Quantum Mechanics-II **Subject Code: 19PHY-201**

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: After studying this course, students can calculate the ground state and excited state energies of various real life systems by using Principle, WKB method and perturbation methods.

CO2: They know about scattering in two different frames and can easily calculate scattering amplitude and scattering cross section

CO3: Students can write total energy and wave function as Slater determinant for system of identical fermions.

Subject: Nuclear and Particle Physics **Subject Code:** 19PHY-202

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Two nucleon problem; the deuteron and its behaviour.

CO2: Learn the Nucleon-nucleon scattering, charge independence and charge symmetry of nuclear forces, iso-spin formalism etc.

CO3: Learn Types of nuclear reactions and Q equation and its solution.

CO4: Get introduced to various nuclear models, Magic numbers and measurement of spin, parities and magnetic moments of nuclei.

CO5: Understand the Nuclear Decays (alpha, beta and gamma decays).

CO6: Learn about the high energy physics; Classification of particles, different fundamental types of interactions, Qualitative idea of Quark, Unitary groups etc.

Subject: Solid State Physics **Subject Code:** 19PHY-203

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about the various types of lattices, i.e. Reciprocal lattice and Brillouin zones etc.

CO2: Learn the Determination of crystal structure and various diffraction methods.

CO3: Learn Crystal and atomic structure factors, Structure factor of the bcc and fcc lattices. Ewald construction.

CO4: Get introduced to Classical theory of lattice vibration and Dispersion relation of monoatomic/diatomic system.

CO5: Understand the Inelastic scattering of neutrons by phonons; Thermal properties etc.

CO6: Learn about the high energy physics; Classification of particles, different fundamental types of interactions, Qualitative idea of Quark, Unitary groups etc.

Subject: Electronic Devices and circuits -II **Subject Code:** 19PHY-

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about operational amplifier.

CO2: Learn the behaviour of differential amplifier, CMRR, transfer characteristics etc.

CO3: Learn the applications of Op-Amp like summing and scaling, integrator, differentiator etc.

CO4: It gives important information about the optoelectronic devices.

CO5: Optoectronic devices help the students for the conversion of energy, like light to electrical energy.

CO6: Learn about the multivibrators and oscillators.

CO7: It will give the knowledge of switching circuit.

M.Sc.(Physics) 3rd Sem.

Subject: Electrodynamics **Subject Code: 19PHY-301**

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: One of the objectives of this course is to introduce students with the formulation of four vectors. They are to be introduced by the Lorentz transformations and the invariance of various quantities in four dimensions

CO2: Main aim is to feed student's mind by fields and radiations from various types of dipoles and localized sources. They will be taught to calculate power radiated in each case.

CO3: The objective is to introduce them about wave guides and their applications

CO4: They will be taught about the transmission lines and propagation of waves through them.

Subject: Atomic & Molecular Physics-I **Subject Code:** 19PHY 302

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about the Vector atom Model, Terms for equivalent & non-equivalent electron Atom, Stern-Gerlach experiment etc.

CO2: Learn the various effects like Normal & anomalous Zeeman effect, Stark Effect, Paschen–Back effect, Spectrum of He-atom, alkali as well as fine & hyperfine structure of Spectra lines, General selection rule etc.

CO3: Learn Rotational spectra of diatomic molecules as a rigid rotator as well as non-rigid rotator.

CO4: Get introduced to Vibrational coarse structure of electronic bands and Morse potential energy curve.

CO5: Understand the vibration spectrum of diatomic Molecules, PQR Branches and Born Oppenheimer approximation.

CO6: Learn about the Frank Condon Principle, Dissociation and pre-dissociation, Dissociation energy.

CO7: Learn about the Rotational fine structure of electronic bands, The Fortratparabole, Fluorescence and Phosphorescence and their mechanism etc.

Subject: Physics of Nano-materials **Subject Code:** 19PHY 303C

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about the Free electron theory, Idea of band structure of metal, semiconductor and insulator, Concept of effective Mass.

CO2: Learn the Density of States, its variation with energy, Nano-crystals, Excitions in Direct and Indirect Band Gap Semiconductors.

CO3: Learn Density of States and Optical Absorption in Quantum Well, Quantum wires, Quantum Dots, Idea of Hetero-junction LED etc.

CO4: Get introduced to Bottom up and Top down Approaches for Synthesis of Nano Materials,

CO5: Understand the various techniques, like Molecular Beam Epitaxy (MBE), MOCVD, Cluster Beam Evaporation, Ion Beam Deposition, Chemical Bath Deposition Technique.

CO6: Learn about the Determination of Crystallite/Particle Size and Strain in Nanomaterials Using Debye Scherrer's Formula and Williamson–Hall's Plot.

CO7: Learn about the Basic Principle and idea of Instrumentation of Photoluminescence (PL) Spectroscopy, Raman Spectroscopy.

Subject: Electronics -I **Subject Code:** 19PHY- 404C

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: The course will provide the knowledge to the students about the various type of diodes etc.

CO2: This will provide the students the knowledge of IC fabrication.

CO3: IC fabrication is very important for the electronic industry.

CO4: Students learn about negative resistance devices and their applications.

CO5: Students learn about modulation and demodulation.

CO6: The course will give the knowledge of switching circuit.

M.Sc.(Physics) 4th Sem.

Subject: Computational Physics **Subject Code:** MSP 401

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs.

CO2: The main objective of this course is to provide students with an introduction to the field of numerical analysis.

CO3: Derive appropriate numerical methods to solve interpolation based problems.

CO4: Derive appropriate numerical methods to solve probability based problems.

CO5: Problem solution using FORTRAN language.

CO6: Understand the theoretical and practical aspects of the use of numerical analysis.

Subject: Lasers & Spectroscopy **Subject Code:** MSP-402

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about LASER and its properties, Relationship of Einstein's coefficient etc.

CO2: Learn the Semiconductor Laser. Nd: YAG Laser, CO_2 laser, Nitrogen laser, Dye laser.

CO3: Learn the line Broadening Mechanisms, Laser oscillation and amplification in homogeneous and inhomogeneous system.

CO4: Get introduced to the principle of NMR, Types of NMR, chemical shift; spin-spin coupling.

CO5: Understand the Applications of NMR spectroscopy, Mossbauer Spectrometer and Applications of Mossbauer spectroscopy.

CO6: Learn about the ESR spectrometer, Resonance condition and Relaxation mechanisms.

CO7: Learn about the Features of ESR spectra (a) the g factor (b) Fine structure (c) hyperfine structure (d) ligand hyperfine structure and Applications of ESR.

Subject: Electronics -II **Subject Code:** MSP 403

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: To learn Number System, Binary Codes and Boolean algebra.

CO2: Student will learn Boolean function representation and minimization techniques.

CO3: To learn about Combinational Logic Circuits and Sequential Logic Circuits.

CO4: Students learn about Counters and their applications.

CO5: To learn Shift registers and their applications.

CO6: Understand the basic electronics of logic circuits, counters, registers and be able to use integrated circuit packages.

CO7: Apply the laws of Boolean algebra and K-map to simplify circuits and Boolean algebra expressions.

Subject: Physics of Nanomaterials **Subject Code:** MSP-404

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Free electron theory, band structure of metal, semiconductor and insulators.

CO2: Learn the Density of states in bands and Variation of density of states with energy.

CO3: Learn the Idea of quantum well structure, Quantum wires and Quantum dots.

CO4: Get introduced to the Ion beam deposition, Chemical bath deposition with capping techniques and Top down: Ball Milling.

CO5: Understand the Variation in Raman spectra of nano-materials, Different methods of preparation of Nanomaterials etc.

CO6: Learn about the Determination of particle size, Shift in photoluminescence peaks etc.

Subject: Experimental Techniques **Subject Code: 19PHY 403C**

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Experimental methods of observing dislocations and stacking faults

CO2: Use the EXAFS, NEAFS, Secondary Ion Mass Spectroscopy (SIMS), to describe surface and structure of the materials

CO3: Explain the Least Squares fitting. Linear and Non-linear curve fitting

CO4: Explain AFM (Atomic Force Microscopy), STS (Scanning Tunneling Spectroscopy)