



Sant Baba Bhag Singh

UNIVERSITY

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**PO, PEO, PSO and CO
of
(Physical Sciences)**

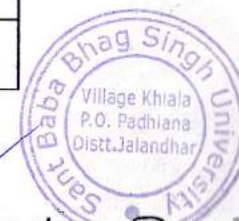
Nikheshan
(Dr. Nikheshan)



SANT BABA BHAG SINGH UNIVERSITY, KHALA -1430030, JALANDHAR		
Institute Name:	UIS	
Department Name:	Physical Sciences	
Programme Name/Programme Code:	B.Sc Non-Medical /UG031	
Number of Semesters	VI	
Vision:	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	<p>Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research.</p> <p>To explore and advance new frontiers in physical sciences and integration with interdisciplinary sciences through visionary research for the benefit of society</p> <p>To develop graduates for lifelong learning and professional growth.</p>	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No.	Programme Educational Objective (PEO) (The Graduate/Undergraduate will....)	
1	PEO1.	To impart quality education in basic physical sciences to achieve excellence in teaching-learning and Graduates will pursue higher studies in related fields.
	PEO2.	To provide hand on training which enable graduates to get employed in private/government institutions.
	PEO3	To construct a bridge between the theoretical and practical aspects of Physical Sciences & inculcate enterprenour skills.
	PEO4	To equip the learners to apply knowledge of Physical Sciences and to analyze the local and global impact of chemistry on individuals, organizations, and society.
	PEO5	To develop employable skills and life time leaning .
Programme Outcomes (PO)(At the end of Programme/Degree mentioned above , the graduates will be able to)		
	PO1.	Disciplinary Knowledge: Students will be able to understand specialised areas and explain major concepts in the Physical sciences and its applications.
	PO2	Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems in Physical Sciences (Physics, Chemistry & Mathematics).
	PO3	Problem Solving: The student will be well-equipped to solve complex problems of numericals related to Physics/ Chemistry & Mathematics that are best approached with critical thinking.

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COD

Dr. V. K. Singh - Dean



2	PO4	Practical skills: Student will be able to demonstrate the ability to read, understand, and critically review scientific information.
	PO5	Modern Tool Usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in laboratory work creates this attribute
	PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, " welcoming for all students"
	PO7	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO8	Research related skills & Ethics: Students will be able to motivate and communicate scientific knowledge in oral and written form accurately using a range of formats.
	PO9	Self-directed Learning: Students are encouraged to accept challenges in Physical Sciences by information available to them. Various activities/advanced ideas equip the students to find relevant information and educate themselves.
	PO10	Individual and Team Work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
	PO11	Communication Skills: Effective communication is a much desirable attribute across courses. However, a Chemistry student is expected to assimilate technical information about chemistry from various sources and convey it to intended audience, both orally and in writing in an intelligible manner.
	PO12	Life long Learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.
Programme Specific Outcomes (PSO)		
3	PSO1.	•Acquire knowledge and understanding of essential facts, concepts, principles and theories of physics, chemistry and Mathematics
	PSO2.	•Develop Skills to evaluate, analyze and interpret information and data.
	PSO3	• Solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem.
	PSO4	• Use standard laboratory equipments, modern instrumentation and classical techniques to carry out experiments and develop skills to interpret and explain the limits of accuracy of experimental data in terms of significance and underlying theory.
	PSO5	• Think creatively (divergently and convergently) to propose novel ideas in explaining facts and figures or providing new solution to the problems.

Nishu Sharma
Dr. Nishu Sharma
(COI)

Dr. Vibha Dhanraj
(Dr. Vibha Dhanraj)



Programme Name:		B.Sc Non Medical/ UG031
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Details of Course Outcomes ((At the end of course, the graduates will be able to))					
S. No	Semester	Course Name	Course Code		Course Outcomes
1	1	Mechanics	PHY101	CO1	Explain the concept of Co-ordinate systems and frame of reference.
				CO2	Understand the concept of central force & Central Force Motion.
				CO3	Illustrate the concept of rotational dynamics, elasticity & relativity.
2	1	Calculus and Matrices	MAT101	CO1	Locate the x and y intercepts, any undefined points, and any asymptotes.
				CO2	Apply the concept of derivative to completely analyze graph of a function.
				CO3	Solve Taylor's series, Maclaurin's series
				CO4	Understand the concept of diagonal, normal for of matrices and applications of matrices in other fields
3	1	Atomic structures , bonding , general organic chemistry and aliphatic hydrocarbons	CHM101	CO1	Solve the conceptual questions using the knowledge gained from quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy. and electron affinity of elements.
				CO2	Draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams.
				CO3	Explains significance of quantum numbers , de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problems.
				CO4	Understand and explain the different nature and behavior of organic compounds and able to analyse and evaluate fundamental concepts of stereochemistry
4	1	General English-I	ENG 101	CO1	Use the English language to make and communicate meaning in spoken and written contexts.
				CO2	Understand the difference between spoken and literary language.
				CO3	The exhaustive exercises in Murphy's Grammar will remove their doubts in tenses, if they had any.
5	1	General Punjabi-I	PBI 101	CO1	ividAwRQI AwDuink pMjwbl kvIAW dI jlvnl qoN jwxU hoxygI
				CO2	ividAwRQIAW nUM AwDuink pMjwbl kivqw dI ivSYgq jwxkwrI ho jwvygI
				CO3	ividAwRQIAW iv'c ryKw ic'qrW dw AiDAYn km dw hunr auqpMn hovygwI




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 Distt. Jalandhar

6	1	HCP-I	HCP 101	CO1	Acquire the knowledge about Punjab and its Historical Resources.
				CO2	Understand the Harppan Culture and different Vedic Periods.
				CO3	Analyze the Alexander's invasions.
7	1	Atomic Structures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons(practic	CHM 103	CO1	Estimate and identify the various ions in stock solutions.
				CO2	Detection of elements (N, S and halogens) in organic compounds, Detection of functional groups
				CO3	Identify amino acid & sugars through chromatographic methods
8	1	Mechanics(practical)	PHY103	CO1	Determine length, height, moment of inertia, young's modulus, modulus of rigidity, elastic constants of various system by using different apparatus.
				CO2	Verify the Newton's 2nd law .
				CO3	.Demonstrate the experimental techniques for different pendulums.
9	2	Electricity and Magnetism	PHY102	CO1	Understand the vector calculus and vector algebra and its applications in electricity and magnetism.
				CO2	Analyze various problems in electrostatics & magnetostatics with mathematical methods.
				CO3	Analyze various problems in electromagnetism with mathematical methods and able to solve Maxwell equations.
10	2	Differential equations	MAT102	CO1	Find out the General, particular, explicit, implicit, and singular solutions of a differential equation.
				CO2	Understand the concept of Wronskian: its properties, its applications, and Linear homogeneous and non-homogeneous equations of higher order with constant coefficients.
				CO3	Solve Partial differential equation with Lagrange's solution and Charpit's general method of solution.
				CO4	Use Laplace transformation to solve differential equation
11	2	Chemical energetic equilibria and functional group organic chemistry-I	CHM 102	CO1	Acquire the knowledge of thermodynamic property of any system , Chemical & Ionic equilibria of various systems.
				CO2	Apply the concepts of concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt, pH and electrolytes.
				CO3	Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
				CO4	Use the synthetic chemistry for functional group transformations & to propose plausible mechanisms in organic Chemistry
				CO1	Use the English language to make and communicate meaning in spoken and written contexts.

Dr. Nisha Sharma
(CoD)

(Dr. Vikas Datta)



12	2	General English-II	ENG 102	CO2	Learn effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work.
				CO3	Knowledge of modals, voice and narration, the learners will confidently handle all modules of the English language.
13	2	General Punjabi-II	PBI 102	CO1	ividAwRQIAW iv'c ryKw ic'qrW dw Alocnwqmk AiDAYn km dw hunr auqpMn hovygw[
				CO2	ividAwRQIAW nUM AwDuink pMjwbl khwxl dl ivSYgq jwxkwrI ho jwvygl[
				CO3	ividAwRQI AwDuink pMjwbl khwxlkwrW dl jlvnl qoN jwxU hoxgy[
14	2	HCP-II	HCP 102	CO1	Acquire the knowledge about Punjab and its Historical Resources.
				CO2	Understand the Harppan Culture and different Vedic Periods.
				CO3	Analyze the Alexander's invasions.
15	2	Chemical Energetic Equilibrium and Functional Group Organic Chemistry-I (practical)	CHM 104	CO1	Acquire basic concepts of thermochemistry, Analyse thermodynamic parameters of solutions and salt mixtures.
				CO2	Find out the acidity, Basicity and pKa Value on pH meter.
				CO3	Accurately evaluate separation, purifications techniques, of organic compounds.
16	2	Electricity and magnetism (practical)	PHY104	CO1	Determine resistance, voltages, current, fuses, capacitances, field strength by using multimeter, galvanometer, de-sauty bridge, carey foster bridge & solenoid.
				CO2	Determine characteristic, resonant frequency & quality factor of RC, LCR (series, parallel) circuits.
				CO3	Determine magnetism by using different apparatus.
17	3	Thermal Physics and Statistical Mechanics	PHY201	CO1	Acquire basic knowledge of the thermodynamically system and potentials.
				CO2	Understand the physics of kinetic theory of gases.
				CO3	Solve statistical mechanics problems for simple non-interacting systems.
18	3	Real Analysis	MAT201	CO1	Understand and find the Bounded and unbounded sets, Infimum and supremum of a set.
				CO2	Learn Bolzano- Weierstrass theorem for sets, topology of real line and R_n .
				CO3	Understand the theorems on limits of sequences, Subsequences, Monotone sequences, Monotone convergence Theorem.
				CO4	Study the basic concept of metric space.

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		Solution, Phase Equilibrium, conductance Electrochemistry and Functional Group Organic chemistry -II	CHM 201	CO1	Acquire coherent knowledge of solutions, phase equilibrium and conductance
				CO2	Coherent knowledge of working of electrochemical cells, EMF & pH determination.
				CO3	Understand structure and bonding in carboxylic acids and amine derivatives & Use the synthetic chemistry for functional group transformations.
				CO4	Identify & Analyse structural components, configuration of amino acids, proteins and Carbohydrates
20	3	EVS	EVS 201	CO1	Understanding of environment and ecosystem.
				CO2	Understand impact of environmental pollutions and status of natural resources.
				CO3	Analyze & propose solutions to social issues related to environment.
21	3	Solution, Phase Equilibrium, conductance electrochemistry and functional group organic chemistry- II (practical)	CHM 203	CO1	Demonstrate and calculate various parameters of distribution & phase equilibria
				CO2	Calculate molar and normal solution of various concentrations.
				CO3	Perform and evaluate outcomes of conductometric & potentiometric titrations.
				CO4	Apply Qualitative Organic Analysis & biochemical analysis of amino acids & carbohydrates.
22	3	Thermal Physics and Statistical Mechanics (practical)	PHY203	CO1	Perform various experiments using Mechanical Equivalent of heat.
				CO2	Devise various experiments using the concept of Thermal conductivity.
				CO3	Illustrate various experiments using the theory of probability & expansion of gases.
23	3	Physics workshop skills	PHY205	CO1	Explain the working of vernier calliper, screw gauge, sextant in measuring length, height, thickness, diameter etc.
				CO2	Understand the physics of various workshops (casting, foundry, welding etc) & their use in electrical circuits.
				CO3	Infer the concepts of gear system, levers, pulleys.
24	3	Logics and sets	MAT207	CO1	Demonstrate the ability to write and evaluate a proof in Logics. CO2
				CO2	Write an argument using logical notation and determine if the argument is or is not valid. CO3 Use Graphs in Networking & other engineering problems.
				CO3	Understand sets, subsets law of theory and venn diagram, Propositional equivalence.

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25	3	Statistical Techniques with Excel	MAT211	CO1	Knowledge about statistical tools used in excel
				CO2	Knowledge about research using correlation and regression
				CO3	Apply t, f and z test in excel
26	3	Basic Analytical chemistry	CHM 209	CO1	Knowledge to Handle analytical data & role of analytical chemistry in science.
				CO2	Understand composition and pH of soil, which can be useful in agriculture
				CO3	Apply Qualitative and quantitative analysis of water, food adultrants & cosmetics
				CO4	Estimation of macro nutrients using Flame photometry & Separate mixtures using separation techniques
27	4	Waves and Optics	PHY202	CO1	Explain various concepts regarding waves motion & simple harmonic motion.
				CO2	Understand the concepts of wave optics, different optical instruments.
				CO3	Analyze the basic difference between interference, diffraction & polarization.
28	4	Algebra	MAT202	CO1	Working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.
				CO2	knowledge of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups.
				CO3	Understand the concept of De-Moivre's theorem and expansion of trigonometric functions.
				CO4	Understand the connection and transition between previously studied mathematics and more advanced mathematics.
29	4	Transition Metal & Coordination Chemistry, States of Matter and Chemical Kinetics	CHM 202	CO1	Acquire coherent knowledge of coordination compounds.
				CO2	Explain basic terms like pairing energy, CFSE, high spin and low spin and colour, magnetic properties of complexes.
				CO3	Derive mathematical expressions for different properties of gas, liquid and solids and understand their physical significance.
				CO4	Understand rate laws and rate of reaction, theories of reaction rates and catalysts
30	4	Transition Metal & Coordination Chemistry, States of Matter and Chemical	CHM 204	CO1	Analyse and estimate Qualitative analysis of inorganic cations & anions.
				CO2	Calculate viscosity and surface tension of different liquids and solutions.
				CO3	Understand and apply gravimetric analysis and complexometric titrations.

Nikheesh
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 (CO1)

Dr. Vikas - Dean
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		Kinetics (practical)		CO4	Derive mathematical expressions of chemical kinetics methods.
31	4	Wave and Optics(practical)	PHY204	CO1	Evaluate refractive index, Cauchy constant of prism using Sodium Light & Mercury Light.
				CO2	Determine the wavelength, grating element, of sodium light & laser light , Resolving Power Plane diffraction grating, Newton's Rings, Michelson interferometer, Diffraction of Single Slit.
				CO3	Draw the inferences of Brewster's law, specific rotation of cane sugar and motion of coupled oscillators.
32	4	Electrical circuits and network skills	PHY206	CO1	Acquire the basic knowledge of role of electricity in electrical circuits.
				CO2	Understand the physics regarding electrical designs, symbols and electric motors.
				CO3	Interpret the different types of electrical wiring & electrical protection devices.
33	4	Number theory	MAT208	CO1	Acquire knowledge of divisibility and related algorithm
				CO2	Solve the Diophantine equations.
				CO3	Understand and gain the knowledge of Mobius inversion formula, Euler's phi functions, the greatest integer functions.
34	4	Green Methods in Chemistry	CHM 210	CO1	Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances.
				CO2	Analyze a process and identify parameters that make environmentally friendly/sustainable/green.
				CO3	Learn to design safer chemical ,products and processes that are less toxic, than current alternatives.
				CO4	Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.
35	6	Digital, analog circuits and instrumentation	PHY301	CO1	Gain knowledge about the concepts of digital circuits.
				CO2	Understand the physics of semiconductor devices and amplifiers including OPAMPS.
				CO3	Infer and Predict the working of different electrical-electronic instruments.
36	5	Digital, analog circuits and instrumentation (practical)	PHY303	CO1	Analyze, design and implement combinational logic circuits.
				CO2	Knowledge of operational working of semiconductor devices.
				CO3	Analyze, design and implement sequential logic circuits.
				CO1	Understand & Explain the basic concepts of quantum mechanics.

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 CO1

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37	5	Elements of modern physics	PHY305	CO2	Explain Schrodinger equations & its application including non-relativistic particles, operators, and energy eigen value and eigen function in 1 dimensional.
				CO3	Interpret various potential barriers using Schrodinger equations & fundamental concepts of nuclear physics.
38	5	Elements of modern physics (practical)	PHY307	CO1	Determine Boltzmann constant, Planck constant, work function of material using electronic devices.
				CO2	Analyse ionization potential of mercury, wavelength of H-atom, absorption lines of iodine vapour.
				CO3	Infer the photo electric effect, charge of electron, e/m value experimentally.
39	5	Numerical Methods	MAT301	CO1	Find numerical solutions of algebraic and transcendental equations.
				CO2	Obtain numerical solutions of system of linear equations and check the accuracy of the solutions.
				CO3	Solve initial and boundary value problems in differential equations using numerical methods.
40	5	Linear algebra	MAT303	CO1	Identify many of familiar systems as vector spaces and operate with them using vector space tools such as basis and dimension.
				CO2	Understand linear transformations and manipulate them using their matrix representations.
				CO3	Find the matrix representation of a linear transformation given bases of the relevant vector spaces.
41	542	Theory of Equations	MAT307	CO1	Understand the basic concept of polynomials and its significance properties.
				CO2	Learn about the Descartes' rule of signs positive and negative rule and Relation between the roots and the coefficients of equations.
				CO3	Understand the Symmetric functions and the Sturm's theorem and its applications.
42	5	Molecules of Life	CHM301	CO1	Understand and demonstrate how structure of biomolecules determines their reactivity and biological functions.
				CO2	Gain insight into concepts of heredity through the study of genetic code, replication, transcription and translation.
				CO3	Demonstrate understanding of metabolic pathways, their inter-relationship, regulation and energy production from biochemical processes.
43	5	Molecules of Life	CHM303	CO1	Acquire knowledge of basic tests and methods to separate, analyse biomolecules.
				CO2	Analyse biochemical analysis of proteins, amino acids and carbohydrates.
				CO3	Identify and carry out qualitative & quantitative analysis of biomolecules in stock solutions.

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(CoD)

Dr. V. K. Sharma
(CoD)



44	5	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	CHM 305	CO1	Apply 18-electron rule to rationalize the stability of organometallic compounds
				CO2	Identify important structural features of the of Zeise's salt, metal alkyls tetrameric methyl lithium and dimeric trialkyl aluminium based organometallics.
				CO3	Explain basic phenomenon of biological systems such as sodium-potassium pump deficiency/excess diseases due to trace elements
				CO4	Analyse and elaborate structure & properties of polynuclear hydrocarbons
				CO5	Gain insight into the basic principles of UV, IR spectroscopic techniques & Use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds.
45	5	Organometallic, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	CHM 307	CO1	Interpret the structures of various complexes and understand their properties.
				CO2	Impart knowledge about handling the spectrophotometer and carry out qualitative & quantitative analysis
				CO3	Employ spectroscopy for characterization of metal complexes and organic compounds
46	5	Industrial chemicals and Environment	CHM 309	CO1	Understand the vital role played by chemistry in industry.
				CO2	Propose solution based on chemical knowledge in various manufacturing processes, handling and storage of chemicals & hazardous effects of chemicals.
				CO3	Knowledge of composition of air, various air pollutants, effects and control measures of air pollutants.
				CO4	Knowledge of water quality parameters, impacts of water pollution, industrial effluents and their treatment methods.
				CO6	understand different sources of energy & generation of nuclear waste and its disposal.
47	5	Industrial chemicals and Environment (practical)	CHM 311	CO1	Identify and analyse various water quality parameters
				CO2	Analyse quantitatively air, water pollutants.
				CO3	Estimate bioindicators of pollution through titrimetrically and spectrophotometrically.
48	5	Renewable and energy harvesting	PHY309	CO1	Explain renewable sources and fundamentals of energy harvesting.
				CO2	Understand the physics of geothermal energy, thermal & hydro energy.
				CO3	Classify different tools for energy harvesting.
				CO1	Learn the concept of differentiation and partial differentiation of vector functions.

Dr. Nisha Sharma (CO1)
Nisha Sharma

Dr. Vipass Dhami
Vipass Dhami



9	5	Vector calculus	MAT305	CO2	Solve the derivatives of sum, dot product, and cross product of two vector functions.
				CO3	Find the gradient, divergence and curl of vector functions.
0	5	Fuel Chemistry	CHM 313	CO1	Understanding of conventional petroleum-based fuels, and alternative & renewable fuels.
				CO2	Analyze origin of petroleum, crude oil, composition, different refining processes employed industrially to obtain different fractions of petroleum.
				CO3	Categorize alternative and renewable fuels like Biofuels (Different generations), Gaseous Fuels (e.g. CNG, LNG, CBG, Hydrogen etc.).
				CO4	Apply various test methods used to qualify different types of fuels as well characterization methods.
	6	Solid state physics	PHY302	CO1	Explain the detail concepts of crystal structure.
				CO2	Understand the physics of magnetic properties of matter & dielectric properties of materials.
				CO3	Illustrate the Kronig model, Hall effect & physics of superconductors.
	6	Solid state physics (practical)	PHY304	CO1	Calculate the magnetic susceptibility, coupling coefficient of crystal.
				CO2	Measure dielectric constant of metals & refractive index of dielectric layer using SPR technique.
				CO3	Analyze PE, BH curve for magnetic materials, resistivity & Hall coefficient for semiconductor crystal.
	6	Quantum mechanics	PHY306	CO1	Apply time dependent Schrodinger equation to understand the general concept of wave function, operators, energy eigen values, stationary states, wavepackets
				CO2	Solve the bound particle in terms of Schrodinger equation and explains the role of potentials, potential barrier, particle in a box, Hydrogen like atom.
				CO3	Understand the physics of atoms in electric, magnetic and external magnetic fields.
	6	Quantum mechanics (practical)	PHY308	CO1	Determine magnetic field of atom by using ESR technique.
				CO2	Predict external magnetic field of atom & hyperfine splitting spectra.
				CO3	Infer quantum tunnelling effect by using semiconductor devices.
				CO4	Apply Scilab /C++ to solve ground state of atom by using schrodinger equation.
				CO1	Understand general properties of nuclei & concept of nuclear models.

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55	6	Nuclear & Particle Physics	PHY310	CO2	Classify the different types of radioactive decay & interaction of nuclear radiation with matter.
				CO3	Interpret the working principle of various particle accelerators.
56	6	Nuclear & Particle Physics (practical)	PHY312	CO1	Draw plateau region, calculate dead time, study gaussian distribution, poisson distribution using GM Counter.
				CO2	Determine absorption coefficient, source strength of beta source using GM Counter.
				CO3	Detect the presence of gamma radiation using scintillation counter.
57	6	Integral calculus	MAT302	CO1	Find the areas and lengths of curves in the plane, volumes and surfaces of solids of revolution.
				CO2	Solve the double and triple integration
				CO3	Understand the concept of Riemann Integral and to solve the improper integrals.
58	6	Complex analysis	MAT306	CO1	Demonstrate accurate and efficient use of complex analysis techniques.
				CO2	Express analytic functions in terms of power series and Laurent series.
				CO3	Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem
59	6	Introduction to Operation Research	MAT308	CO1	Prepare model a problem as a linear programming problem and to apply the appropriate method in order to find an optimal solution.
				CO2	Find primal – dual Relationship.
				CO3	Use transportation and game theory in real life problem.
60	6	Chemistry of main group elements, theories of acids and bases	CHM 306	CO1	Acquire coherent knowledge of fundamental principles of metallurgy and importance & recovery of byproducts during extraction.
				CO2	Understand the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the periodic table.
				CO3	Predict and analyse structure, properties and role of inorganic polymers.
				CO4	Elaborate different acid and base reactions & covalent and ionic bonding using Lewis dot structure.
61	6	Chemistry of main group elements, theories of acids and bases (practical)	CHM 308	CO1	Perform iodometric/iodimetric analysis.
				CO2	Estimate constituent ions through complexometric titrations & gravimetric analysis techniques.
				CO3	Handle and prepare some industrially significant complex salts

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Dr. Virender Sharma
(CoD)



62	6	Green Chemistry	CHM 310	CO1	Acquire knowledge of twelve principles of green chemistry and build the basic understanding of toxicity, hazard and risk of chemical substances.
				CO2	Learn to design safer chemical products and processes that are less toxic, than current alternatives as well as safer design for accident prevention.
					Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.
				CO3	Observe the current environmental issues and their appropriate solutions by chemical approach.
63	6	Green chemistry(practical)	CHM 312	CO1	Apply twelve principles of green chemistry for synthesis and analysis.
				CO2	Design safer chemical products and processes that are less toxic, than current alternatives
				CO3	Incorporate problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.
64	6	Analytical method in chemistry	CHM 314	CO1	Understand basic principle of instrument of various spectrophotometric, electroanalytical and thermal methods of analysis
				CO2	Develop experience and knowledge to operate and use effectively the analytical tools and instruments available in laboratory.
				CO3	Understand the significance, quality and limitations of the results produced by various separation techniques.
				CO4	Develop methods of analysis for different samples independently.
65	6	Analytical method in chemistry(practical)	CHM 316	CO1	Perform experiment with accuracy and precision.
				CO2	Perform various types of titrations i.e redox, colorimetric, complexometric and acid- base titration.
					Analyse soil samples, water analysis, Estimation of macronutrients using Flame Photometry
				CO3	Apply chromatographic methods for separation and identification of analytes.
66	6	Radiology and Safety	PHY314	CO1	Explain the basics of atomic & nuclear physics.
				CO2	Understand about different types of radiation, its detection and measuring instruments.
				CO3	Classify the radiation safety measures.
67	6	Probability and Statistics	MAT310	CO1	Acquire knowledge about random variables (discrete and continuous) and discrete and continuous distributions
				CO2	Understand Joint cumulative distribution function, its properties and the concept of bivariate normal distribution and correlation coefficient
				CO3	Understand and solve the concept of Measures of Central tendency and dispersion.

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(CoD)



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68	6	Pharmaceutical Chemistry	CHM 318	CO1	Acquire knowledge about retro-synthesis approach in drug design and drug discovery.
				CO2	Learn synthetic pathways of major drug classes.
				CO3	Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins.
69	4	Gender Equity	SSC001	CO1	Knowledge of importance of Gender Equity in current scenario.
				CO2	Understand different domains of society require gender equity.
				CO3	Apply and implement gender equity in social behaviour.
70	5	Human values & Professional Ethics	SSC006	CO1	Knowledge to behave ethically and promote human values in society.
				CO2	Behave professionally in working place.
				CO3	Implement a sense of empathy toward each creature in society
71	6	Communication Skills and Personality Development	ENG004	CO1	Acquire basic knowledge of communication skills
				CO2	Students will use their communication skills and personality effectively.
72	3rd -6th	Practical Training	PHY320	CO1	Investigate various practical aspects related to the chemistry, Physics, mathematics and computers.
				CO2	Appreciate the literature and its relevance to his/her topic of interest how to write a report on a given topic.
				CO3	Apply theoretical knowledge to technical writing and presentation on a given topic of training

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SANT BABA BHAG SINGH UNIVERSITY, KHIALA -1430030, JALANDHAR		
Institute Name:	UIS	
Department Name:	Physical Sciences	
Programme Name:	B.Sc Computer Science /UG030	
Number of Semesters	VI	
Vision:	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	<p>Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research.</p> <p>To explore and advance new frontiers in physical sciences and integration with interdisciplinary sciences through visionary research for the benefit of society</p> <p>To develop graduates for lifelong learning and professional growth.</p>	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No.	Programme Educational Objective (PEO) (The Graduate/Undergraduate will....)	
1	PEO1.	Graduates are prepared to be employed in IT industries by providing expected domain knowledge.
	PEO2.	Effectively communicating computing concepts and solutions to bridge the gap between computing industry experts and business leaders to create and initiate innovation.
	PEO3.	Graduates will be employed in the computing profession, and will be engaged in learning, understanding, and applying new ideas and technologies as the field evolves.
	PEO4.	Developing and implementing solution based systems and/or processes that address issues and/or improve existing systems within in a computing based industry.
	PEO5	To develop employable skills and life time learning .
Programme Outcomes (PO)(At the end of Programme/Degree mentioned above , the graduates will be able to)		
	PO1.	Discipline knowledge: An ability to apply discipline –specific knowledge to solve core and/or applied computational problems.
	PO2	Critical Thinking: Apply knowledge of Computer Science to identify, analyze problems and to provide effective solution in the area of Computing.
	PO3	Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve computational problems.
	PO4	Problem Solving: The student will be well-equipped to solve complex problems of numericals related to Physics/ Chemistry & Mathematics that are best approached with critical thinking.

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2	PO5	Modern Tool Usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in laboratory work creates this attribute
	PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, " welcoming for all students"
	PO7	Research related skills & Ethics: Students will be able to motivate and communicate scientific knowledge in oral and written form accurately using a range of formats.
	PO8	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO9	Self-directed Learning: Students are encouraged to accept challenges in Physical Sciences by information available to them. Various activities/advanced ideas equip the students to find relevant information and educate themselves.
	PO10	Individual and Team Work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
	PO11	Effective Communication: Inculcate skills to excel in the fields of Information Technology and its Enabled services, Government and Private sectors, Teaching and Research.
	PO12	Life long Learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.
Programme Specific Outcomes (PSO)		
3	PSO1	Ability to use current techniques , skills and tools necessary for computing practices.
	PSO2	Ability to apply knowledge of computing , mathematics , and basic sciences that may be relevant to the domain.
	PSO3	Understanding of professional , ethical , legal ,security , scoical issue and responsibilities.
	PSO4	Apply problem-solving skills and the knowledge of computer science to solve real world problems.
	PSO5	Ability to apply knowledge of layered network models, protocols, technologies and topologies as well as incorporating security policies for building network and internet based applications.
	PSO6	Develop technical project reports and present them orally among the users.
	PSO7	Ability to analyze the local and global impact of computing on society.

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 (Dr. Upas D Sharma)



Programme Name:

B.Sc Computer Science /UG030

Details of Course Outcomes ((At the end of course, the graduates will be able to))

No	Semester	Course Name	Course Code	Course Outcomes
1	1	Mechanics	PHY101	CO1 Explain the concept of Co-ordinate systems and frame of reference.
				CO2 Understand the concept of central force & Central Force Motion.
				CO3 Illustrate the concept of rotational dynamics, elasticity & relativity.
2	1	Calculus and Matrices	MAT101	CO1 Locate the x and y intercepts, any undefined points, and any asymptotes.
				CO2 Apply the concept of derivative to completely analyze graph of a function.
				CO3 Solve Taylor's series, Maclaurin's series
				CO4 Understand the concept of diagonal, normal for of matrices and applications of matrices in other fields
3	1	Object oriented programming in C++	CSA151	CO1 To understand how C++ improves C with object-oriented features.
				CO2 To learn how to write inline functions for efficiency and performance.
				CO3 To learn the syntax and semantics of the C++ programming language.
4	1	General English-I	ENG 101	CO1 Use the English language to make and communicate meaning in spoken and written contexts.
				CO2 Understand the difference between spoken and literary language.
				CO3 The exhaustive exercises in Murphy's Grammar will remove their doubts in tenses, if they had any.
5	1	General Punjabi-I	PBI 101	CO1 ividAwRQI AwDuink pMjwbl kvIAW dI jlvnI qoN jwxU hoxgy[
				CO2 ividAwRQIAW nUM AwDuink pMjwbl kivqw dI ivSYgq jwxkwrl ho jwvygl[
				CO3 ividAwRQIAW iv'c ryKw ic'qrW dw AiDAYn km dw hunr auqpMn hovygw[
6	1	HCP-I	HCP 101	CO1 Acquire the knowledge about Punjab and its Historical Resources.
				CO2 Understand the Harppan Culture and different Vedic Periods.
				CO3 Analyze the Alexander's invasions.
				CO1 Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.

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Distt. Jalandhar

	1	Object oriented programming in C++(practical)	CSA155	CO2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc.
				CO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
8	1	Mechanics(practical)	PHY103	CO1	Determine length, height, moment of inertia, young's modulus, modulus of rigidity, elastic constants of various system by using different apparatus.
				CO2	Verify the Newton's 2nd law .
				CO3	.Demonstrate the experimental techniques for different pendulums.
9	2	Electricity and Magnetism	PHY102	CO1	Understand the vector calculus and vector algebra and its applications in electricity and magnetism.
				CO2	Analyze various problems in electrostatics & magnetostatics with mathematical methods.
				CO3	Analyze various problems in electromagnetism with mathematical methods and able to solve Maxwell equations.
10	2	Differential equations	MAT102	CO1	Find out the General, particular, explicit, implicit, and singular solutions of a differential equation.
				CO2	Understand the concept of Wronskian: its properties, its applications, and Linear homogeneous and non-homogeneous equations of higher order with constant coefficients.
				CO3	Solve Partial differential equation with Lagrange's solution and Charpit's general method of solution.
				CO4	Use Laplace transformation to solve differential equation
11	2	Data structure and file processing	CSA152	CO1	Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms.
				CO2	Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs.
				CO3	Demonstrate different methods for traversing trees.
12	2	General English-II	ENG 102	CO1	Use the English language to make and communicate meaning in spoken and written contexts.
				CO2	Learn effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work.
				CO3	Knowledge of modals, voice and narration, the learners will confidently handle all modules of the English language.
13	2	General Punjabi-II	PBI 102	CO1	ividAwRQIAW iv'c ryKw ic'qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[
				CO2	ividAwRQIAW nUM AwDuink pMjwbl khwxl dl ivSYgq jwxkwrl ho jwvygl[
				CO3	ividAwRQI AwDuink pMjwbl khwxlkwrW dl jlvnl qoN jwxU hoxgy[
				CO1	Acquire the knowledge about Punjab and its Historical Resources.

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14	2	HCP-II	HCP 102	CO2	Understand the Harppan Culture and different Vedic Periods.
				CO3	Analyze the Alexander's invasions.
15	2	Data structure and file processing(practical)	CSA156	CO1	Understand basic data structures such as arrays, linked lists, stacks and queues.
				CO2	Solve problem involving graphs, trees.
				CO3	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
16	2	Electricity and magnetism (practical)	PHY104	CO1	Determine resistance, voltages, current, fuses, capacitances, field strength by using multimeter, galvanometer, de-sauty bridge, Carey Foster bridge & solenoid.
				CO2	Determine characteristic, resonant frequency & quality factor of RC, LCR (series, parallel) circuits.
				CO3	Determine magnetism by using different apparatus.
17	3	Thermal Physics and Statistical Mechanics	PHY201	CO1	Acquire basic knowledge of the thermodynamically system and potentials.
				CO2	Understand the physics of kinetic theory of gases.
				CO3	Solve statistical mechanics problems for simple non-interacting systems.
18	3	Real Analysis	MAT201	CO1	Understand and find the Bounded and unbounded sets, Infimum and supremum of a set.
				CO2	Learn Bolzano- Weierstrass theorem for sets, topology of real line and \mathbb{R}^n .
				CO3	Understand the theorems on limits of sequences, Subsequences, Monotone sequences, Monotone convergence Theorem.
				CO4	Study the basic concept of metric space.
19	3	Numerical computing	CSA261	CO1	Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.
				CO2	Understand how numerical methods afford a mean to generate solutions in a manner that can be implemented on digital computers
				CO3	Understand the mathematical background for the different numerical methods introduced in the course.
20	3	Environmental Science	EVS 001	CO1	Understanding of environment and ecosystem.
				CO2	Understand impact of environmental pollutions and status of natural resources.
				CO3	Analyze & propose solutions to social issues related to environment.

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21	3	Numerical computing (practical)	CSA265	CO1	Analyze worst-case running times of algorithms using asymptotic analysis.
				CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
				CO3	Explain the major graph algorithms and their analyses.
22	3	Thermal Physics and Statistical Mechanics (practical)	PHY203	CO1	Perform various experiments using Mechanical Equivalent of heat.
				CO2	Devise various experiments using the concept of Thermal conductivity.
				CO3	Illustrate various experiments using the theory of probability & expansion of gases.
23	3	Physics workshop skills	PHY205	CO1	Explain the working of vernier calliper, screw gauge, sextant in measuring length, height, thickness, diameter etc.
				CO2	Understand the physics of various workshops (casting, foundry, welding etc) & their use in electrical circuits.
				CO3	Infer the concepts of gear system, levers, pulleys.
24	3	Logics and sets	MAT207	CO1	Demonstrate the ability to write and evaluate a proof in Logics. CO2
				CO2	Write an argument using logical notation and determine if the argument is or is not valid. CO3 Use Graphs in Networking & other engineering problems.
				CO3	Understand sets, subsets law of theory and venn diagram, Propositional equivalence.
25	3	Statistical Techniques with Excel	MAT211	CO1	Knowledge about statistical tools used in excel
				CO2	Knowledge about research using correlation and regression
				CO3	Apply t, f and z test in excel
26	3	Computer graphics	CSA281	CO1	Demonstrate various algorithms for scan conversion and filling of basic objects and their comparative analysis.
				CO2	Apply geometric transformations, viewing and clipping on graphical objects.
				CO3	Understand a typical graphics pipeline and have made pictures with their computer.
27	4	Waves and Optics	PHY202	CO1	Explain various concepts regarding waves motion & simple harmonic motion.
				CO2	Understand the concepts of wave optics, different optical instruments.
				CO3	Analyze the basic difference between interference, diffraction & polarization.

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28	4	Algebra	MAT202	CO1	Working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.
				CO2	knowledge of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups.
				CO3	Understand the concept of De-Moivre's theorem and expansion of trigonometric functions.
				CO4	Understand the connection and transition between previously studied mathematics and more advanced mathematics.
29	4	Design and analysis of algorithm	CSA262	CO1	Analyze the running time and space complexity of algorithms.
				CO2	Explain and apply backtracking, branch and bound and string matching techniques to deal with some hard problems
				CO3	Describe the classes P, NP, and NPComplete and be able to prove that a certain problem is NP-Complete.
30	4	Design and analysis of algorithm (practical)	CSA266	CO1	Analyze worst-case running times of algorithms using asymptotic analysis.
				CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
				CO3	Explain the major graph algorithms and their analyses.
31	4	Wave and Optics (practical)	PHY204	CO1	Evaluate refractive index, Cauchy constant of prism using Sodium Light & Mercury Light.
				CO2	Determine the wavelength, grating element, of sodium light & laser light, Resolving Power Plane diffraction grating, Newton's Rings, Michelson interferometer, Diffraction of Single Slit.
				CO3	Draw the inferences of Brewster's law, specific rotation of cane sugar and motion of coupled oscillators.
32	4	Electrical circuits and network skills	PHY206	CO1	Acquire the basic knowledge of role of electricity in electrical circuits.
				CO2	Understand the physics regarding electrical designs, symbols and electric motors.
				CO3	Interpret the different types of electrical wiring & electrical protection devices.
33	4	Number theory	MAT208	CO1	Acquire knowledge of divisibility and related algorithm
				CO2	Solve the Diophantine equations.
				CO3	Understand and gain the knowledge of Mobius inversion formula, Euler's phi functions, the greatest integer functions.
34	6	Digital, analog circuits and instrumentation	PHY301	CO1	Gain knowledge about the concepts of digital circuits.
				CO2	Understand the physics of semiconductor devices and amplifiers including OPAMPS.

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		instrumentation		CO3	Infer and Predict the working of different electrical-electronic instruments.
35	5	Digital, analog circuits and instrumentation (practical)	PHY303	CO1	Analyze, design and implement combinational logic circuits.
				CO2	Knowledge of operational working of semiconductor devices.
				CO3	Analyze, design and implement sequential logic circuits.
36	5	Elements of modern physics	PHY305	CO1	Understand & Explain the basic concepts of quantum mechanics.
				CO2	Explain Schrodinger equations & its application including non-relativistic particles, operators, and energy eigen value and eigen function in 1 dimensional.
				CO3	Interpret various potential barriers using Schrodinger equations & fundamental concepts of nuclear physics.
37	5	Elements of modern physics (practical)	PHY307	CO1	Determine Boltzmann constant, Planck constant, work function of material using electronic devices.
				CO2	Analyse ionization potential of mercury, wavelength of H-atom, absorption lines of iodine vapour.
				CO3	Infer the photo electric effect, charge of electron, e/m value experimentally.
38	5	Matrices	MAT301	CO1	Student should be able to know the concept of Linear Independence and examples of different bases.
				CO2	Student should be able to present the matrix form of basic geometric transformations and interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.
				CO3	Students will be able to use elementary row operations to reduce matrices into echelon forms and computation of matrix inverses by using elementary row operations.
39	5	Linear algebra	MAT303	CO1	Identify many of familiar systems as vector spaces and operate with them using vector space tools such as basis and dimension.
				CO2	Understand linear transformations and manipulate them using their matrix representations.
				CO3	Find the matrix representation of a linear transformation given bases of the relevant vector spaces.
40	5	Theory of Equations	MAT307	CO1	Understand the basic concept of polynomials and its significance properties.
				CO2	Learn about the Descartes' rule of signs positive and negative rule and Relation between the roots and the coefficients of equations.
				CO3	Understand the Symmetric functions and the Struvs theorem and its applications.
41	5			CO1	Describe the important computer system resources and the role of operating system in their management policies and algorithms.
				CO2	Understand the process management policies and scheduling of processes by CPU.

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		Operating system	CSA383	CO3	Evaluate the requirement for process synchronization and coordination handled by operating system.
42	5	Database application	CSA385	CO1	Identify & Explain the features of database.
				CO2	Apply knowledge of computing and mathematics appropriate to the discipline.
				CO3	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
				CO3	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
43	5	Database application (practical)	CSA391	CO1	Acquire Knowledge on SQL and able to create tables with and without constraints.
				CO2	Make relation between two or more tables.
				CO3	Retrieve data based on various conditions.
				CO3	Retrieve data based on various conditions.
44	5	Computer network	CSA387	CO1	Describe the functions of each layer in OSI and TCP/IP model.
				CO2	Describe various layers and services provided by them.
				CO3	Understand how C++ improves C with object-oriented features.
				CO3	Understand how C++ improves C with object-oriented features.
45	5	Computer Network (practical)	CSA397	CO1	Explore the basis of computer networks and various protocols and also understand the World Wide Web concepts.
				CO2	understand easily the concepts of network security.
				CO3	Enumerate the layers of the OSI model and TCP/IP, explain the function(s) of each layer.
				CO3	Enumerate the layers of the OSI model and TCP/IP, explain the function(s) of each layer.
46	5	Renewable and energy harvesting	PHY309	CO1	Explain renewable sources and fundamentals of energy harvesting.
				CO2	Understand the physics of geothermal energy, thermal & hydro energy.
				CO3	Classify different tools for energy harvesting.
				CO3	Classify different tools for energy harvesting.
47	5	Vector calculus	MAT305	CO1	Learn the concept of differentiation and partial differentiation of vector functions.
				CO2	Solve the derivatives of sum, dot product, and cross product of two vector functions.
				CO3	Find the gradient, divergence and curl of vector functions.
				CO3	Find the gradient, divergence and curl of vector functions.
48	5			CO1	Demonstrate an understanding of the foundations and importance of E-commerce.
				CO2	Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.

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		Electronic commerce	CSA393	CO3	Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
49	6	Solid state physics	PHY302	CO1	Explain the detail concepts of crystal structure.
				CO2	Understand the physics of magnetic properties of matter & dielectric properties of materials.
				CO3	Illustrate the Kronig model, Hall effect & physics of superconductors.
50	6	Solid state physics (practical)	PHY304	CO1	Calculate the magnetic susceptibility, coupling coefficient of crystal.
				CO2	Measure dielectric constant of metals & refractive index of dielectric layer using SPR technique.
				CO3	Analyze PE, BH curve for magnetic materials, resistivity & Hall coefficient for semiconductor crystal.
51	6	Quantum mechanics	PHY306	CO1	Apply time dependent Schrodinger equation to understand the general concept of wave function, operators, energy eigen values, stationary states, wavepackets
				CO2	Solve the bound particle in terms of Schrodinger equation and explains the role of potentials, potential barrier, particle in a box, Hydrogen like atom.
				CO3	Understand the physics of atoms in electric, magnetic and external magnetic fields.
52	6	Quantum mechanics (practical)	PHY308	CO1	Determine magnetic field of atom by using ESR technique.
				CO2	Predict external magnetic field of atom & hyperfine splitting spectra.
				CO3	Infer quantum tunnelling effect by using semiconductor devices.
				CO4	Apply Scilab /C++ to solve ground state of atom by using schrodinger equation.
53	6	Nuclear & Particle Physics	PHY310	CO1	Understand general properties of nuclei & concept of nuclear models.
				CO2	Classify the different types of radioactive decay & interaction of nuclear radiation with matter.
				CO3	Interpret the working principle of various particle accelerators.
54	6	Nuclear & Particle Physics (practical)	PHY312	CO1	Draw plateau region, calculate dead time, study gaussian distribution, poisson distribution using GM Counter.
				CO2	Determine absorption coefficient, source strength of beta source using GM Counter.
				CO3	Detect the presence of gamma radiation using scintillation counter.
				CO1	Find the areas and lengths of curves in the plane, volumes and surfaces of solids of revolution.

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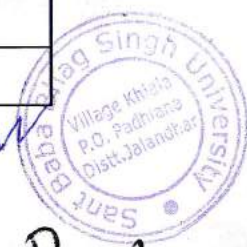
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55	6	Integral calculus	MAT302	CO2	Solve the double and triple integration
				CO3	Understand the concept of Riemann Integral and to solve the improper integrals.
56	6	Complex analysis	MAT306	CO1	Demonstrate accurate and efficient use of complex analysis techniques.
				CO2	Express analytic functions in terms of power series and Laurent series.
				CO3	Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem
57	6	Linear programming	MAT308	CO1	The field of linear programming provides the appropriate methods for the efficient computation of optimal solutions of a problem which is modeled by a linear objective function and a set of linear
				CO2	Students will be ready to model a problem as a linear programming problem and to apply the appropriate method in order to find an optimal solution.
				CO3	Students should be able to identify parametersthat will influence the optimal solution of an Linear programming problem and derive feasible solution using atechnique of operational research.
58	6	Information security	CSA384	CO1	understand the CIA triad of Confidentiality, Integrity and Availability.
				CO2	Provide security of the data and information over the network and implement various network protocols.
				CO3	Do research in the emerging areas of cryptography and network security.
59	6	Information security Practical	CSA386	CO1	Acquire knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
				CO2	Explore emerging areas of cryptography and network security.
				CO3	Use different features of information security for system design
60	6	Data mining	CSA396	CO1	Identify appropriate data mining algorithms to solve real world problems.
				CO2	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.
				CO3	Describe complex data types with respect to spatial and web mining.
61	6	Data mining Practical	CSA398	CO1	Identify appropriate data mining algorithms to solve real world problems.
				CO2	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.
				CO3	Describe complex data types with respect to spatial and web mining.
				CO1	Explain the basics of atomic & nuclear physics.

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62	6	Radiology and Safety	PHY314	CO2	Understand about different types of radiation, its detection and measuring instruments.
				CO3	Classify the radiation safety measures.
63	4	Gender Equity	SSC001	CO1	Knowledge of importance of Gender Equity in current scenario.
				CO2	Understand different domains of society require gender equity.
				CO3	Apply and implement gender equity in social behaviour.
64	5	Human values & Professional Ethics	SSC006	CO1	Knowledge to behave ethically and promote human values in society.
				CO2	Behave professionally in working place.
				CO3	Implement a sense of empathy toward each creature in society
65	6	Communication Skills and Personality Development	ENG004	CO1	Acquire basic knowledge of communication skills
				CO2	Students will use their communication skills and personality effectively.

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SANT BABA BHAG SINGH UNIVERSITY, KHALA -1430030, JALANDHAR		
Institute Name:	UIS	
Department Name:	Physical Sciences	
Programme Name:	B.Sc (Hons.) Mathematics /UG033	
Number of Semesters	VI	
Vision:	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	<p>Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research.</p> <p>To explore and advance new frontiers in physical sciences and integration with interdisciplinary sciences through visionary research for the benefit of society</p> <p>To develop graduates for lifelong learning and professional growth.</p>	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No.	Programme Educational Objective (PEO) (The Graduate/Undergraduate will....)	
1	PEO1	Apply principles of basic science concepts in understanding, analysis and prediction of mathematical systems.
	PEO2	Develop human resource with knowledge, abilities and insight in Mathematics and related fields required for career in academia and industry.
	PEO3	Engage in lifelong learning and adapt to changing professional and societal needs.
	PEO4	Empower students with substantial knowledge in mathematics, scientific and primitive engineering concepts required to solve computing problems and pursue higher studies.
Programme Outcomes (PO) (At the end of Programme/Degree mentioned above, the graduates will be able to)		
	PO1.	Disciplinary Knowledge: Students will be able to understand specialised areas and explain major concepts in the Mathematical sciences and its applications.
	PO2	Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems of mathematics.
	PO3	Problem Solving: The student will be well-equipped to solve complex problems of numericals related to Mathematics that are best approached with critical thinking.
	PO4	Practical skills: Student will be able to demonstrate the ability to read, understand, and critically review scientific information.
	PO5	Modern Tool Usage: Increasing the usage of appropriate techniques, resources having interface with computers and mathematics

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Dr. Vikas Dahiya
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PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, " welcoming for all students"
PO7	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Research related skills & Ethics: Students will be able to motivate and communicate scientific knowledge in oral and written form accurately using a range of formats.
PO9	Self-directed Learning: Students are encouraged to accept challenges in mathematical Sciences by information available to them. Various activities/advanced ideas equip the students to find relevant information and educate themselves.
PO10	Individual and Team Work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
PO11	Communication Skills: Effective communication is a much desirable attribute across courses. Student is expected to assimilate technical information about chemistry from various sources and convey it to intended audience, both orally and in writing in an intelligible manner.
PO12	Life long Learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.

Programme Specific Outcomes (PSO)

PSO1	•Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
PSO2	•Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of mathematics and statistics.
PSO3	• Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
PSO4	• Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.
PSO5	• To develop interest in specialization.

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Nishu Sharma
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 (Co-1)

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Programme Name:

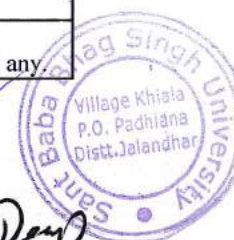
B.Sc (Hons.) Mathematics

Details of Course Outcomes

Sl. No	Semester	Course Name	Course Code	Course Outcomes (At the end of course , the graduates will be able to)	
				CO1	CO2
1	1	Mechanics	PHY101	CO1	Explain the concept of Co-ordinate systems and frame of reference.
				CO2	Understand the concept of central force & Central Force Motion.
				CO3	Illustrate the concept of rotational dynamics, elasticity & relativity.
2	1	Calculus	MAT101	CO1	Locate the x and y intercepts, any undefined points, and any asymptotes.
				CO2	Apply the concept of derivative to completely analyze graph of a function.
				CO3	Solve Taylor's series, Maclaurin's series
				CO4	Understand the concept of diagonal, normal for of matrices and applications of matrices in other fields
3	1	Algebra	MAT109	CO1	Simplify and evaluate algebraic expressions.
				CO2	Create & solve linear equations in one variable.
				CO3	Solve equations involving linear, polynomial, radical, rational, exponential, or logarithmic expressions.
4	1	Atomic structures , bonding , general organic chemistry and aliphatic hydrocarbons	CHM101	CO1	Solve the conceptual questions using the knowledge gained from quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy. and electron affinity of elements.
				CO2	Draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams.
				CO3	Explains significance of quantum numbers , de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problems.
				CO4	Understand and explain the different nature and behavior of organic compounds and able to analyse and evaluate fundamental concepts of stereochemistry
5	1	General English-I	ENG 101	CO1	Use the English language to make and communicate meaning in spoken and written contexts.
				CO2	Understand the difference between spoken and literary language.
				CO3	The exhaustive exercises in Murphy's Grammar will remove their doubts in tenses, if they had any

Dr. Nisha Sharma
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Dr. Vikas Dhanu
Sharma



6	1	General Punjabi-I	PBI 101	CO1	ividAwrQI AwDuink pMjwbl kvIAW dI jlvnl qoN jwxU hoxgy[
				CO2	ividAwrQIAW nUM AwDuink pMjwbl kivqw dI ivSYgg jwxkwrI ho jwvygl[
				CO3	ividAwrQIAW iv`c ryKw ic`qrW dw AiDAYn krn dw hunr auqpMn hovygw[
7	1	HCP-I	HCP 101	CO1	Acquire the knowledge about Punjab and its Historical Resources.
				CO2	Understand the Harppan Culture and different Vedic Periods.
				CO3	Analyze the Alexander's invasions.
8	1	Atomic Structures , Bonding , General Organic Chemistry and Aliphatic Hydrocarbons(practi	CHM 103	CO1	Estimate and identify the various ions in stock solutions.
				CO2	Detection of elements (N, S and halogens) in organic compounds, Detection of functional groups
				CO3	Identify amino acid & sugars through chromatographic methods
9	1	Mechanics(practical)	PHY103	CO1	Determine length, height, moment of inertia, young's modulus, modulus of rigidity, elastic constants of various system by using different apparatus.
				CO2	Verify the Newton's 2nd law .
				CO3	.Demonstrate the experimental techniques for different pendulums.
10	2	Electricity and Magnetism	PHY102	CO1	Understand the vector calculus and vector algebra and its applications in electricity and magnetism.
				CO2	Analyze various problems in electrostatics & magnetostatics with mathematical methods.
				CO3	Analyze various problems in electromagnetism with mathematical methods and able to solve Maxwell equations.
11	2	Differential equations	MAT102	CO1	Find out the General, particular, explicit, implicit, and singular solutions of a differential equation.
				CO2	Understand the concept of Wronskian: its properties, its applications, and Linear homogeneous and non-homogeneous equations of higher order with constant coefficients.
				CO3	Solve Partial differential equation with Lagrange's solution and Charpit's general method of solution.
				CO4	Use Laplace transformation to solve differential equation
12	2	Real Analysis	MAT110	CO1	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
				CO2	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration

Dr. Nisha Sharma
(CoD)

Dr. Vikas Sharma



				CO3	Construct rigorous mathematical proofs of basic results in real analysis.
13	2	Chemical energetic equilibria and functional group organic chemistry-I	CHM 102	CO1	Acquire the knowledge of thermodynamic property of any system, Chemical & Ionic equilibria of various systems.
				CO2	Apply the concepts of concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt, pH and electrolytes.
				CO3	Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
				CO4	Use the synthetic chemistry for functional group transformations & to propose plausible mechanisms in organic Chemistry
14	2	General English-II	ENG 102	CO1	Use the English language to make and communicate meaning in spoken and written contexts.
				CO2	Learn effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work.
				CO3	Knowledge of modals, voice and narration, the learners will confidently handle all modules of the English language.
15	2	General Punjabi-II	PBI 102	CO1	ividAwRQIAW iv'c ryKw ic'qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[
				CO2	ividAwRQIAW nUM AwDuink pMjwbl khwxl dl ivSYgg jwxkwrl ho jwvygl[
				CO3	ividAwRQI AwDuink pMjwbl khwxlkrW dl jlvnl qoN jwxU hoxgy[
16	2	HCP-II	HCP 102	CO1	Acquire the knowledge about Punjab and its Historical Resources.
				CO2	Understand the Harppan Culture and different Vedic Periods.
				CO3	Analyze the Alexander's invasions.
17	2	Chemical Energetic Equilibrium and Functional Group Organic Chemistry-I (practical)	CHM 104	CO1	Acquire basic concepts of thermochemistry, Analyse thermodynamic parameters of solutions and salt mixtures.
				CO2	Find out the acidity, Basicity and pKa Value on pH meter.
				CO3	Accurately evaluate separation, purifications techniques, of organic compounds.
18	2	Electricity and magnetism (practical)	PHY104	CO1	Determine resistance, voltages, current, fuses, capacitances, field strength by using multimeter, galvanometer, de-sautv bridge, carey foster bridge & solenoid.
				CO2	Determine characteristic, resonant frequency & quality factor of RC, LCR (series, parallel) circuits.
				CO3	Determine magnetism by using different apparatus.
				CO1	Understand and use the properties of group actions.

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19	3	Group Theory -I	MAT209	CO2	understand and use the terms homomorphism and isomorphism.
				CO3	Use the definitions and properties of dihedral, symmetric and alternating groups.
20	3	Partial Differential Equations and System of Ordinary Differential Equations	MAT213	CO1	Classify partial differential equations and transform into canonical form.
				CO2	Apply partial derivative equation techniques to predict the behaviour of certain phenomena.
				CO3	Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases.
21	3	Theory of Real Functions	MAT215	CO1	Have a rigorous understanding of the concept of limit of a function.
				CO2	Learn about continuity and uniform continuity of functions defined on intervals.
				CO3	Understand geometrical properties of continuous functions on closed and bounded intervals.
22	3	Environmental Science	EVS 001	CO1	Understanding of environment and ecosystem.
				CO2	Understand impact of environmental pollutions and status of natural resources.
				CO3	Analyze & propose solutions to social issues related to environment.
23	3	Thermal Physics and Statistical Mechanics	PHY201	CO1	Acquire basic knowledge of the thermodynamically system and potentials.
				CO2	Understand the physics of kinetic theory of gases.
				CO3	Solve statistical mechanics problems for simple non-interacting systems.
24	3	Solution, Phase Equilibrium, conductance Electrochemistry and Functional Group Organic chemistry -II	CHM 201	CO1	Acquire coherent knowledge of solutions, phase equilibrium and conductance
				CO2	Coherent knowledge of working of electrochemical cells, EMF & pH determination.
				CO3	Understand structure and bonding in carboxylic acids and amine derivatives & Use the synthetic chemistry for functional group transformations.
				CO4	Identify & Analyse structural components, configuration of amino acids, proteins and Carbohydrates
25	3	Solution, Phase Equilibrium, conductance electrochemistry and functional group	CHM 203	CO1	Demonstrate and calculate various parameters of distribution & phase equilibria
				CO2	Calculate molar and normal solution of various concentrations.
				CO3	Perform and evaluate outcomes of conductometric & potentiometric titrations.

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		organic chemistry- II (practical)		CO4	Apply Qualitative Organic Analysis & biochemical analysis of amino acids & carbohydrates.
26	3	Thermal Physics and Statistical Mechanics (practical)	PHY203	CO1	Perform various experiments using Mechanical Equivalent of heat.
				CO2	Devise various experiments using the concept of Thermal conductivity.
				CO3	Illustrate various experiments using the theory of probability & expansion of gases.
				CO4	
27	3	Logics and sets	MAT207	CO1	Demonstrate the ability to write and evaluate a proof in Logics.
				CO2	Write an argument using logical notation and determine if the argument is or is not valid. CO3 Use Graphs in Networking & other engineering problems.
				CO3	Understand sets, subsets law of theory and venn diagram, Propositional equivalence.
28	3	Computer Graphics	CSE 233	CO1	Demonstrate various algorithms for scan conversion and filling of basic objects and their comparative analysis.
				CO2	Apply geometric transformations, viewing and clipping on graphical objects.
				CO3	Understand a typical graphics pipeline and have made pictures with their computer.
29	4	Numerical Methods (Theory)	MAT218	CO1	Obtain numerical solutions of algebraic and transcendental equations.
				CO2	Find numerical solutions of system of linear equations and check the accuracy of the solutions.
				CO3	Solve initial and boundary value problems in differential equations using numerical methods.
30	4	Numerical Methods (Practical)	MAT220	CO1	Use mathematical libraries for computational objectives and represent the outputs of programs visually in terms of well formatted text and plots.
				CO2	Obtain the numerical solutions of algebraic and transcendental equations.
				CO3	Find numerical solutions of system of linear equations and check the accuracy of the solutions.
31	4	Riemann Integration and Series of Functions	MAT222	CO1	Learn about some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
				CO2	Understand the Beta and Gamma functions and their properties.
				CO3	Learn the valid situations for the inter-changeability of differentiability and integrability with infinite sum, and approximation of transcendental functions in terms of power series.
32	4	Ring Theory and Linear Algebra-I	MAT224	CO1	Learn about the fundamental concept of Rings, Fields, subrings, integral domains.
				CO2	Understand the concept of linear independence of vectors over a field, the idea of a finite dimensional vector space, basis of a vector space and the dimension of a vector space.

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(C.D.)

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33	4	Waves and Optics	PHY202	CO3	To learn the basic concepts of linear transformations, the Rank-Nullity Theorem, matrix of a linear transformation, algebra of transformations and the change of basis.
				CO1	Explain various concepts regarding waves motion & simple harmonic motion.
				CO2	Understand the concepts of wave optics, different optical instruments.
				CO3	Analyze the basic difference between interference, diffraction & polarization.
34	4	Wave and Optics(practical)	PHY204	CO1	Evaluate refractive index, Cauchy constant of prism using Sodium Light & Mercury Light.
				CO2	Determine the wavelength, grating element, of sodium light & laser light, Resolving Power Plane diffraction grating, Newton's Rings, Michelson interferometer, Diffraction of Single Slit.
				CO3	Draw the inferences of Brewster's law, specific rotation of cane sugar and motion of coupled oscillators.
35	4	Coordination Chemistry, States of Matter and Chemical Kinetics	CHM 202	CO1	Acquire coherent knowledge of coordination compounds.
				CO2	Explain basic terms like pairing energy, CFSE, high spin and low spin and colour, magnetic properties of complexes.
				CO3	Derive mathematical expressions for different properties of gas, liquid and solids and understand their physical significance.
				CO4	Understand rate laws and rate of reaction, theories of reaction rates and catalysts
36	4	Coordination Chemistry, States of Matter and Chemical Kinetics (practical)	CHM 204	CO1	Analyse and estimate Qualitative analysis of inorganic cations & anions.
				CO2	Calculate viscosity and surface tension of different liquids and solutions.
				CO3	Understand and apply gravimetric analysis and complexometric titrations.
				CO4	Derive mathematical expressions of chemical kinetics methods.
37	4	Graph Theory	MAT226	CO1	This course will enable the students to appreciate the definition and basics of graphs along with types and their examples.
				CO2	To understand the concept of Paths and circuits
				CO3	To Solve problems related to Travelling salesman's problem and to learn Dijkstra's algorithm and Floyd-Warshall algorithm
38	4	Operating System: Linux	CSE 234	CO1	To understand and make effective use of linux utilities and shell scripting language to solve problems.
				CO2	To implement in C some standard linux utilities like mv,cp,ls etc.
				CO3	To learn the fundamentals of Operating Systems.

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39	5	Multivariate Calculus	MAT311	CO1	This course will enable the students to learn conceptual variations while advancing from one variable to several variables in calculus.
				CO2	Students will be able to apply multivariable calculus in optimization problems and Inter-relationship amongst the line integral, double and triple integral formulations.
				CO3	To Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.
				CO4	To understand the applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.
40	5	Group Theory-II	MAT313	CO1	This course will enable the students to understand the basic concepts of Automorphism, inner automorphism, automorphism groups.
				CO2	To Learn the idea of external and internal direct products of groups.
				CO3	To Understand the basic concepts of group actions and their applications and Recognize the use of the Sylow theorems to characterize certain finite groups.
41	5	Portfolio Optimization	MAT315	CO1	To understand the basic concepts of Financial markets, Measures of return and risk and Mutual funds.
				CO2	To learn the Portfolio of assets, the Markowitz model and the two-fund theorem.
				CO3	To know about Capital market theory and Capital assets pricing model- the capital market line.
42	5	Number Theory	MAT317	CO1	To learn about some important results in the theory of numbers including the prime number theorem, Chinese remainder theorem, Wilson's theorem and their consequences.
				CO2	To Learn about number theoretic functions, modular arithmetic and their applications.
				CO3	To familiarise with modular arithmetic and find primitive roots of prime and composite numbers.
43	5	Analytical Geometry	MAT319	CO1	This course will enable the students to sketch the conics like parabola, ellipse, hyperbola and understand the properties of parabola, ellipse and hyperbola.
				CO2	To learn Classification of quadratic equations representing lines, parabola, ellipse and hyperbola, Spheres, Cylindrical surfaces.
				CO3	To understand about graphing standard quadric surfaces like cone, ellipsoid.
44	5	Industrial Mathematics	MAT321	CO1	This course will enable the students to learn about Medical Imaging and Inverse Problems.
				CO2	To understand the concept of Inverse problems and its applications.
				CO3	To know about X-ray and its properties and X-ray behavior and to understand the Algorithms of CT scan machine. Learn about Medical Imaging and Inverse Problems.
45	5	Boolean Algebra and Automata Theory	MAT323	CO1	To learn about partially ordered sets, lattices and their types.
				CO2	To understand Boolean algebra and Boolean functions, logic gates, switching circuits and their applications.

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46	5	Probability and Statistics	MAT325	CO3	To solve real-life problems using finite-state, Turing machines and assimilate various graph theoretic concepts and familiarize with their applications.
				CO1	This course will enable the students to learn about random variables (discrete and continuous) and discrete and continuous distributions
				CO2	To understand Joint cumulative distribution function, its properties and the concept of bivariate normal distribution and correlation coefficient
				CO3	To learn Chebyshev's inequality, Markov Chains and Chapman-Kolmogorov equations
47	5	Introduction to R Programming	MAT327		List motivation for learning a programming language.
					Access online resources for R and import new function packages into the R workspace.
					Import, review, manipulate and summarize data-sets in R.
					Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
48	6	Metric Spaces and Complex Analysis	MAT314	CO1	The course will enable the students to understand the basic concepts of metric spaces and Appreciate the abstractness of the concepts such as open balls, closed balls, compactness, connectedness etc.
				CO2	To Understand Functions of complex variable, mappings, Differentiate among Contours, upper bounds for moduli of contour integrals. and Contour integrals
				CO3	To Understand Cauchy-Goursat theorem, Cauchy integral formula and to be able to explain Liouville's theorem and the fundamental theorem of algebra.
				CO4	To Understand the concept of Laurent series and its examples, absolute and uniform convergence of power series
49	6	Ring Theory and Linear Algebra-II	MAT316	CO1	On successful completion of this course, students will be able to understand Polynomial rings, principal ideal domains, Euclidean domains, factorization of polynomials, unique factorization in $\mathbb{Z}[x]$ and Divisibility in integral domains.
				CO2	To be able to understand the concept of Dual spaces, dual basis and transpose of a linear transformation and its matrix in the dual basis
				CO3	To understand Eigen spaces of a linear operator, diagonalizability and Differentiate between invariant subspaces and Cayley-Hamilton theorem
				CO4	To learn the Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements, and Normal and self-adjoint operators.
50	6	Theory of Equations	MAT318	CO1	To understand the basic concept of polynomials and its significance properties.
				CO2	To learn about the Descartes's rule of signs positive and negative rule and Relation between the roots and the coefficients of equations.
				CO3	To understand the Symmetric functions and the Strums theorem and its applications.
				CO1	This course will enable the students to explain the Mathematical Biology and the modeling process.

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51	6	Bio-Mathematics	MAT320	CO2	To understand the Activator-Inhibitor system, Insect Outbreak Model.
				CO3	To learn various Spatial , Discrete Models and different models with their application
52	6	Linear Programming	MAT322	CO1	On successful completion of this course, students will be able to solve problems related to <u>formulation of linear programming problems (LPP), Simplex method, two-phase method, Big-M</u>
				CO2	To undersatnd the Transportation problemm, Feasible and optimal solution of transportation <u>Problems and Assignment problems</u>
				CO3	To understand the basic concepts of game theory including strategic games and graphical solution <u>procedure and linear programming solution of games.</u>
53	6	Mathematical Modeling	MAT324	CO1	This course will enable the students to understand the concepts of Power series , Bessel's equation and <u>Legendre's equation.</u>
				CO2	To understand the Laplace transform and its application to initial value problem up to second order.
				CO3	To learn Monte Carlo Simulation Modeling and know the optimization modeling and its applications
54	6	Static & Dynamic Mechanics	MAT326	CO1	To understand the concept of Moment and couple moment of a force about a point and an axis.
				CO2	To learn Laws of Coulomb friction , its applications and understand the concept of Conservative <u>force field and translation and rotation of rigid bodies.</u>
				CO3	To understand the general relationship between time derivatives of a vector for different references
55	6	Differential Geometry	MAT328	CO1	This course will enable the students to explain the basic concepts of tensors and role of tensors in <u>differential geometry</u>
				CO2	To learn various properties of curves and to know the Interpretation of the curvature tensor, Geodesic curvature, Gauss and Weingarten formulae.
				CO3	To Understand the role of Gauss-Bonnet theorem and its consequences and to apply problem-solving with differential geometry to diverse situations in physics, engineering and in other
56	6	Fundamental of Python	MAT330	CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control <u>flow statements.</u>
				CO2	Express proficiency in the handling of strings and functions.
				CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like <u>lists, dictionaries, tuples and sets.</u>

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SANT BABA BHAG SINGH UNIVERSITY, KHALA -1430030, JALANDHAR		
Institute Name:	UIS	
Department Name:	Physical Sciences	
Programme Name/Code:	M.Sc. (Hons.) Physics /PG037	
Number of Semesters	4	
Vision:	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	1. Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research. 2. To explore and advance new frontiers in physical sciences and integration with interdisciplinary sciences through visionary research for the benefit of society. 3. To impart academic environment to seed skills and to promote creativity and to provide a student-centered and professions-oriented higher education.	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No.	Programme Educational Objective (PEO) (The Graduate will able)	
1	PEO1.	Students will have knowledge of fundamental laws and principle in a variety of areas of Physics along with their applications.
	PEO2.	Develop research skills which might include advance laboratory techniques, numerical techniques, computer algebra, computer interfacing.
	PEO3	Become effective researcher who will be able to provide the summation of scientific literature on a given topic.
	PEO4	To create a sense of ethical responsibilities among students.
	PEO5	To make the students to accept the challenges in physics and can effectively disseminate the physics knowledge to coming generations.
	PEO6	Design solutions for advanced scientific problems and design system components or processes.
Programme Outcomes (PO)(At the end of Programme/Degree mentioned above , the graduates will be able to)		
	PO1	Disciplinary Knowledge: The student has acquired in-depth knowledge of the various concepts and theoretical principles of Physics and is aware of their manifestations. An understanding of the centrality of Physics is usually evident from familiarity with interfacial disciplines. A graduate in Physics is expected to be thoroughly conversant with all fundamental laws and principle in variety of areas of Physics along with their applications and laboratory techniques.
	PO2	Critical thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems in Physics. A graduate in Physics is expected to assess, reconstruct and solve the problem.
	PO3	Problem solving: A vital part of Physics curriculum is problem solving. The student will be well-equipped to solve complex problems of numerical related to engineering/Physics that are best approached with critical thinking.

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2	PO4	Scientific /Analytical reasoning: Students learn to investigate, experiments/ theoretical methods, relate information and interpretation of data based on scientific reasoning. The student will be able to draw logical conclusions based on a group of observations, mathematical techniques and measurements.
	PO5	Modern tool usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in laboratory work creates this attribute. A student with degree in Physics is able to employ knowledge and skill in computers in a variety of situations- data analysis, coding of complex physics problems as well as information retrieval and library use.
	PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Ingrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, "welcoming for all students".
	PO7	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO8	Research related skills & Ethics: Develop skills for critically review scientific information and become able to comprehend and write effective reports and design documentation. Able to create a sense of ethical responsibilities among students. The student is aware of what constitutes unethical behaviour-- plagiarism, fabrication and misrepresentation or manipulation of data.
	PO9	Self-directed learning: Students are encouraged to accept challenges in Physics by information available to them. Various activities/advanced ideas require the students to find relevant information and educate themselves.
	PO10	Individual and team work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
	PO11	Communication skills: Effective communication is a much desirable attribute across courses. However, a Physics student is expected to assimilate technical information and convey it to intended audience, both orally and in writing in an intelligible manner.
	PO12	Lifelong learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.
	Programme Specific Outcomes (PSO)	
3	PSO1.	Explain and apply principles of physics for understanding the scientific aspects in classical domain.
	PSO2.	Explain and apply mathematical techniques for illustrating and deeper understanding of physical systems.
	PSO3	Learn and apply statistical methods for portraying the classical and quantum particles in various physical systems.
	PSO4	Learn and apply inter-disciplinary concepts and computational skills for interpreting and describing the different phenomenon in physics.
	PSO5	Learn and apply advanced experimental/theoretical methods for measurement, observation, and fundamental understanding of physical phenomenon/system
	PSO6	Provide exposure in research in various specialization of Physics like (Solid State Physics/Nuclear Physics/Particle Physics/Radiation Physics etc).

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Details of Course Outcomes

Sl. No.	Semester	Course Name	Course Code	Course Outcomes (The students will be able to)	
				CO	Outcome
1	I	Electronics	PHY501	CO1	To get to know about the working of various electronic devices
				CO2	To gain basic knowledge of OPAMP and their applications in different areas.
				CO3	To understand the basics of digital electronics.
				CO4	To analyze various combinational and sequential circuits.
2	I	Mathematical Physics	PHY503	CO1	To understand the general coordinate transformations, their relevant transformation equations, basic tensor algebra, covariant- and contra-variant tensors and fourier series.
				CO2	To learn various special functions, solve corresponding differential equations and understand about their properties.
				CO3	To determine accurate and efficient use of complex analysis techniques.
				CO4	To describe the basics of Group Theory.
3	I	Classical Mechanics	PHY505	CO1	To understand about the mechanics of system of particles, Lagrangian and Hamiltonian formulations in classical mechanics.
				CO2	To determine distinct problems related with central force including kepler's laws of motion.
				CO3	To understand the idea about Euler's equations of motion of rigid body.
				CO4	To apply the theories and mathematical equations related to Canonical Transformations.
4	I	Computational Techniques	PHY507	CO1	To learn various examples for interpolation, least square fitting and cubic splines.
				CO2	To learn different numerical methods for solving non-linear and linear system of equations.
				CO3	To solve the problem related to integration and differentiation numerically.
				CO4	To apply FORTRAN to solve different numerical methods.
5	I	Quantum Mechanics I	PHY509	CO1	To apply different types of ket-bra notations, operators and determine commutation relations in quantum mechanics
				CO2	To learn the difference between Schrodinger and Heisenberg picture.
				CO3	To learn and apply one dimensional system including step potential, potential barrier on quantum mechanics problem and study their energy eigen states.
				CO4	To describe the orbital angular momentum and spin angular momentum theory and will be able to calculate CG coefficients.
				CO1	To perform the analysis and design of electrical circuits .
				CO2	To understand the practical concept behind the design of any electrical designs.

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Dr. Vikas Kumar
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6	1	Electronics Lab	PHY511	CO3	To study the output in different operating modes of different semiconductor devices.
				CO4	To make mini as well as major projects related to electronics.
7	1	Computational Lab	PHY513	CO1	To gain basic knowledge of programming skills of FORTRAN.
				CO2	To solve a problems using the FORTRAN language.
				CO3	To demonstrate an understanding of applicabilty of numerical methods for modeling physical system in physics.
				CO4	To prepare codes of different numerical methods using FORTRAN.
8	2	Quantum Mechanics-II	PHY502	CO1	To study the importance of perturbation theory to explain Stark effect, fine structure of helium atom, Fermi Golden rule and selection rules for absorption and emission of light.
				CO2	To apply the approximation methods and scattering theories.
				CO3	To study the importance of relativistic quantum mechanics compared to non-relativistic quantum mechanics.
				CO4	To distinguish between identical and non-identical particles and can write the symmetric and antisymmetric wavefunctions.
9	2	Electrodynamics-I	PHY504	CO1	To explain fundamentals and applications of various laws in electrostatics.
				CO2	To explain fundamentals and applications of various laws in magnetostatics.
				CO3	To solve Maxwell equations in free space and for harmonically varying fields.
				CO4	To solve Electromagnetic wave equations in conducting as well as in non-conducting media and to gain understanding of the phenomenon of reflection, refraction and polarization.
10	2	Condensed Matter Physics-I	PHY506	CO1	To understand the fundamental of magnetic materials, phenomena of dia, para and ferromagnetism and their properties.
				CO2	To gain understanding of ferroelectrics materials, transition temperatures and their potential application and the behavior of materials below a certain temperature (superconducting materials).
				CO3	To describe the detail of existing defects and their role in diffusion process.
				CO4	To gain understanding of the lattice vibration and concept of phonons in crystal structure .
11	2	Atomic & Molecular Spectroscopy	PHY508	CO1	To describe the atomic spectra of one and two valence electron atoms.
				CO2	To explain the change in behavior of atoms in external applied electric and magnetic field.
				CO3	To apply their knowledge of quantum mechanical concepts to describe atomic and molecular spectra in details.
				CO4	To understand the importance and practical application of spectroscopy in modern research.

Nishant
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12	2	Condensed Matter Physics Lab-I	PHY510	CO1	To study the band gap, magneto resistance, resistivity and charge carrier concentration in semiconductors.
				CO2	To know how to determine the crystal structure, lattice parameter and crystallite size?
				CO3	To understand measurement and analysis of various types of transport.
				CO4	To explain optical characterization of solid, magnetic and dielectric behavior of solids.
13	2	Atomic and Molecular Spectroscopy Lab	PHY512	CO1	To study the spectroscopic behavior of materials.
				CO2	To understand nature of atomic energy levels.
				CO3	To gain understanding of the wave nature of light along with the measurement of the wavelength of the light.
				CO4	To learn the impact of the external magnetic field on the atomic energy levels.
14	2	Medicinal Chemistry	CHM520	CO1	To focus on the application of chemistry to clinical medicine.
				CO2	To gain a broad and fundamental understanding of chemistry while developing particular expertise in medical applications.
				CO3	To gain knowledge with reference to working of various diagnostic tools, medical imaging techniques, therapeutic technique and radiation safety practices.
				CO4	To understand relevant chemical reactions/synthetic pathways for selected drugs.
15	2	MATLAB Theory	MAT520	CO1	To understand the main features of the MATLAB development environment.
				CO2	To design simple algorithms to solve problems.
				CO3	To learn the basics of graphics and data analysis in MATLAB.
				CO4	To learn basics of plotting functions in MATLAB.
16	2	MATLAB Practical	MAT522	CO1	To design simple algorithms to solve problems.
				CO2	To write simple programs in MATLAB for solving scientific and mathematical problems.
				CO3	To carry out simple numerical computations and analyses using MATLAB.
				CO4	To write basic mathematical, quantum mechanical problems in MATLAB.
17	2	Research Methodology & Intellectual Property Rights	PHY540	CO1	To identify a research problem.
				CO2	To understand importance of educational research, interpret the results and report writing.
				CO3	To describe the role of Intellectual Property Rights (IPR) in research and development.
				CO4	To understand the different types and laws of Intellectual Property Rights (IPR).
18	3	Statistical Mechanics	PHY601	CO1	To identify the link between statistics and thermodynamics, classical and quantum statistics and its applications.
				CO2	To describe the fundamentals of classical statistical mechanics and learn about phase space, various ensembles and their application in some cases.
				CO3	To learn about the quantum mechanical theory of statistics and its application in various important cases of Bosons and Fermions.
				CO4	To understand the behaviour of ideal Bose and Fermi gases.

Nishu
Dr. Nishu Sharma
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8/11/2020



19	3	Electrodynamics-II	PHY603	CO1	To understand the concept of different wave guides.
				CO2	To understand relativistic formulation of electrodynamics.
				CO3	To study the radiation field systems in electrodynamics.
				CO4	To learn the concept of field of moving charges.
20	3	Condensed Matter Physics-II	PHY605	CO1	To explain the thermal properties in solid and the elastic behavior under stress and elastic constants.
				CO2	To understand the concept of conductivity of metals and luminescence in detail.
				CO3	To distinguish between plasmons & polaritons and can study the concept of optical properties.
				CO4	To understand the theory of dielectrics and ferro-electrics.
21	3	Nuclear Physics	PHY607	CO1	To understand the role of nuclear forces, strong interactions & nuclear properties.
				CO2	To get knowledge about the hyperfine structure & nuclear model.
				CO3	To analyze the radioactive decays like α -particle emission, beta decays, gamma decay, Angular momentum and parity selection rules, Internal conversion, Nuclear isomerism
				CO4	To understand the nuclear reactions and their properties like Compound nuclear-scattering matrix, Resonance scattering.
22	3	Experimental Techniques	PHY609	CO1	To explain the working principles of the various Vacuum techniques.
				CO2	To understand the techniques involved in the fabrication of thin films.
				CO3	To understand the different techniques for the analysis of structure, surface of nanomaterials.
				CO4	To understand the working principle of different microscopy (SPM, SEM, TEM, STM, AFM etc).
23	3	Physics of Nanomaterial	PHY611	CO1	To develop fundamental knowledge of nanomaterials.
				CO2	To correlate the properties of nano structures with their size, shape and surface characteristics.
				CO3	To explain the effects of quantum confinement on the electronic structure & corresponding physical and chemical properties of materials at nanoscale.
				CO4	To understand the physics of carbon nano tubes involving their synthesis and applications in different areas.
24	3	Non Linear fiber optics	PHY613	CO1	To explain the wave propagation in anisotropic crystal and polarization response of materials to light.
				CO2	To understand the theory and experiments involved in optics.
				CO3	To explain the use of organic and inorganic materials, X-ray diffraction, FTIR, FT-NMR in qualitative study.
				CO4	To understand the applications of optical fibres, optical sensors and its classifications.
25	3	Fabrication of Electronic devices	PHY615	CO1	To explain the physics of crystal growth & can apply to fabricate electronic devices.
				CO2	To understand the role of diffusion in fabricating electronic devices.
				CO3	Apply the knowledge of interconnections (metallic) to fabricate electronic circuits.
				CO4	Apply optical lithography to design electronic devices.
				CO1	To provide knowledge about the measurement of radiations using counters, detectors.

Nishu Sharma
Dr. Nishu Sharma
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Dr. Vipin Sharma
(Dr. Vipin Sharma)



26	3	Nuclear Physics Lab	PHY617	CO2	To study absorption of radioactive particles in matter using counter, detectors.
					To make relevant measurements of energy and decay spectra using basic experimental facilities and apply Poisson statistics.
				CO3	
				CO4	To investigate the statistics of radioactive measurements.
27	3	Project Part I (Review of Literature)	PHY629	CO1	To measure and progress in particular area of subjects.
				CO2	To frame the background of particular area of the subject.
				CO3	To study the concern literature of particular field of physics.
				CO4	To formulate research problem of particular field of physics.
28	4	Particle Physics	PHY602	CO1	To describe the types of basic interactions and invariance principles.
				CO2	To apply the concepts and principles/laws on quantum numbers including Parity, Isospin, G-parity.
				CO3	To describe the weak interactions, including V-A weak interaction theory and Cabbibo theorem.
				CO4	To get knowledge of spontaneous breaking of symmetry and Goldstone theorem, Abelian and Non-Abelian gauge fields.
29	4	Reactor Physics	PHY604	CO1	To understand the interaction of neutron with matter.
				CO2	To study the detail aspects of moderation of neutrons.
				CO3	To study homogenous and heterogeneous reactor assemblies.
				CO4	To get detail information of power reactors.
30	4	Radiation Physics	PHY606	CO1	To study nuclear radiation and its radiation quantities.
				CO2	To understand in detail about different dosimeters.
				CO3	To study nuclear radiation effects and its detection and protection.
				CO4	To understand about different radiation shielding.
31	4	Plasma Physics	PHY608	CO1	To understand the origin of plasma, conditions of plasma formation and properties of plasma.
				CO2	To classify propagation of electrostatic and electromagnetic waves in magnetized and non-magnetized plasmas.
				CO3	To describe the basics of boltzman & vlasvov equations.
				CO4	To describe the non-linear plasma theories.
32	4	Physics of Materials	PHY610	CO1	To know different types & applications of Polymers.
				CO2	To learn different concept of glass formations and ceramics.
				CO3	To understand the basics of Liquid Crystals its characteristics.
				CO4	To understand various methods involved in material characterization.
				CO1	To study the the optical properties & various type of spintronics-based devices.
				CO2	To understand the theory of charge and spin in quantum dots.

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Dr. Vikas Dhanu
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33	4	Spintronics	PHY612	CO3	To understand about spin based transport in the device.
				CO4	To understand magnetic dynamics and application of spin transfer torque.
				CO1	To measure and evaluate different solar energy technologies through knowledge of the physical function of the semiconductor devices.
				CO2	To study different types of solar cells.
				CO3	To understand the basic principle, working and applications of photoelectrochemical solar cell and dye sensitized solar cells.
34	4	Solar cells and Applications	PHY614	CO4	To understand the polymer, nanostructure involved in fabrication of solar cells.
				CO1	To Detect Nuclear Radiations and also do their measurements.
				CO2	To determine Nuclear properties.
				CO3	To design & develop skills on Accelerators of Charged Particles.
35	4	Nuclear Accelerator & Radiation Physics	PHY616	CO4	To modify the role of neutron in working of accelerators.
				CO1	To understand different methods involved in synthesis nanomaterials.
				CO2	To determine the basic properties of nanoparticles using different characterization techniques.
				CO3	To understand the physics of carbon nano tubes, fullerenes, graphene involving their synthesis and applications.
				CO4	To gain basic knowledge of nanosemiconductors devices, nanosensors and their applications in different areas.
36	4	Nano Technology	PHY618	CO1	To know the energy demand of world and India.
				CO2	To understand the solar energy and different concepts to develop solar physics applications.
				CO3	To understand in general the production of hydrogen through solar energy and their storage applications.
37	4	Science of Renewable Energy Source	PHY620	CO4	To study in detail about the wind energy, nature of wind, and their electronics applications.
				CO1	To study the overview of the structure and evolution of the Earth as a dynamic planet within our solar system.
				CO2	To study the Geodynamics and Geochronology of earth surface.
				CO3	To understand the radioactivity & radioactive contents in different rocks.
				CO4	To describe different nuclear techniques involved to detect rock density, concentration of radioactive elements in rock.
38	4	Geophysics	PHY622	CO1	To apply atomic physics and do the Elemental analysis.
				CO2	To apply molecular physics and laser technology to do the molecular analysis.
				CO3	To apply Vacuum technology to study the elements.
39	4	Analytical Techniques of Materials	PHY624	CO4	To prepare Sample using of different techniques.
				CO1	To investigate various aspects related to the Physics.

Nishu
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42	4	Seminar & Summer Training	PHY625	CO2	To appreciate the literature and its relevance to his/her topic of interest how to write a report on a given topic.
				CO3	To write technically and presentation on a given topic of research and commercial worth of Physics.
43	4	Project Part II	PHY630	CO1	To understand a methodology to solve the research problem.
				CO2	To design and carry out scientific experiments as well as accurately record the results of experiments.
				CO3	To analyze the data and interpret the results.
				CO4	To interpret the results and can write the research report.
44	4	Natural Hazards and Disaster Management	EVS003	CO1	To know the current overview of natural hazard materials.
				CO2	To discuss the physical aspects of vulnerability and elements of risk mapping, assessment.
				CO3	To know the development planning, sustainable development in the context of Climate Change.

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SANT BABA BHAG SINGH UNIVERSITY		
Institute Name:	University Institute of Science (UIS)	
Department Name:	Physical Sciences	
Programme Name/Code:	M.Sc (Hons.)Mathematics/PG036	
Number of Semesters	4	
Vision:	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	<p>Holistic development of students through academic excellence, employability, acquisition of analytical skills and higher research.</p> <p>To explore and advance new frontiers in physical sciences integrated with life sciences, medicine, energy, materials and environmental sciences through visionary research for the benefit of society</p> <p>To develop graduates for lifelong learning and professional growth.</p>	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No	Programme Educational Objective (PEO) (The Course Objective is....)	
1	PEO1.	To provide high quality education in pure and applied mathematics.
	PEO2.	To develop talented and committed human resource which act as catalyst to support interdisciplinary research and become fit for industry and entrepreneur.
	PEO3	To motivate for research in mathematical and statistical sciences.
	PEO4	To empower students to investigate new mathematical methodologies for future applications.
	PEO5	To develop employable skills and life time learning skills to handle real world challenging problems.
Programme Outcomes (PO)(At the end of Programme/Degree mentioned above, the graduates will be able to)		
	PO1	Disciplinary Knowledge: The student has acquired in-depth knowledge of the various concepts and theoretical principles of Mathematics and is aware of their manifestations. An understanding of the centrality of Mathematics is usually evident from familiarity with interfacial disciplines. A postgraduate in Mathematics is expected to be thoroughly conversant with all fundamental laws and principle in variety of areas of Mathematics along with their applications.
	PO2	Critical thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems in Mathematics. A postgraduate in Mathematics is expected to assess, reconstruct and solve the problem.
	PO3	Problem solving: A vital part of Mathematics curriculum is problem solving. The student will be well-equipped to solve complex problems of Mathematics related to engineering etc that are best approached with critical thinking.

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Neha
 Dr. Vibha Sharma
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2	PO4	Scientific /Analytical reasoning: Students learn to investigate, computational/ analytical methods, relate information and interpretation of data based on scientific reasoning. The student will be able to draw logical conclusions based on a group of observations, mathematical techniques and measurements.
	PO5	Modern tool usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in mathematics creates this attribute. A student with degree in Mathematics is able to employ knowledge and skill in computers in a variety of situations- data analysis, coding of complex physics problems as well as information retrieval and library use.
	PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Ingrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, " welcoming for all students"
	PO7	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO8	Research related skills & Ethics: Develop skills for critically review scientific information and become able to comprehend and write effective reports and design documentation. Able to create a sense of ethical responsibilities among students. The student is aware of what constitutes unethical behaviour--plagiarism, fabrication and misrepresentation or manipulation of data.
	PO9	Self-directed learning: Students are encouraged to accept challenges in Mathematics by information available to them. Various activities/advanced ideas require the students to find relevant information and educate themselves.
	PO10	Individual and team work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, labs or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
	PO11	Communication skills: Effective communication is a much desirable attribute across courses. However, a Mathematics student is expected to assimilate technical information about Mathematics from various sources and convey it to intended audience, both orally and in writing in an intelligible manner.
	PO12	Lifelong learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.
Programme Specific Outcomes (PSO) Post graduates will		
3	PSO1.	Acquired critical analysis and problem solving skills with respect to all field of core mathematics required for science and engineering application.
	PSO2.	Attained mathematical knowledge of experimental/computational techniques and instrumentation required to work independently in research or industrial environments.
	PSO3	Become a person with sharpen analytical thinking, logical deductions and rigor in reasoning.
	PSO4	Ability to apply mathematical methodologies to open- ended real -world situations.
	PSO5	Acquire ability to explain applications of Mathematics relates to the real world in term of advanced computational/numerical methods, advanced software and analytical tools.

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(Dean)



Details of Course Outcomes						
S. No	Semester	Course Name	Course Code	Course Outcomes (At the end of course, students will be able to :)		
1	1	Real Analysis-I	MAT-501	CO1	Describe fundamental properties of the real numbers that lead to the formal development of real	
				CO2	Comprehend rigorous arguments developing the theory underpinning real analysis.	
				CO3	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.	
2	1	Complex Analysis	MAT503	CO1	Demonstrate the remarkable properties of complex variable functions, which are not the features	
				CO2	Acquire knowledge about different types of functions viz. analytic, entire and meromorphic functions occur in complex analysis along with their properties.	
				CO3	Apply the knowledge of complex analysis in diverse fields related to mathematics.	
				CO4	Utilize the concepts of complex analysis to specific research problems in mathematics or other	
				CO5	Enhance and develop the ability of using the language of mathematics in analyzing the real-world problems of sciences and engineering.	
3	1	Abstract Algebra-I	MAT505	CO1	Demonstrate insight into abstract algebra with focus on axiomatic theories.	
				CO2	Demonstrate knowledge and understanding of fundamental concepts including groups, subgroups, normal subgroups, homomorphisms and isomorphism.	
				CO3	Demonstrate knowledge and understanding of rings, fields and their properties.	
4	1	Ordinary Differential Equations	MAT507	CO1	Explain the concept of differential equation.	
				CO2	Solve higher order differential equations and exact equations.	
				CO3	Expresses the basic existence theorem for higher-order linear differential equations.	
5	1	Classical Mechanics and Calculus of Variations	MAT509	CO1	Solve isoperimetric problems of standard type.	
				CO2	Solve simple initial and boundary value problems by using several variable calculus.	
				CO3	Solve mechanics problems in one dimension that involve one or more of the forces of gravity, friction and air resistance.	
6	1	Human values & Professional Ethics	SSC006	CO1	Students will behave ethically and promote human values in society.	
				CO2	Students will behave professionally.	
7	2	Real Analysis-II	MAT502	CO1	Improve and outline the logical thinking.	
				CO2	Illustrate how to communicating with: Peers, Lecturers and Community	
				CO3	Define and recognize the basic properties of the field of real number	
				CO1	Recognise technical terms and appreciate some of the uses of algebra	

Nisha Sharma
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Dr. V. K. Sharma
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		Abstract Algebra-II	MAT504	CO2	Simplify & Elaborate some formulas of Abstract Algebra		
				CO3	Solve simple linear equations		
9	2	Mathematical Methods	MAT506	CO1	Solve problems using mathematics in unfamiliar settings.		
				CO2	Engage in analyzing, solving, and computing real-world applications.		
				CO3	use mathematical concept while solving various problems of Engineering.		
10	2	Partial Differential Equations	MAT508	CO1	Solve the systems of linear differential equations.		
				CO2	Solve the homogeneous linear systems with constant coefficients.		
				CO3	Find the type of a linear differential equation systems.		
11	2	Linear Algebra	MAT510	CO1	Understand the concept of basis and dimensions of vector space and solve the system of linear		
				CO2	Use the concept of the Eigen values and Eigenvectors, Characteristic and minimal polynomials,		
				CO3	Solve the numericals based on Inner Product Spaces, Norms and Distances, Orthonormal basis,		
				CO4	Apply the concept of Unitary and Normal Operators, Spectral Theorem, Bilinear and Quadratic forms in the applied fields of mathematics		
				CO5	Apply the knowledge of Linear Algebra to attain a good mathematical maturity and enables to build mathematical thinking and skill.		
12	2	Fundamental of Computer Science-Theory	CSE558	CO1	Acquire knowledge of basic hardware and software concepts.		
				CO2	Familiar with using C++ functions and the concepts related to good modular design.		
				CO3	Familiar with using C++ structures, pointers and reference parameters.		
13	2	Fundamental of Computer Science-Lab	CSE560	CO1	Work with basic features of MS excel.		
				CO2	Display documents using various views.		
				CO3	Work with the basic features of Word.		
14	2	Research Methodology & IPR	MAT540	CO1	Identify a research problem.		
				CO2	Understand importance of educational research, interpret the results and report writing.		
				CO3	Describe the role of Intellectual Property Rights (IPR) in research and development.		
				CO4	Understand the different types and laws of Intellectual Property Rights (IPR).		
15	3	Topology	MAT601	CO1	Demonstrate an understanding of the concepts of metric spaces and topological spaces, and their role in mathematics.		
				CO2	Prove basic results about completeness, compactness, connectedness and convergence within		
				CO3	Demonstrate an understanding of the concepts of Hausdorff spaces.		
16		Probability and Statistics	MAT603	CO1	learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.		
				CO2	Derive the distribution of function of random variables,		
				CO3	Derive the marginal and conditional distributions of random variables.		
				CO4	estimation		

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		Numerical Analysis	MAT605	CO5	Analyse data statistically and interpretation of the results.		
				CO1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.		
				CO2	differentiation, integration.		
				CO3	Solve linear and nonlinear equations, and the solution of differential equations. equations, and the solution of differential equations.		
18	3	Numerical Analysis Lab	MAT625-19	CO1	Apply their knowledge of computer programming to develop and implement their own computer codes of numerical methods for solving different types of complex problems viz. nonlinear equations, system of linear equations, interpolation and extrapolation, numerical differentiation and integration, numerical initial and boundary value problems of ordinary differential equations etc.		
				CO2	Understand different implementation modes of a numerical method in order to solve a given		
				CO3	Analyze and modify computer codes available in the scientific literature.		
				CO4	Utilize the symbolic tools of Computer Algebra System (CAS) for example MATLAB or MATHEMATICA independently and in their computer codes for solving a given problem.		
				CO5	Develop, select and apply numerical methods as a computer code with the understanding of their limitations so that they can be implemented in order to get acceptable results.		
19	3	Seminar	MAT627	CO1	Study different topics for understanding of a new field in Mathematics in the absence of regular course textbooks.		
				CO2	Improve their different skills like presentation skill, discussion skills, listening skills, argumentative skills and critical thinking, interdisciplinary inquiry.		
				CO3	Effectively communicate by making an oral presentation before an evaluation committee.		
20	3	Operation Research-I	MAT613	CO1	Formulate and solve problems as networks and graphs.		
				CO2	Construct linear integer programming models and discuss the solution techniques.		
				CO3	Design decision models and use some solution methods for nonlinear optimization problems.		
21	3	Fluid Mechanics -I	MAT615	CO1	Identify derivation of basic equations of fluid mechanics.		
				CO2	Describe the motion of fluids.		
				CO3	Formulate the problems on buoyancy and solve them.		
22	3	Topological Vector Spaces	MAT617	CO1	Define and solve topological vector spaces.		
				CO2	Explain subspaces, product spaces and quotient space.		
				CO3	Explain Convex, balanced and absorbing sets.		
23		Fundamentals of Python	MAT629	CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.		
				CO2	Express proficiency in the handling of strings and functions.		

Dr. Nisha Sharma
(COI)

Dr. Vikas Datta



	3			CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.		
24	3	Differential Geometry	MAT619	CO1	Analyse the equivalence of two curves by applying some theorems.		
				CO2	Defines surfaces and their properties.		
				CO3	List topological aspects of surfaces.		
25	3	Calculus of Several Variables	MAT621	CO1	Explain differential forms of R^n .		
				CO2	Perform integration on R^n .		
				CO3	Define and express the continuity, Differentiability on Euclidian space.		
26		Discrete Mathematics	MAT623	CO1	1. Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.		
				CO2	2. Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.		
				CO3	use effectively algebraic techniques to analyse basic discrete structures and algorithms.		
27		Fractional Calculus	MAT631	CO1	1. understand the Riemann-Liouville fractional integral and evaluate fractional integrals of some common functions		
				CO2	2. define the Riemann-Liouville and Caputo fractional derivatives and find the fractional derivatives of some common functions		
				CO3	3. state sufficient conditions under which the fractional integrals and derivatives exist		
				CO4	4. investigate some applications of the fractional calculus to the real world.		
				CO5	Transforms		
28		Natural Hazards and Disaster Management	EVS003	CO1	Understand the current overview of natural hazard materials.		
				CO2	Discuss the physical aspects of vulnerability and elements of risk mapping, assessment.		
				CO3	Propose development planning, sustainable development in the context of Climate Change.		
29	4	Functional Analysis	MAT602	CO1	Apply the theory of functional analysis in the qualitative study of different mathematical models in Biological and Ecological systems and different engineering problems.		
				CO2	Study the stability theory of Differential equations and difference equations.		
				CO3	Understand the concept of topology in real world problems.		
				CO4	Applications of topological approach in the study of solutions of Difference Equations in different boundary value problems arising in Biological and Ecological systems and different		
				CO5	Use of topological concepts in Architecture Engineering.		
				CO1	Apply the knowledge of Number theory to attain a good mathematical maturity and enables to build mathematical thinking and skill.		
				CO2	Utilize the congruences, Chinese remainder theorem, indices, residue classes, Legendre symbols to solve different related problems.		

Dr. Nisha Sharma
(Co1)

Dr. Vikas Dey
(Co2)



	4		MAT604	CO3	Identify and analyze different types of divisibility tests, Euler's theorem, Wilson theorem, Mobius inversion formula to formulate and solve various related problems.		
				CO4	Design, analyze and implement the concepts of Diophantine equations for solving different types of problems, for example, sum of two and four squares.		
				CO5	Identify the challenging problems in modern mathematics and find their appropriate solutions.		
31	4	Field Extensions and Galois Theory	MAT606	CO1	will understand Galois Theory properly.		
				CO2	Get Experience to interpret the result.		
				CO3	Demonstrate mastery of the basic elements of Galois Theory.		
32	4	Operational Research-II	MAT616	CO1	Use this knowledge to become entrepreneur		
				CO2	Apply different methods to solve different problems based in real life situations		
				CO3	Devise the optimal solution to gain more profit		
33	4	Fluid Mechanics-II	MAT618	CO1	Acquire thorough knowledge of integral		
				CO2	Attain thorough knowledge of Bessel's functions.		
				CO3	Apply Legendre's functions during research		
34	4	Special Functions	MAT620	CO1	Apply various methods to obtain accurate results in Engg. Problems		
				CO2	Analyse student learning in mathematics.		
				CO3	Implement knowledge of special functions to create various software.		
35	4	Advanced Numerical Analysis	MAT622	CO1	Apply various methods to obtain accurate results in Engg. Problems.		
				CO2	Acquire coherent knowledge of advanced numerical analysis.		
				CO3	Apply knowledge of numerical analysis to development of software.		
36	4	Fuzzy Set Theory	MAT624	CO1	Use the knowledge of fuzzy mathematics in real life situations based on credit & debit.		
				CO2	Apply the knowledge of fuzzy mathematics in economics & Engg.		
				CO3	Develop & Enhance reasoning ability in students		
37	4	Advanced Complex Analysis	MAT626	CO1	Understand the fundamental concepts of complex analysis and their role in modern mathematics and applied contexts.		
				CO2	Demonstrate accurate and efficient use of complex analysis techniques.		
				CO3	Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from complex analysis.		
				CO4	Apply problem-solving using complex analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts.		
				CO5	Formulate and prove theorems concerning analytic functions.		

Dr. Vishesh Sharma
(2007)

Dr. Vikas Dharma
(2007)



4	Project (Research Paper review and Viva)	MAT628	CO1	Acquire thorough knowledge and progress in particular area of mathematics.		
			CO2	Frame the background of particular area of the subject.		
			CO3	Study the concern literature of particular field of Mathematics		
			CO4	Formulate research problem of particular field of Mathematics.		
39	Introduction to R Programming	MAT630	CO1	Access online resources for R and import new function packages into the R workspace.		
			CO2	Import, review, manipulate and summarize data-sets in R.		
			CO3	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.		
			CO4	Understand the concept of Maximum-Likelihood Decoding and Syndrome Decoding.		
40	Coding Theory	MAT632	CO2	Analyze Double Error-Correcting B.C.H. code and Finite Fields Polynomials.		
			CO3	Understand Cyclic Codes.		
			CO4	Study the concept of Bose-Chaudhuri-Hocquenghem (B.C.H.) Codes and Weight Distributions.		
			CO5	Understand basic techniques of algebraic coding theory like matrix encoding, polynomial encoding, and decoding by coset leaders etc.		

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SANT BABA BHAG SINGH UNIVERSITY, KHIALA -1430030, JALANDHAR		
Institute Name:	UIS	
Department Name:	Physical Sciences	
Programme Name/Code:	M.Sc (Hons.) Chemistry/PG035	
Number of Semesters	4	
Vision	To aspire, achieve and sustain for excellence in academics and research through scientific knowledge so as to provide solutions to global environmental issues and transform graduates into responsible citizens and competent professionals.	
Mission:	Holistic development of learner through academic excellence, employability, acquisition of analytical skills and higher research. To explore and advance new frontiers in Physical Sciences and integration with interdisciplinary sciences through visionary research for the benefit of society To develop graduates for lifelong learning and professional growth.	
Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes		
S.No	Programme Educational Objective (PEO) (The Graduate/Undergraduate will....)	
1	PEO1.	To impart quality education in chemical sciences to achieve excellence in teaching-learning and research.
	PEO2.	To provide hand on training and execution of the chemical experiments and safe handling of chemistry laboratory and chemical waste.
	PEO3	To construct a bridge between the theoretical and practical aspects of chemistry and inculcate research aptitude.
	PEO4	To equip the learners to apply knowledge of Chemistry and to analyze the local and global impact of chemistry on individuals, organizations, and society.
	PEO5	To develop talented and committed human resource which act as catalyst to support interdisciplinary research and become fit for industry and entrepreneur.
	PEO6	To develop employable skills and life time learning .
Programme Outcomes (PO)(At the end of Programme/Degree mentioned above , the graduates will be able to)		
	PO1	Disciplinary Knowledge: The student has acquired in-depth knowledge of the various concepts and theoretical and practical principles of Chemistry and is aware of their manifestations. A graduate in Chemistry is expected to be thoroughly conversant with all fundamental laws and principle in variety of areas of Chemistry along with their applications and laboratory techniques
	PO2	Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and analyze a complex variety of problems in Chemistry. A graduate in Chemistry is expected to assess, reconstruct and solve the problem
	PO3	Problem Solving: A vital part of Chemistry curriculum is problem solving. The student will be well-equipped to solve complex problems of numerical related to engineering/ Chemistry that are best approached with critical thinking.

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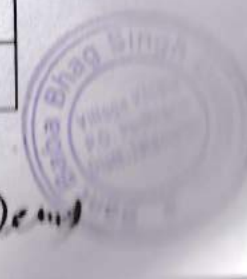
(Dr. Vikas) She
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2	PO4	Scientific /Analytical Reasoning: Students learn to investigate, experiments/ theoretical methods, relate information and interpretation of data based on scientific reasoning. The student will be able to draw logical conclusions based on a group of observations, mathematical techniques and measurements
	PO5	Modern Tool Usage: Increasing the usage of appropriate techniques, resources having interface with computers and use of computers in laboratory work . A student with degree in Chemistry is able to employ knowledge and skill in computers in a variety of situations- data analysis, coding of complex Chemistry problems as well as information retrieval and library use
	PO6	Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity with in universities to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is, " welcoming for all students"
	PO7	Environment & Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
	PO8	Research related skills & Ethics: Develop skills for critically review scientific information and become able to comprehend and write effective reports and design documentation. Able to create a sense of ethical responsibilities among students. The student is aware of what constitutes unethical behavior-- plagiarism, fabrication and misrepresentation or manipulation of data
	PO9	Self-directed Learning: Students are encouraged to accept challenges in Chemistry by information available to them. Various activities/advanced ideas equip the students to find relevant information and educate themselves
	PO10	Individual and Team Work: Leadership is essential in making teamwork into a reality. Working in teams promotes both teamwork and leadership qualities in the student. Teams may comprise of peers in classroom, laboratory or any other team of members from diverse fields. The student is capable of contributing meaningfully to team ethos and goals.
	PO11	Communication Skills: Effective communication is a much desirable attribute across courses. However, a Chemistry student is expected to assimilate technical information about chemistry from various sources and convey it to intended audience, both orally and in writing in an intelligible manner
	PO12	Life long Learning: Having a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.
	Programme Specific Outcomes (PSO)	
	PSO1.	Able to provide chemical nomenclature, classification, structure, reactivity and stereochemistry of organic and inorganic matter.
3	PSO2.	Proficient in organic and inorganic reaction mechanisms and chemical analysis through quantitative/qualitative mode.
	PSO3	Apply modern spectroscopic methods of analysis for chemical characterization of any form of matter.
	PSO4	Employ core analytical and practical experiences of Chemical Sciences for the Societal expectations and solutions for environmental problems.
	PSO5	Proficient in theoretical as well as practical aspects of Electrochemistry, chemical thermodynamics, kinetics, quantum chemistry.
	PSO6	Acquire ability to explain applications of Chemistry relates to the real world in term of advanced synthetic methods, advanced materials and analytical tools.

Dr. Nisha Sharma
(Co-1)

Dr. Vipasha Sharma
(Co-2)



Programme Name:		M.Sc (Hons.) Chemistry/ PG035		
Details of Course Outcomes				
S. No	Semester	Course Name	Course Code	Course Outcomes (The students will be able to)
1	1	Main Group Chemistry	CHM501	CO1 Coherent Knowledge of main group elements
				CO2 Recognition of capability of s-block elements and group 12 elements to form coordination complexes
				CO3 Realization of importance of p-block elements such as silicon as natural silicate materials.
2	1	Organic Reaction Mechanism-I	CHM503	CO1 Understand Coherent Knowledge of mechanistic aspects in nucleophilic ,electrophilic substitution, addition and elimination reactions.
				CO2 Analyze reaction conditions, products formation and mechanisms of some named reactions.
				CO3 Apply various reaction pathways to develop new and notable organic compounds.
3	1	Thermodynamics: Chemical and Statistical Thermodynamics	CHM505	CO1 Understand Coherent Knowledge of different thermodynamic parameters for chemical reactions.
				CO2 Analyze advanced classical and statistical thermodynamics.
				CO3 Interpret irreversible thermodynamics for biological systems.
4	1	Pericyclic Reactions & Photochemistry	CHM507	CO1 Understand the Basic principles of pericyclic & photochemical reactions, photochemistry of carbonyl compounds at different conditions.
				CO2 Analyze correlation diagrams method, PMO approach and FMO approach of pericyclic reactions.
				CO3 Apply Mechanistic and stereochemical aspects of thermally or photochemically driven pericyclic reactions.
5	1	Computers for Chemists-Theory	CSE551	CO1 Understand Coherent Knowledge of use different operating system and their tools easily
				CO2 Apply word processing software, presentation software, spreadsheet software and latex.
				CO3 Analyze use of computers in every field like teaching, industry and research.
6	1	Inorganic Chemistry Practical-I	CHM509	CO1 Acquire Coherent Knowledge of analytical data forTitrimetric and gravimetric analysis of different cations and anions.
				CO2 Understand the principles, and methodology involved in precipitations and its titrations for assaying different ions.
				CO3 Discuss and apply the principles involved in the redox titrations and Prepare different types of inorganic compounds.
				CO1 Adopt safe laboratory practices by handling laboratory glassware, equipment and chemicals.

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Dr. Nisha Sharma
 (Dr. Nisha Sharma)



7	1	Organic Chemistry Practical-I	CHM511	CO2	Understand the basic nature of reagents like reducing agents and oxidizing agents.
				CO3	Apply & propose starting materials, functional groups, mechanism, and typical reaction conditions.
8	1	Computers in Chemistry-Lab-I	CSE553	CO1	Understand about background functioning of System Programs.
				CO2	Use working of the internet for the use of domains, IP addresses, URLs and different web browsers.
				CO3	Acquire knowledge to search information using search engines for different programme.
9	2	Coordination Chemistry	CHM502	CO1	Understand Formation and reaction mechanism of coordination complexes.
				CO2	Analyse Kinetic and thermal stability of coordination complexes.
				CO3	Interpret the electronic and magnetic properties of coordination compounds.
10	2	Organic Reaction Mechanism-II	CHM504	CO1	Coherent knowledge of mechanisms and feasibility of a chemical reaction.
				CO2	Apply mechanistic aspects in nucleophilic and electrophilic substitution.
				CO3	Interpret reaction conditions, products formation and mechanisms of some addition and rearrangement reaction.
11	2	Quantum Chemistry	CHM506	CO1	Acquire Knowledge about Electronic energy states and different operators for molecules.
				CO2	Understand Quantum chemical description of angular momentum.
				CO3	Use Quantum chemical description of chemical bonding, reactivity and their applications in molecular spectroscopy in organic chemistry.
12	2	Spectroscopy: I (Techniques for Structural elucidation of Organic Compounds)	CHM508	CO1	Acquire Coherent and advanced knowledge of the principles and techniques in spectroscopy.
				CO2	Understand electronic, Vibrational, proton NMR & ¹³ C NMR and mass spectrometry methods of analysis.
				CO3	Apply spectroscopic methods (UV, IR, ¹ H-NMR, ¹³ C-NMR & mass spectrometry) in organic structure elucidation.
13	2	Mathematics for Chemists (for B.Sc. Medical students)	MAT 528	CO1	Understand basic numerical methods like order of reaction, method of partial fractions
				CO2	Analyze & interpret the area under a curve using Integral Calculus.
				CO3	Apply solution of linear equations by using Determinants and Matrices.
14	2	Chemistry of biological systems (for B.Sc. Non Medical students)	CHM528	CO1	Acquire basic knowledge about organization and working principles of various components of living cell.
				CO2	Understand basic principles of structure, function, and folding of biomolecules
				CO3	Acquire knowledge of molecular structure and interactions of proteins, carbohydrates, lipids and nucleic acids.
15	2	Organic Chemistry Practical-II	CHM510	CO1	Acquire basic knowledge of organic synthesis of organic compounds.
				CO2	Analyze & Interpret the quantitative analysis of organic compounds.
				CO3	Propose methodologies for the extraction of Organic Compounds from Natural Sources.

Dr. Nishu Sharma
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(Dr. Vibha Sharma)



16	2	Physical Chemistry Practical-I	CHM512	CO1	Acquire basic knowledge about analytical techniques such as conductometric, pH metric and potentiometry techniques.
				CO2	Understand and apply different thermodynamic techniques like viscosity and surface tension measurements for solutions.
				CO3	Analyze determination of solubility of different inorganic and organic salt.
17	2	Inorganic Chemistry Practical-II	CHM514	CO1	Acquire knowledge of basic preparation routes of inorganic compounds.
				CO2	Apply semi-micro qualitative analysis of mixtures & gravimetric analysis for different cations and anions.
				CO3	Apply different types of Potentiometry and pHmetry titrations.
18	2	Research Methodology & Intellectual properties rights	PHY540	CO1	Acquire & Understand significance of IPR, copyright laws in present scenario.
				CO2	Identify a research problem, educational research, interpretation of the results and report writing.
				CO3	Apply role of Intellectual Property Rights (IPR) in research and development.
19	3	Spectroscopy-II (Techniques for Structural elucidation of Inorganic Compounds)	CHM601	CO1	Understand the basic concepts and principles of rotational and vibrational spectroscopic methods.
				CO2	Apply various spectroscopic methods for structure elucidation of different inorganic compounds.
				CO3	Comprehend the basic knowledge of X-ray spectroscopy and physical techniques for analysis of different medical diagnostics.
20	3	Electrochemistry & Surface Chemistry	CHM603	CO1	Acquire basic knowledge of Electrochemistry of electrode electrolyte interface and properties of surfaces or phase boundaries.
				CO2	Understanding basic concepts of electro chemistry, redox processes in electrochemical systems, EMF, pH and their applications
				CO3	Knowledge of Activity and Activity coefficient and Application of homogeneous and heterogeneous catalysis in chemical synthesis
21	3	Organometallics Chemistry and Metal Clusters	CHM605	CO1	Explain basic properties, formation, reaction mechanism of organometallic compound.
				CO2	Understand synthesis, properties, bonding and structures of organometallic compound.
				CO3	Understand the principles behind the formation of metal cluster compounds, stability and application of Inorganic Rings, Chains and cages.
22	3	Environmental Chemistry	CHM607	CO1	Comprehend Basic chemical processes in the air water and soil environment
				CO2	Understand & Propose policies as guidelines regarding different environmental interfaces.
				CO3	Apply different chemical phenomena as applied to environmental interfaces.

Dr. Nisha Sharma
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23	3	Recent Trends in Inorganic Chemistry	CHM609	CO1	Understand electronic structure of a variety of d orbital metal complexes and recent advancements in Inorganic Chemistry.
				CO2	Acquire knowledge of Inorganic Photochemistry, Oxidative-Addition and Migration reactions
				CO3	Use of Transition Metal Compounds with Bonds to Hydrogen and advanced catalysis.
24	3	Pharmaceutical Chemistry & Drug Design	CHM611	CO1	Acquire knowledge of Basic process of drug discovery & drug design
				CO2	Understanding of drug-receptor interactions and various drug mechanisms.
				CO3	Prediction of ligand interactions with the active site of receptor in novel drug design and discovery.
25	3	Bio-Organic Chemistry	CHM613	CO1	Understand structure, function and physicochemical properties of biomolecules.
				CO2	Interpret Structure & Properties of enzymes, Mechanism of Enzyme Action metalloenzymes heme proteins and oxygen carriers.
				CO3	Apply and use of non-heme proteins and therapatic Agents.
26	3	Advance Solid State Chemistry	CHM615	CO1	Gain knowledge of Advanced solid materials, their characteristics and physical functions.
				CO2	Acquire knowledge of different types of materials like Glasses, Ceramics, polymers, Composites.
				CO3	Apply Materials for Solid State Devices and Molecular Conductor.
27	3	Analytical Chemistry	CHM617	CO1	Acquire knowledge of environmental analytical method.
				CO2	Apply semi-micro qualitative analysis of soil, water air and food ingredients
				CO3	Apply different techniques of industrial analysis
28	3	Chemical Kinetics and Chemical Equilibrium	CHM619	CO1	Acquire basic knowledge of Kinetics of a chemical reaction and relation between reactant concentration and time in a reaction
				CO2	Understading basic concepts of Chemical Kinetics, order, molecularity, rate laws of a reaction, temperature dependence of reaction rates and their applications
				CO3	Apply law of chemical equilibrium, van't hoff reaction isotherm and LeChatelier's principle in a chemical reaction.
29	3	Symmetry & Group Theory	CHM621	CO1	Understand Coherent Knowledge of concepts and importance of symmetry
				CO2	group theory to recognize and assign symmetry characteristics to molecules and objects
				CO3	Solve chemical problems and transition metal complexes.
30	3	Physical Chemistry Practical-III	CHM623	CO1	Understand experimental techniques for controlling chemical reactions.
				CO2	Apply and measure various physical and chemical properties of materials.
				CO3	Design & carry out scientific experiments and result interpretation.
				CO1	Investigate various aspects related to chemistry.

Dr. Vishal Sharma
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Dr. Vikash Sharma
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31	3	Seminar & Summer Training	CHM625	CO2	Appreciate the literature and its relevance to his/her topic of interest how to write a report on a given topic.
				CO3	Technical write and presentation on a given topic of research and commercial worth of chemistry.
32	3	Project Part-I (Review of Literature)	CHM629	CO1	Analyze current literature research for research topic of his/her area of expertise.
				CO2	Design a research problem and prepare synopsis.
				CO3	Plan future experiments in the laboratory.
33	4	Chemistry of Natural Products/Heterocyclic Chemistry	CHM602	CO1	Gain Coherent and advanced knowledge of various types of natural products, their biosynthesis
				CO2	Analyse structure, properties and synthetic routes of complex natural products and heterocyclic compounds
				CO3	Acquaint knowledge about heterocyclic compounds, their structure, synthetic routes and elaborate structure and properties of heterocyclics
34	4	Bio-Inorganic Chemistry	CHM604	CO1	Gain Coherent and advanced knowledge of various types of metals, enzymes, photosystems in biology.
				CO2	Acquaint knowledge about the role of electron Transfer in Biology.
				CO3	Analyse structure, function, and physicochemical properties of biomolecules
35	4	Instrumental Methods of Analysis	CHM606	CO1	Understand Coherent and advanced knowledge of various analytical and instrumental methods for chemical characterization and analysis.
				CO2	Cognitive skills to analyse and apply analytical instrumental techniques for identification, separation & characterization of compounds
				CO3	Apply theoretical and practical skills of the instruments for identification/characterization of compounds.
36	4	Nano-Science& Nano Chemistry	CHM608	CO1	Acquire knowledge of Nanotechnology, properties and applications of nanomaterials
				CO2	Cognitive skills to use the methods for fabrication and characterization of nanomaterials.
				CO3	Apply use of carbon nanotubes based nanomaterials and various supramolecular aspects of interaction between two chemical systems
37	4	Green Chemistry	CHM610	CO1	Acquire Coherent knowledge of concepts and tools of green chemistry and their importance in sustainable development
				CO2	Utilize abundantly available precursors for the production of value added chemicals
				CO3	Adopt and design solvent free synthesis strategies, Microwave assisted and sonicator in organic synthesis
		Industrial Chemical analysis & Quality Control	CHM612	CO1	Acquire Coherent and advanced knowledge of the basic of Industrial Chemical analysis & Quality Control processes
				CO2	Analyze Chemical, biological and radiation hazards in laboratory and safety followed during analysis of Special Industrial Material

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Dr. Vikas Sharma
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38	4			CO3	Apply & Design analytical sample preparation and the analyze the clinical samples and chemical Sensors
39	4	Polymer Science	CHM614	CO1	Acquire Coherent knowledge of different polymers, their processing, structure, properties and mechanisms of polymerization.
				CO2	Analyze number, weight and viscosity average molecular weights with various techniques
				CO3	Apply & Design of methodologies for thermoplastic and thermosetting polymers, concept of conducting polymers and their applications
40	4	Chemistry of Materials	CHM616	CO1	Attain basic knowledge of polymers, ceramics, solid state ceramics
				CO2	Analyze the methodologies for fabrication and characterization of nanomaterials, glasses and composites.
				CO3	Interpretation of reaction of organic materials and Materials for Solid State Devices
41	4	Photo Physical Chemistry	CHM618	CO1	Understand photochemistry and photo Physical principles of different processes.
				CO2	Identify and characterize of transient intermediates by ultrafast modern techniques
				CO3	Apply photochemistry and photo Physical principles for different Macromolecules.
42	4	Organic Reactions & Reagents	CHM620	CO1	Comprehensive Knowledge of various reactions, reagents mechanism along with applications.
				CO2	Critical study of reaction mechanism and applications to impart deep insight about various organic reaction pathways
				CO3	Analyse and apply alternative methods of synthesis using different organic reagents.
43	4	Biofuels	CHM622	CO1	Acquire knowledge of current processes for biofuel production from biomass
				CO2	Analyze models of biomass concentration and utilization.
				CO3	Evaluate the possibilities of various application of biofuels as an alternative liquid fuels
44	4	Natural Hazards and Disaster Management	EVS003	CO1	Understand the current overview of natural hazard materials
				CO2	Discuss the physical aspects of vulnerability and elements of risk mapping & assessment.
				CO3	Acquire knowledge of development planning, sustainable development in the context of Climate Change
45	4	Project Part-II	CHM630	CO1	Explore research aptitude & practicalabilty of knowledge gained by student in understanding the basics of Reserach
				CO2	Develop critical thinking through the detailed review of litrature comprehend expertise for writing the research reports in form of review article as well as research publications
				CO3	Equiped for the industrial outreach through the experimental knowledge gained through project work.

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