

(PO) Programme Outcomes of Integrated B.Sc.-M.Sc. Basic Science

The course Integrated Basic Science consists of basic understanding with advancement to applied form. Accordingly, students are encouraged to undertake summer training in University, Institutes and Industry as per the need. Programme outcome is given below:

Integrated B.Sc+M.Sc. Basic Sciences

It's a course which gives strength to the basic concepts of Physics, Chemistry, Biology and Mathematics and advanced courses from third year onwards helps them to expertise in any one field and become independent researchers, provides them the enthusiasm to make impactful contributions in their area of research. Independent research projects empower them to plan meticulously and execute the research projects. Can take up higher studies, train human resource for the nation building and can find application in any organization of repute.

(CO) Course Outcomes

CO's-Integrated B.Sc.+M.Sc. Basic Science

LEARNING OUTCOMES

COURSE STRUCTURE FOR B.Sc./M.Sc. BASIC SCIENCES

1stSemester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-101	World of Biology I: Introduction Biology	70	30	4
	Learning Outcome: The content of this paper is so designed that will provide basic and good knowledge of diversity, evolution, taxonomy, unicellular, multicellular organisms and also students will be able to learn about foundation of physics and chemistry both.			
IBS-101a*	Biomolecules	35	15	2
	Learning Outcome: This paper will help in understanding the basic knowledge of carbohydrates, lipids, proteins and nucleic acid which help in techniques used in biochemistry and research.			
IBS-101b*	Microbial Genetics	35	15	2

	Learning Outcome: The students will attain knowledge about the basic gene constitution of various microbes and also bacterial transduction, conjugation etc. and viral genetics too.			
IBS-102	World of Chemistry I: General Chemistry	70	30	4
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> the fundamental properties of atoms, molecules, and the various states of matter simple quantum mechanical treatments of atoms and molecules the gases laws and Kinetic Theory Stoichiometric calculations involving gas laws of chemical equations to determine the quantities of reactants and products and limiting reagent problems concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other states of matter and how they depend on temperature and pressure as well as how they co-exist in phase equilibrium 			
IBS-102a*	Bioorganic Chemistry	35	15	2
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> metabolism of carbohydrates, lipids, and proteins in humans. They will be able to describe in structures and words the metabolism of sugars through the pathways of glycolysis. different bio synthesis of molecules. 			
IBS-102b*	Chemoinformatics	35	15	2
	Learning Outcome: Students will gain an understanding of: Role of Chemoinformatics in pharmaceutical/chemical research, Molecular Descriptors (1D, 2D and 3D), Chemical Databases – Design, Storage and Retrieval methods, Quantitative Structure Activity/Property/Toxicity Relationship Studies, In-silico ADMET Studies, Docking Studies.			
IBS-103	World of Mathematics I: Basic Mathematics	70	30	4
	Learning Outcome: a student will be able to compute limits derivatives and definite and indefinite integrals of algebraic, logarithmic and exponential functions and Solve problems by using differentiation and integration.			
IBS-103a*	Differentiation, integration and their applications	35	15	2

	Learning Outcome Student will learn about Differentiation integration and their applications in real life problems such as to find the equation of motion of a accelerating body we sue differentiation.			
IBS-103b*	Vector analysis (fundamental)	35	15	2
	Learning Outcome Student will learn about fundamental concepts of vectors.			
IBS-104	World of Physics I:Mechanics	70	30	4
	Students will be able to articulate and describe: <ul style="list-style-type: none"> • Relative motion. Inertial and non-inertial reference frames. • Parameters defining the motion of mechanical systems • Study of the interaction of forces between solids in mechanical systems. • Centre of mass of mechanical systems. • Laws of motion and conservation principles 			
IBS-104a*	Mathematical Physics-I	35	15	2
	<ul style="list-style-type: none"> • Various techniques to solve differential equations • How to use vector calculus in various physics problems. 			
IBS-104b*	Classical Mechanics	35	15	2
	Learning outcome: Student will learn Euler-Lagrange equation from variational principle, constraints and Lagrange multipliers, integrals of motion, symmetries and conservations laws. Hamiltonian formalism: Hamilton equations.			
MPDC-105	Remedial Language	15		1
Total Credits				24+1

2nd Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	

IBS-201	World of Biology II : Introduction of Cell Biology and Biochemistry	70	30	4
	Learning outcome: This paper will help students to attain knowledge about basic cell biology including different cell organelles like Endoplasmic reticulum, Golgi complex etc., hydrogen bonding and most important molecular biology including DNA replication, transcription etc.			
IBS-201a*	Cellular Basis of Structure and Function in Biology	35	15	2
	Learning Outcome: This paper contains the knowledge about the transport of molecules in cell, signal transduction and cell division help to the student about learning and research purpose.			
IBS-201b*	Biophysics I	35	15	2
	Learning Outcome: Students will be able to learn about physics involved in biology including thermodynamics of macromolecules and emphasis of light in biology.			
IBS-202	World of Chemistry II: Physical Chemistry	70	30	4
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> • concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other • states of matter and how they depend on temperature and pressure as well as how they co-exist in phase equilibria • the transport of ions and thermodynamic functions with applications to electron transfer in biological systems. chemical kinetics; how reaction rates are measured and represented in rate laws, and applications of chemical kinetics in studying enzyme mechanisms.			
IBS-202a*	Statistical Thermodynamics	35	15	2
	Learning Outcome: Student will gain the statistical approach of thermodynamics.			
IBS-202b*	Quantum Chemistry	35	15	2
	Learning Outcome: Students will gain an understanding of: account for the basic principles and concepts of quantum mechanics . solve the Schrödinger equation for model systems of relevance within chemistry and physics. describe many-electron atoms with the independent particle model.			
IBS-203	World of Mathematics II: Multi	70	30	4

	Variable Calculus			
	Learning Outcome: Students will be able to: <ul style="list-style-type: none"> • Represent vectors analytically and geometrically. • Evaluate double and triple integrals for area and volume. Differentiate vector fields. • Determine gradient vector fields and find potential functions • Evaluate the problems related to three dimensional geometry. • Evaluate line integrals directly by the fundamental theorems 			
IBS-203a*	Ordinary differential equations	35	15	2
	Learning Outcome student will be able to Analyze basic concept of differential equations , first order differential equations and linear system of differential equations.			
IBS-203b*	Vector calculus	35	15	2
	Learning Outcome student will able to compute line integrals green's theorem surface integrals which is useful in physics and chemistry.			
IBS-204	World of Physics II: Waves and Matter	70	30	4
	Students will be able to: <ul style="list-style-type: none"> • Understand the role of the wave equation and appreciate the universal nature of wave motion. • Understand superposition of harmonic waves. 			
IBS-204a*	Mathematical Physics-I	35	15	2
	Students will be able to: <ul style="list-style-type: none"> • Use, advanced mathematical methods and theories on various mathematical and physical problems. • Understand the Fourier theorem and its applications. • Understand partial differential equations. 			
IBS-204b*	Fluid Dynamics	35	15	2
	Learning outcome: Basic conservation equations of fluid dynamics, compressible and incompressible flows, dimensionless numbers in fluid dynamics.			
MPDC-205	Moral Studies	15		1
Total Credits				24+1

3rdSemester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-301	World of Biology III: Evolution and Ecology	70	30	4
	Learning Outcome: The students will be able to learn more about population genetics aspects such as Hardy Weinberg law including random mating, panmictic population. In ecology they will get knowledge of food chain, food web biodiversity.			
IBS-301a*	Biophysics II	35	15	2
	Learning Outcome: Students will be aware about dynamics of macromolecules, mechano-biology of cells including muscle, nerve and stem cells.			
IBS-301b*	Neurobiology I	35	15	2
	Learning Outcome: This paper include the Knowledge about nervous system, Action potential and transmission of nerve impulse which help to understand the neuroscience and disease related to nervous system.			
IBS-302	World of Chemistry III: Inorganic Chemistry	70	30	4
	Learning Outcome: Students will gain an understanding of: <ol style="list-style-type: none"> a. bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data b. predicting geometries of simple molecules c. the fundamentals of the chemistry of the main group elements, and important real world applications of many of these species 			
IBS-302a*	Heterocyclic chemistry	35	15	2
	Learning Outcome: Students will learn the importance of heterocycles in biological systems and in pharmaceuticals. Students will be able to draw mechanisms for reactions involving heterocycles as starting materials, intermediates and products, and be able to propose syntheses of heterocycles from the major classes. Students will be able to relate significant chemical properties to structure.			
IBS-302b*	Environmental and Green	35	15	2

	chemistry			
	Learning Outcome: Students will gain an understanding of Synthesize and apply concepts from multiple sub-disciplines in environmental chemistry and toxicology. Use technical and analytical skills to quantify the level and effects of xenobiotics in environmental compartments			
IBS-303	World of Mathematics III: Linear Algebra	70	30	4
	Learning Outcome: Student will be able to : <ul style="list-style-type: none"> • Solve system of linear equations • Analyze vectors in ring geometrically and algebraically. • Recognize the concept of the terms span, linear independence , basis and dimension and apply these concepts to various vector spaces and sub-spaces. • Use matrix algebra and related matrices to linear transformation which is useful in programming of many languages in computer. 			
IBS-303a*	Laplace transform	35	15	2
	Learning Outcome Student will learn Laplace transform and inverse Laplace transform which useful in finding the behaviour of different biological fluids using equation motion related to fluids in the form of Differential equations.			
IBS-303b*	Numerical analysis	35	15	2
	Learning Outcome: Student will be able to derive numerical methods for approximation of continuous mathematics and analyze the errors in any such numerical approximation. This is useful in finding erros in different Lab experiments..			
IBS-304	World of Physics III: Electricity & Magnetism	70	30	4
	Learning Outcome: Students will be able to: <ul style="list-style-type: none"> • Understand the relationship between electrical charge, electrical field, electrical potential, and magnetism. • Solve numerical problems involving topics covered. • Understand various network theorems. • Define the magnetic field and magnetic flux, solve technical problems. • Calculate the magnitude and direction of the magnetic field for symmetric current distributions using the Law of Biot-Savart and Ampere's Law 			

IBS-304a*	Quantum Physics	35	15	2
	Learning Outcome: Completion of this course will enable the students to: <ul style="list-style-type: none"> • Understanding of: Importance of quantum mechanics compared to classical mechanics at microscopic level. • Understand various tools to calculate Eigen values and total angular momentum of particles. 			
IBS-304b*	Nanotechnology	35	15	2
	Learning Outcome: The goal is to generate new interest in nanoscience and nanotechnology among students and prepare them with the knowledge and skills <ul style="list-style-type: none"> • Apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale • To develop human resource with specialization in theoretical and experimental techniques required for career in academia and Nano technology driven industry 			
MPDC-305	Community Service	15		1
Total Credits				24+1

4th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-401	World of Biology IV: Biology of Systems	70	30	4
	Learning outcome: The students after studying this particular paper will easily be able to understand and explain about detailed embryogenesis such as different stages morula, blastula, gastrula and organogenesis too. Students will also attain knowledge about regeneration of stem cell and also basic immunology included in this course.			
IBS-401a*	Vaccines	35	15	2
	Learning Outcome: The students will be able to learn about types of vaccines which are prepared from killed and attenuated system and also the mechanism of action and drug resistance.			

IBS-401b*	Neurobiology II	35	15	2
	Learning Outcome: Students will be able to know about the knowledge of different brain imaging function like MRI, PET Scan, emotions, learning and memory help to understand the different diseases in daily life.			
IBS-402	World of Chemistry IV: Organic Chemistry	70	30	4
	<p>Learning Outcome: Students will gain an understanding of:</p> <ul style="list-style-type: none"> the hybridization and geometry of atoms and the three-dimensional structure of organic molecules. the reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry. an understanding of nucleophiles, electrophiles, electronegativity, and resonance. the prediction of mechanisms for organic reactions. <p>how to use their understanding of organic mechanisms to predict the outcome of reactions.</p>			
IBS-402a*	Polymer chemistry	35	15	2
	<p>Learning Outcome: Students will gain an understanding of:</p> <ol style="list-style-type: none"> isolate the key design features of a product which relate directly to the material(s) used in its construction indicate how the properties of polymeric materials can be exploited by a product designer 			
IBS-402b*	Physical Organic Chemistry	35	15	2
	<p>Learning Outcome: Students will gain an understanding of: concepts of acidity, basicity, and pKa; Equilibria, kinetics and mechanisms; Rearrangements; Radical Reactions; Mechanisms in Biological Chemistry; Advanced Molecular Orbital Theory; Stereochemistry and conformational analysis; Thermal pericyclic reactions; Sigmatropic and electrocyclic reactions; Synthesis and Reactions of carbenes.</p>			
IBS-403	World of Mathematics IV: Probability and Statistics	70	30	4
	<p>Learning Outcome: students will be able to :</p> <ul style="list-style-type: none"> Organize, present and interpret statistical data both numerically and graphically. Use various methods to compute the probabilities of events. Analyze and interpret statistical data using appropriate probability distribution. Construct and interpret confidence intervals to estimate means, standard deviations and proportion for populations. 			

	<ul style="list-style-type: none"> Perform a correlation and regression Analysis . 			
IBS-403a*	Dynamics of rigid bodies	35	15	2
	Learning Outcome Student will be able to learn terms position, velocity acceleration , straight line motion, absolute motion, relative motion relative acceleration and motion relative to rotating axes.			
IBS-403b*	Moment of inertia & Conservation of energy	35	15	2
	Learning Outcome: Student will be able to analyze centre of mass, motion of inertia, kinetic energy of a rigid body in a plane and conservation of energy.			
IBS-404	World of Physics IV: Quantum Physics	70	30	4
	Learning Outcome: Completion of this course will enable the student to <ul style="list-style-type: none"> Understand the discrete spectra and wave particle duality. Student will know basic information on uncertainty principal. Understand Schrodinger's equation, complete solution of hydrogen atom Students got an idea of Pauli spin matrices which are very important in nuclear and particle physics as well as atomic and molecular physics 			
IBS-404a*	Atomic and Molecular Physics	35	15	2
	Learning Outcome: After the completion of the course, Students will be able to <ul style="list-style-type: none"> Student will be able to select molecular spectroscopy methods suitable for solving given scientific problem. Student will know basic information on molecular methods (THz) Student will be able to analyze results of measurements using molecular spectroscopy methods. Understand the concept of continuous absorption and emission spectra. 			
IBS-404b*	Electromagnetism	35	15	2
	Learning outcome: Student will be able to learn Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems- vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem. Coulomb's Law – Electric			

	field intensity			
MPDC-405	Ambedkar Studies	15		1
Total Credits				24+1

5th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-501	Animal Physiology I	105	45	6
	Learning Outcome: Students will be required with detailed knowledge of physiology of various systems, about the pumping of heart and its circulation of blood digestion, various nerve and conduction of impulse. Students will be able to understand more about processes E.C.G., Ultrasound.			
IBS-502	Advanced Molecular Biology	105	45	6
	Learning Outcome: Student will be equipped with the knowledge to handle techniques about DNA fingerprinting, Cloning methods, DNA sequencing, making genomic libraries help to handle various problem in life and criminal cases.			
IBS-503	Advanced Cell Biology	70	30	4
	Learning Outcome: Students will be provided with great knowledge of plasma membrane and transport mechanism, cell cycle, cell division along with cytoskeleton.			
IBS-504	Biostatistics	35	15	2
	Learning Outcome: This paper will provide students knowledge about various basic statistics variables. Mean, median, mode and types of various tests as t-test etc.			
IBS-505	Animal Behaviour	35	15	2
	Learning Outcome: The students will attain knowledge of various behavior of animals such as proximate, ultimate, sexual foraging types of behavior and parental care.			
IBS-506	Lab Course	105	45	6
	Learning Outcome: Students have to choose dissertation topic related with the subject and also some experiments such as blood test, parasitic slide preparation etc.			
IBS-507	Advanced Organic Chemistry Laboratory	105	45	6

	Learning outcomes: Student will gain the lab techniques of Separation of ternary quantitative analysis of organic compounds. Electrophilic aromatic substitution reactions			
IBS-508	Symmetry and Group Theory	105	45	6
	<p>Learning Outcome: Students will gain an understanding of:</p> <p>By the end of the module the student should be able to: Recognize symmetry elements in a molecule; State the point group a molecule belongs to; Understand degenerate and non-degenerate representations; Combine matrices and set up matrix for transformations; Carry out linear combinations of orbitals to form molecular orbitals; Apply this to polyatomic systems (e.g. square planar, octahedral) Be familiar with Morse potential energy curves, P/R branches in rotational spectroscopy; Find symmetry species of normal modes of vibrations; Deduce which modes are IR/Raman active; Have a firm grasp of σ, π transitions, Jablonski diagrams; Understand the role of symmetry in electronic spectroscopy, selection rules; Apply orbital symmetry to chemical reactions. This module will develop skills in numeracy and problem solving. The students should develop the ability to apply their knowledge to problems related to those covered in the lectures. The subject specific skill is the acquisition of a theoretical framework which underlies much of spectroscopy.</p>			
IBS-509	Self-assembly in Chemistry	70	30	4
	<p>Learning Outcome: Students will gain an understanding of the principles of main-group chemistry.</p>			
IBS-510	Main Group Chemistry	35	15	2
	<p>Learning Outcome: Students will gain an understanding of: self-assembly and supramolecular chemistry, types of non-covalent interactions, importance of pre-organization, determination of association, problem solving, metal ion-macro-ligand supramolecular structures and metallo-supramolecular polymers. Single & self-complementary system, two, three and four and multiple arm hydrogen bonding systems, switching of recognition functions, hydrogen bonded supramolecular polymers, etc. Guest-host approaches in cyclodextrins, Calixarenes, Molecular rings & Nodes, Rotaxanes and Dendrimers with examples. Anionic, cationic and neutral Micelles, critical micelle concentration (CMC) determination, bolaamphiphilic and application of micelles in drug delivery, etc. Origin of liquid crystals, mesogens self-organization, Types: nematic, smectic and cholesteric liquid crystals and characterization of LC-materials. Self-assembly in DNA, protein and peptides.</p>			
IBS-511	Separation Principles and	35	15	2

	Techniques			
	<p>Learning Outcome: Students will gain an understanding of: Thermodynamics, diffusion rates, mass transfer etc. Solvent extraction, distillations, liquid-liquid extraction and other methods of separation. Types of Chromatography: GC, HPLC, hyphenated techniques. Electrophoresis, centrifugation DNA/Protein separations / purifications. Green Separation process separation using zeolite and polymer membranes. Chiral separations, molecular recognition, molecule imprinting and polymer separations.</p>			
IBS-512	Lab Course	105	45	6
	<p>Learning Outcome: Students will gain an understanding of:</p> <ol style="list-style-type: none"> a. the use of an analytical balance for mass measurement b. the use of graduated cylinders, graduated pipettes, and volumetric pipettes for volumetric measurement c. the use of thermometers and temperature probes d. titrations e. the calibration and use simple spectrophotometers, pH meters, centrifuges, and vortexers f. The analysis of data using a spreadsheet program such as Excel g. how to design and perform experiments to determine the rate, order, and activation energy of chemical reactions by varying concentrations and/or temperature h. methods to measure equilibrium concentrations and equilibrium constants for acid-base, solubility, and complexation reactions given initial concentrations of reactant i. the preparation of buffer solutions at a required pH, given a choice of solutions of acid/conjugate base pairs j. the identification of the absence or presence of a number of cations or anions in solution, using tests based on acid-base, solubility, and complexation equilibria. k. the acquisition of solubility vs. temperature data and the calculation of ΔH, ΔS, and ΔG for dissolving a salt at a given temperature. l. how to set up and use an electrolysis cell to determine the equivalent mass of an unknown metal m. the determination of the molar mass of an unknown nonelectrolyte and an unknown electrolyte from a freezing point depression experiment n. ligand strengths by the stability of the complexes and precipitates formed by the ligands with a given metal ion 			

IBS-513	Group Theory	105	45	6
	<p>Learning Outcome: theory Students will be able to-</p> <ul style="list-style-type: none"> • Assess the properties of implied by the definition of group. • Use various canonical types of groups. • Analyze and demonstrate the examples of subgroups, normal subgroups and quotient groups • Use the concepts of isomorphism and homomorphism for groups. 			
IBS-514	Elementary Geometry	105	45	6
	<p>Learning Outcome student will able to Compare and contrast the geometries of Euclidean and non- Euclidean and will use transformational and axiomatic techniques to prove the theorem. And demonstrate the knowledge of the historical development of Euclidean and non-Euclidean geometries.</p>			
IBS-515	Analysis	70	30	4
	<p>Learning Outcome: Student will be able to :</p> <ul style="list-style-type: none"> • Determine the Riemann integrability and the Riemann-Stieljes Integrability of a bounded function. • Recognize the difference between point-wise and uniform convergence of a sequence of function. • Illustrate the convergence properties of power series. 			
IBS-516	Topics in Algebra	35	15	2
	<p>Learning Outcome: Students will be able to-</p> <ul style="list-style-type: none"> • Assess the properties of implied by the definition of group. • Use various canonical types of groups. • Analyze and demonstrate the examples of subgroups, normal subgroups and quotient groups • Use the concepts of isomorphism and homomorphism for groups. Solve system of linear equations. 			
IBS-517	Topics in Geometry & Topology	35	15	2
	<p>Learning Outcome: Students will be able to:</p> <ul style="list-style-type: none"> • Define and Illustrate the concept of topological spaces and continuous functions • Define and illustrate the concept of product topology and quotient topology. <p style="text-align: center;">This theory is helpful in visualising the model of universe.</p>			

IBS-518	Topics in Discrete Mathematics	105	45	6
	<p>Learning Outcome: Students will be able to:</p> <ul style="list-style-type: none"> • Write and interpret the mathematical notations and mathematical definition. Formulate and interpret statements presented in Boolean logic. • Apply truth tables and the rules of propositional and predicate calculus. Formulate short proofs using the following methods: Direct proofs, Indirect proofs and proof by Contradiction 			
IBS-519	Mathematical Methods in Physics	105	45	6
	<p>Learning Outcome: Upon successful completion of this course it is intended that a student will be able to:</p> <ul style="list-style-type: none"> • Students will demonstrate competence with the basic ideas of Ordinary differential equation and partial differential equation. • Use the method of special function (Legendre, Hermit, Laguerre, and Green Function) to solve problems • Solve a complex analysis and tensor. 			
IBS-520	Astronomy and Astrophysics Electronics I	105	45	6
	<p>Students who have completed this course will:</p> <ul style="list-style-type: none"> • be able to perform basic experiments in astronomy, • be able perform a statistical analysis of observed data, • understand the formation, evolution, death and classification of stars, • understand the physics of stars, including nuclear and neutrino processes, the emission, absorption and transport of radiation, and stellar atmospheres, • have an ability to interpret observations of stars including spectra and binary phenomena. 			
IBS-521	Methods of Experimental Physics	70	30	4

	<ul style="list-style-type: none"> • This paper deals with the study of various phenomenons of Nano science and Nano technology. • First unit describes the free electron theory which can describe various phenomenons. • The last unit describes various synthesis techniques like cluster beam deposition, ion beam deposition, chemical bath deposition techniques etc. • The understanding of the subject leads the students in their research work. 			
IBS-522	Electrodynamics	35	15	2
	<ul style="list-style-type: none"> • After taking this course, students are able to appreciate the need and necessity of four Maxwell equations. • They have applied it for electromagnetic field tensor which is one of the major aspects of theoretical physics. • They have understood the covariance formulation of Maxwell equation. • One of the major advantages of this course is that it is very much related to the real life where the ionosphere is playing very important part. • Students now know the basics of scattering and absorption and relate them to real life phenomena. • They have learnt about wave guides and transmission lines and propagation of waves through them. • Understand the relationship between electrical charge, electrical field, electrical potential, and magnetism 			
IBS-523	Physics Lab IV	35	15	2
	Learning Outcome: Student will learn lab techniques of Skin depth measurement, Generation and transmission of electromagnetic waves (Lecher Wire). Magnetic susceptibility measurement			
IBS-524	Lab Course	105	45	6
	Learning Outcome: The student will has to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			

Total Credits	24
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6th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-601	Plant Biology I	10 5	45	6
	Learning Outcome: This paper include the knowledge about the Introduction of plants, Physiology growth hormone and mineral nutrition which help to the student to understand the breeding techniques, crop improvement and research and socio economic development			
IBS-602	Immunology I	10 5	45	6
	Learning outcome: This paper of immunology will provide detailed knowledge to the students about the natural and acquired immunity including macrophages dendritic cells, B-and T-cell immunity. The students will also be able to learn more about complement system and major histocompatibility complex.			
IBS-603	Advanced Biochemistry I	70	30	4
	Learning outcome: The Paper will help the students to know the role of water and biomolecules in life. The paper also focuses on the structure and functions of biomolecules including protein, Carbohydrates, Nucleic etc. Some other topics such as Thermodynamic principles, Enzyme biochemistry are included which helps in providing the advanced knowledge of Biochemistry. Some biochemistry techniques are also covered which helps the students to know about Lab techniques and Instrumentation part for further research.			
IBS-604	Epigenetics	35	15	2
	Learning outcome: This study will provide students to know how the expression of DNA can be changed without changing the structure of DNA itself and will be able to understand what causes disease and is not only essential to create treatments but also precautions.			
IBS-605	Developmental Biology	35	15	2

	Learning outcome: The students will attain knowledge of evolution of body plans, stem cell biology and tissue repair, Regeneration and nervous system development. The students will also learn embryogenesis in plants and genes controlling embryogenesis.			
IBS-606	Lab Course	10 5	45	6
	Learning outcome: The student has to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			
IBS-607	Quantum Chemistry	10 5	45	6
	Learning Outcome: Students will gain an understanding of: quantum mechanics, wave equation and Schrodinger equation, postulates of quantum mechanics, particle in a box, harmonic oscillator, rigid rotor, hydrogen atom, variational principle, perturbation theory, introduction to many electron systems, electron spin, antisymmetry, Slater determinants, 2-e system, Valence Bond theory, Molecular Orbital theory, Huckel theory, Hartree-Fock theory, post Hartree-Fock methods.			
IBS-608	Physical Chemistry of Solutions	10 5	45	6
	Learning Outcome: Students will gain an understanding of: Thermodynamic Description of mixtures, Partial Molar Quantities, Ideal Solutions, Nonideal solutions, Gibbs-Duhem Relation, Equilibrium constant for solutes, vapour-pressure lowering, Application to biology and polymer science, Electrolytes in Solution, Ionic Liquids, Ionic Mobilities, Dielectric Effect, Ionic Strength, Dissociation of Weak Electrolytes, Debye-Huckel Theory, Activities in more Concentrated Solutions, Polymer and Gel electrolyte, Thermodynamic description of Electrochemical Cells, Nernst equation, Activity Coefficients from EMF's, Equilibrium Constant from EMF's, Chemical Sensors, Fuel Cells, Impact on Biochemistry, Phase Equilibria, Pressure-Temperature Phase Diagrams, Phase Rule, Immiscible Liquids, Eutectic Formation, Solid-Compound Formation, Three-Component, Solid-Liquid Systems, Liquid-vapor, Pressure-Composition Diagrams, Boiling-Point Diagrams, Distillation, Adsorption of Gases, Supercritical fluids, Impact on Materials Science..			
IBS-609	Fundamentals of Molecular Spectroscopy	70	30	4

	Learning Outcome: Students will gain an understanding of the use of nuclear magnetic resonance spectroscopy, mass spectrometry and infrared spectroscopy, ESR spectroscopy for organic structure elucidation			
IBS-610	Transition Metal Chemistry	35	15	2
	Learning Outcome: Students will gain an understanding of: Identify the principles, structure and reactivity of selected coordination complexes Interpret their electronic spectra and magnetic properties.			
IBS-611	Organic Synthesis – I	35	15	2
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> • concept of protecting of different functional groups so that can use in the synthesis of desired medicinal molecules. • Formation of sigma and pi bonds and related reactions. 			
IBS-612	Lab Course	10 5	45	6
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> • apply basic techniques used in the organic laboratory for preparation, purification and identification of organic compounds. • employ the major techniques used in organic chemistry laboratory for analyses such as melting point determination, extraction, chromatography, infrared spectroscopy, distillation and chemical characterization tests. • synthesize at least one organic compound will be synthesized and identify the corresponding alteration in the functional groups. • correctly calculate reaction yield for relevant lab experiments. • analyze the given procedure of an experiment and suggest or recommend improvements. • apply safety rules in the practice of laboratory investigations. develop better understanding of the organic chemistry behind everyday observations such as the action of soap, or application of color dyes on variety of fabrics. 			
IBS-613	Vector Spaces, Rings and Modules	10 5	45	6

	<p>Learning Outcome: Students will be able to-</p> <ul style="list-style-type: none"> Analyze vectors in ring geometrically and algebraically. Recognize the concept of the terms span, linear independence, basis and dimension and apply these concepts to various vector spaces and sub-spaces. <p>Use of matrix algebra and related matrices to linear transformation which is useful in programming of many languages in computer.</p>			
IBS-614	<p>Measure Theory and Integration</p> <p>Point Set Topology</p>	10 5	45	6
	<p>Learning Outcome student will be able to define lebesgue measure Algebra and sigma Algebra of a set . and will also Learn about Canter's set Cantor's ternary function , integrability, etc. Determine convex function , General measure integration of measurable functions</p>			
IBS-615	<p>Graph Theory</p>	70	30	4
	<p>Learning Outcome: a student will be able learn about different types of graphs and their applications in real life situations.</p>			
IBS-616	<p>Ordinary Differential Equations</p>	35	15	2
	<p>Learning Outcome: Students will be able to Solve problems in ordinary differential equations, dynamical systems, stability theory, and a number of applications to scientific and engineering problems.</p>			
IBS-617	<p>Topics in Algebra</p>	35	15	2
	<p>Learning Outcome: Students will be able to use matrix algebra and related matrices to linear transformation which is useful in programming of many languages in computer.</p>			
IBS-618	<p>Topics in Geometry & Topology</p>	10 5	45	6
	<p>Learning Outcome: Students will be able to:</p> <ul style="list-style-type: none"> Define and Illustrate the concept of topological spaces and continuous functions Define and illustrate the concept of product topology and quotient topology. Define and illustrate the axioms of separation axioms. <p>Define Connectedness and compactness.</p>			
IBS-619	<p>Quantum Mechanics I</p>	10	45	6

		5		
	<ul style="list-style-type: none"> • After taking this course students will be able to appreciate the beauty of quantum mechanics. They will know all types of representations of operators and ways to apply them in different problems. • The most important thing students learned from this course was how to solve the hydrogen atom problem by using quantum mechanics. • Students learned about time independent degenerate and non degenerate perturbations and to apply them in harmonic oscillator. 			
IBS-620	Statistical Mechanics I	10 5	45	6
	<p>On completion of this course a student should be able to:</p> <ul style="list-style-type: none"> • Define and discuss the concepts of microstate and macrostate of a model system • Define and discuss the concepts and roles of entropy and free energy from the view point of statistical mechanics • Apply the machinery of statistical mechanics to the calculation of macroscopic properties resulting from microscopic models of magnetic and crystalline systems • Define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltzmann distribution • Apply the Fermi-Dirac distribution to the calculation of thermal properties of electrons in metals 			
IBS-621	Nonlinear Dynamics	70	30	4
	<p>Learning Outcome: Student will be able to determine Nonlinear dynamical systems: classification, chaos, features of chaos, continuous and discrete dynamical systems; 1-d flows: fixed points and stability, linear stability analysis, bifurcations, flows on a circle, population dynamics; 2-d flows: classification of fixed points, stability analysis, limit cycles, bifurcations, predator-prey systems; higher-dimensional systems: stability, attractors, bifurcations, chaos, Lorenz system, Rossler system, pendulum.</p>			
IBS-622	Electronics II	35	1 5	2

	<p>After the completion of the course, Students will be able to</p> <ul style="list-style-type: none"> • Understand the fundamentals of converting from one number system to another. • Represent signed decimal numbers in 2's complement form, and vice versa. • Explain the basic logic operations of NOT, AND, OR, NAND, NOR, and XOR. • Apply the laws of Boolean algebra and Boolean algebra expressions. • Understand the basic electronics of logic circuits, counters, registers and be able to use integrated circuit packages. 			
IBS-623	Group Theory in physics	35	1 5	2
	Learning Outcome: This covers Introduction to discrete groups, Lie groups and Lie algebras, Lie algebras in particle physics, discrete and continuous symmetries in nature, symmetries and conserved quantities, gauge symmetries and fundamental forces.			
IBS-624	Lab Course	10 5	4 5	6
	Learning Outcome: The student will have to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			
Total Credits				24

7th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-701	Biology and Disease	105	45	6

	Learning Outcome: Students will be more aware and get more knowledge about various dreadful and important diseases like cancer, AIDS and various fungal, bacterial and parasitic diseases. The students will also know more about precautions and preventive measures.			
IBS-702	Plant Biology II	105	45	6
	Learning Outcome: This paper will help in understanding the knowledge about the tissue culture, crop improvement tool, breeding techniques and secondary metabolites help in socio economic development.			
IBS-703	Structural Biology	70	30	4
	Learning Outcome: Students will be equipped with various experimental techniques such as X-ray crystallography, electron microscopy, recombinant technology and purification tools to isolate biomolecules.			
IBS-704	Animal Physiology II	35	15	2
	Learning Outcome: This paper will provide more information about the physiology of sub-mammalian vertebrates to the students. Nervous and sensory systems across various invertebrate groups and respiration, digestion, moulting, sensory, nervous and neuroendocrine systems and reproduction in insects will also provide knowledge about the lower groups of animals.			
IBS-705	Immunology II	35	15	2
	Learning Outcome: After studying this paper the students will be able to learn and explain molecular interactions between the T cell receptor and MHC molecules; immune synapse, polyspecificity of T cell receptor recognition, molecular mimicry and epitope spreading; T cell memory; Peripheral tolerance and regulatory lymphocytes; Interactions between the immune and the nervous systems.			
IBS-706	Lab Course	105	45	6
	Learning Outcome: The student has to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			
IBS-707	Advanced Molecular Spectroscopy	105	45	6
	Learning Outcome: Students will gain an understanding of: The course will provide an introduction to modern optical spectroscopic and imaging techniques and their applications to biology and chemistry. First part of the course will be an introduction to fundamental concepts of light-matter interaction,			

	lasers and laser systems, detectors and other relevant aspects of instrumentation necessary for spectroscopy and imaging. In the second part of the course we will discuss various modern spectroscopic techniques. Discussion of each technique will be followed by examples from classic and contemporary literature.			
IBS 708(O)/712(N)	Organic Synthesis – II			
	<p>Learning Outcome: Students will gain an understanding of: Formation of carbon-carbon single bonds, Organometallic reagents, synthesis of carbocyclic systems, sketches of synthesis, tactics in organic synthon approach, disconnection approach for multiple step syntheses, functional group interconversions, synthesis of heterocycles: ring-closing reactions; asymmetric synthesis, chiral pool synthesis, chiral auxiliary, organocatalysis, Desymmetrisation, total synthesis of natural products.</p>			
IBS-708	Bioinorganic Chemistry	105	45	6
	<p>Learning Outcome: Students will gain an understanding of: Interpret their electronic spectra and magnetic properties. Utilize the principles of transition metal coordination complexes in understanding functions of biological systems.</p>			
IBS-709	Molecular Modelling and Simulation	70	30	4
	<p>Learning Outcome: Students will gain an understanding of:</p> <ol style="list-style-type: none"> formulate the basis for and the most important approximations in key molecular computational models. choose computational model in various chemical problems. apply modern molecular-level software on presented problems. assess computational results critically. 			
IBS-710	Advanced Physical Chemistry	35	15	2
	<p>Learning Outcome: Students will gain an understanding of: Building of molecules using Gaussview: Calculation of energy, structure and vibrational frequencies using Gaussian software, Visualization of geometry, orbitals, vibrations and spectra using Gaussian software, Contact angle measurement on hydrophobic and hydrophilic surface, Synthesis and spectroscopic characterization of metallic nanostructures, Raman spectroscopic studies of CCl₄, Lithographic patterning, Study of an oscillatory reaction by Emf, or (and) absorbance measurement, To study the fluorescence quenching of Anthracene by CCl₄ in n-hexane or (and) ethanol.</p>			
IBS-711	Solid State Chemistry	35	15	2

	Learning Outcome: Students will gain an understanding of the subject for further study			
IBS-712	Lab Course	105	45	6
	<p>Learning Outcome: Students will gain an understanding of:</p> <ol style="list-style-type: none"> the use of an analytical balance for mass measurement the use of graduated cylinders, graduated pipettes, and volumetric pipettes for volumetric measurement the use of thermometers and temperature probes titrations the calibration and use simple spectrophotometers, pH meters, centrifuges, and vortexers The analysis of data using a spreadsheet program such as Excel how to design and perform experiments to determine the rate, order, and activation energy of chemical reactions by varying concentrations and/or temperature methods to measure equilibrium concentrations and equilibrium constants for acid-base, solubility, and complexation reactions given initial concentrations of reactant the preparation of buffer solutions at a required pH, given a choice of solutions of acid/conjugate base pairs the identification of the absence or presence of a number of cations or anions in solution, using tests based on acid-base, solubility, and complexation equilibria the acquisition of solubility vs. temperature data and the calculation of ΔH, ΔS, and ΔG for dissolving a salt at a given temperature. how to set up and use an electrolysis cell to determine the equivalent mass of an unknown metal the determination of the molar mass of an unknown nonelectrolyte and an unknown electrolyte from a freezing point depression experiment ligand strengths by the stability of the complexes and precipitates formed by the ligands with a given metal ion 			
IBS-713	Galois Theory	105	45	6
	Learning Outcome: Students will learn about Field, extension field, Galois Group and its application . This theory is applicable in various programming language.			
IBS-714	Functional Analysis	105	45	6
	Learning Outcome student will learn about linear spaces which is nothing but vector space but approach is different, l-p spaces , normed linear spaces, and other important spaces which are the extension of topological spaces.			

IBS-715	Differential Geometry	70	30	4
	<p>Learning Outcome: Student will be able to:</p> <ul style="list-style-type: none"> • Compare and contrast the geometries of Euclidean and non- Euclidean • Learn the geometrical aspects like curvature, torsion with help of differentiation techniques. 			
IBS-716	Algorithms	35	15	2
	<p>Learning Outcome: Student will learn about different types of algorithms which are useful in different programming languages and data analysis and experimental techniques.</p>			
IBS-717	Topics in Algebra	35	15	2
	<p>Learning Outcome: Students will be able to Compute with the characteristic polynomial, eigenvectors, eigenvalues and eigen spaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result,</p>			
IBS-718	Topics in Geometry & Topology	105	45	6
	<p>Learning Outcome: Students will be able to:</p> <ul style="list-style-type: none"> • Define and illustrate the concept of topological spaces and continuous functions, • Define and illustrate the concept of product topology and quotient topology, • Prove a selection of theorems concerning topological spaces, continuous functions, product topologies, and quotient topologies, • Define and illustrate the concepts of the separation axioms, • Define connectedness and compactness, and prove a selection of related theorems, and <p>Describe different examples distinguishing general, geometric, and algebraic topology.</p>			
IBS-719	Quantum Mechanics II	105	45	6
	<ul style="list-style-type: none"> • After studying this course, students can calculate the ground state and excited state energies of various real life systems by using Principle, WKB method and perturbation methods. • Students will be knowing about the Einstein's coefficients and relating them to lasers. 			

	<ul style="list-style-type: none"> • They know about scattering in two different frames and can easily calculate scattering amplitude and scattering cross section. • Students can write total energy and wave function as Slater determinant for system of identical fermion. 			
IBS-720	Statistical Mechanics II	105	45	6
	<ul style="list-style-type: none"> • Understand the kinetic theory of gases: Maxwell –Boltzmann distribution law, Brownian motion etc. • Understand the behaviour of real gases. 			
IBS-721	Computational Physics	70	30	4
	<p>After the completion of the course, Students will be able to</p> <ul style="list-style-type: none"> • Understand the theoretical and practical aspects of the use of numerical analysis. • Proficient in implementing numerical methods for a variety of multidisciplinary applications. • Establish the limitations, advantages, and disadvantages of numerical analysis. • Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations 			
IBS-722	Quantum Information	35	15	2
	Learning Outcome: Student will be able to learn Fundamental Concepts-Qubits and their measurements, superdense coding, ensembles, Schmidt decomposition, Bell inequality.			
IBS-723	Condensed Matter Physics I	35	15	2
	<p>After the completion of the course, Students will be able to</p> <ul style="list-style-type: none"> • Understand the physics behind structural properties of the solids. • The properties of solids with proper understanding. • Pursue the research work in the field of material science and nanotechnology 			

IBS-724	Lab Course	105	45	6
	Learning Outcome: The student will has to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			
Total Credits				24

8th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-801	Microbiology	10 5	45	6
	Learning outcome: This paper provides the knowledge of basic concepts of microbiology include microbial diversity, taxonomy and classification. Students also study the role and importance of micro-organisms in human life, about Biodegradation and Bioreactor. Such topics are helpful to move further in various Industrial, Pharmaceutical other research sectors.			
IBS-802	Advanced Biochemistry II	10 5	45	6
	Learning outcome: Students will be able to learn more about carbohydrate, protein and fat metabolism. This paper will also improve knowledge of students about different metabolism pathways and different processes such as glycolysis, gluconeogenesis pathway, amino acid biosynthesis and urea cycle.			
IBS-803	Bioinformatics & Computational Biology	70	30	4
	Learning outcome: The students will be equipped with the knowledge to prepare sequences analysis (pair wise alignment, multiple sequence alignment, motif discovery, gene annotation), inferring phylogenetic trees (UPGMA, neighbor-joining, maximum parsimony, maximum likelihood), analysis of next generation sequencing data.			

IBS-804	Genome Biology	35	15	2
	Learning outcome: The students will attain knowledge of nucleic acid, protein structure and chemistry. FISH methods, chromosome painting studies and molecular cytogenetics, copy number variations (CNV), array-comparative genomic hybridization (a-CGH), Chromosome conformation capture, 3C, 4C and Hi-C; microarrays, next generation DNA and RNA Sequencing.			
IBS-805	Mathematical Biology	35	15	2
	Learning outcome: This paper will provide information about the relationship of mathematics and biology, such as modeling in neuroscience (the classification of spiking activity based on different bifurcation scenarios), enzyme kinetics and Michaelis Menten equations.			
IBS-806	Lab Course	10 5	45	6
	Learning Outcome: The student has to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.			
IBS-807	Structural Methods and Analysis	10 5	45	6
	Learning outcome: The paper focuses the Instrumentation part and the Structural Methods and Analysis techniques that may help the students to learn the biological techniques which would be beneficial for their further research work. The course will also play an important role in understanding the biological macromolecules with their functions with the help of advanced techniques.			
IBS-808	Statistical Thermodynamics	10 5	45	6
	<ul style="list-style-type: none"> • Learning Outcome: Students will gain an understanding of: • To apply distribution function to quantum and classical systems • To evaluate thermal properties of solids using statistical approach • To classify magnetic and superconducting behaviour of solids 			
IBS-809	Medicinal Chemistry	70	30	4
	Learning Outcome: Students will gain an understanding of: <ul style="list-style-type: none"> • enzyme structure, inhibitors, types of inhibitors and their use in drug designing. • concept of designing the drugs 			

IBS-810	Advanced Materials Science	35	15	2
	<p>Learning Outcome: Students will gain an understanding of:</p> <p>Ability to apply knowledge of mathematics, science, and engineering to solve problems related to materials science and engineering.</p> <p>Ability to design and conduct experiments, as well as to analyze and interpret data using statistical, computational, or mathematical methods.</p> <p>Ability to collaborate effectively on multidisciplinary teams.</p> <p>Ability to communicate effectively in written and oral formats.</p> <p>Broad education necessary to understand the impact of engineering and scientific solutions in a global, economic, environmental, and societal context.</p>			
IBS-811	Organometallic Chemistry: Principles and Applications	35	15	2
	<p>Learning Outcome: Students will gain an understanding of:</p> <p>Organometallic compounds have been widely used in industry. Major industrial processes include hydrogenation, hydrosilylation, hydrocyanation, olefin metathesis, alkene polymerization, alkene oligomerization, hydrocarboxylation, methanol carbonylation, and hydroformylation. Organometallic complexes are also used in small-scale fine chemical synthesis as well, especially in cross-coupling reactions that form carbon-carbon bonds, e.g. Suzuki-Miyaura coupling, and Sonogashira coupling.</p>			
IBS-812	Lab Course	10 5	45	6
	<p>Learning Outcome: Students will gain an understanding of:</p> <ul style="list-style-type: none"> the planning and implementation of advanced organic reactions, purification of molecules, FTIR, uv-vis, laser methods etc.. reporting of experimental results (including error analysis) in a publication-style (journal paper) an appreciation for modern problems and scientific controversies in physical chemistry 			
IBS-813	Algebraic Number Theory	10 5	4 5	6
	<ul style="list-style-type: none"> Learning Outcome: Student will be able to Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization, 			

	<ul style="list-style-type: none"> Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues, Formulate and prove conjectures about numeric patterns, and Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems. 			
IBS-814	Complex Analysis	10 5	4 5	6
	<p>Learning Outcome student will be able to</p> <ul style="list-style-type: none"> Analyze sequences and series of analytic functions and types of convergence, Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, and Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem. 			
IBS-815	Topics in Geometry & Topology	70	3 0	4
	<p>Learning Outcome: Student will be able to:</p> <ul style="list-style-type: none"> Define and illustrate the concept of topological spaces and continuous functions, Define and illustrate the concept of product topology and quotient topology, Prove a selection of theorems concerning topological spaces, continuous functions, product topologies, and quotient topologies, Define and illustrate the concepts of the separation axioms, Define connectedness and compactness, and prove a selection of related theorems, and Describe different examples distinguishing general, geometric, and algebraic topology. 			
IBS-816	Topics in Discrete Mathematics	35	1 5	2
	<p>Learning Outcome: Student will be able to:</p> <ul style="list-style-type: none"> Write and interpret the mathematical notations and mathematical definition. Formulate and interpret statements presented in Boolean logic. Apply truth tables and the rules of propositional and predicate calculus. 			

	<ul style="list-style-type: none"> Formulate short proofs using the following methods: Direct proofs, Indirect proofs and proof by Contradiction. Demonstrate the working knowledge of Set notation and Elementary Set operations and logics. 			
IBS-817	Topics in Algebra	35	1 5	2
	<p>Learning Outcome: Student will be able to:</p> <ul style="list-style-type: none"> Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces, Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism, Compute with the characteristic polynomial, eigenvectors, eigenvalues and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result, Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization, and Identify self-adjoint transformations and apply the spectral theorem and orthogonal decomposition of inner product spaces, the Jordan canonical form to solving systems of ordinary differential equations. 			
IBS-818	Topics in Applicable Mathematics	10 5	4 5	6
	<p>Learning Outcome: student will learn different mathematical techniques in different field of mathematical modelling , Science and technology.</p>			
IBS-819	Classical and Quantum Optics	10 5	4 5	6
	<ul style="list-style-type: none"> Understand interference and diffraction (Fraunhofer and Fresnel diffraction) Understand optical phenomena such as polarization. Through the lab course, understand the principles of measurement and error analysis and develop skills in experimental design. 			
IBS-820	Nuclear and Particle Physics	10 5	4 5	6
	After the completion of the course, Students will be able to			

	<ul style="list-style-type: none"> • Students shall learn about the knowledge of particles. • Significance of various decays tells the students about the nuclear process. • It will teach the students about the spin parity concept & magic no. Related to shell. • About the scattering process how it will occur. 			
IBS-821	Advanced Materials Science	70	3 0	4
	<p>After the completion of the course, Students will be able to</p> <ul style="list-style-type: none"> • Understand the Metals, Alloys, Insulators, Polymers, Semiconductors, Composites, Liquid Crystals, Quasi Crystals. • Defects in Solids – Point, Line and Volume or Bulk Defects. • Study of Mechanical, Thermal, Optical and Magnetic. 			
IBS-822	Condensed Matter Physics II	35	1 5	2
	<ul style="list-style-type: none"> • The objective of the paper is to aware the students about the field of Condensed matter physics. • This paper enable the students to understand about the crystal structure, interaction with X-ray, lattice vibrations, defects, electronic properties and the magnetic properties etc. • It also helps the students to understand various properties about crystals. • This paper deals with the study of structural properties of solids 			
IBS-823	Gravitation and Cosmology	35	1 5	2
	<p>Learning outcome: Introduction to four-vectors, Principle of equivalence, Einstein's equation from action principle and its basic properties, Schwarzschild solution and classical tests of relativity; basic ideas of black hole physics, introduction to gravitational waves. Basic introduction to contents and scales in the universe, Friedmann metric, dynamics of the FRW universe and elements of cosmology.</p>			
IBS-824	Lab Course	10 5	4 5	6

	Learning Outcome: The student will have to identify, talk to and mutually agree on a research project before registering for this course. The scope, duration, structure, expectations, and evaluation criteria for the course are decided by the project supervisor.
Total Credits	24

9th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-901	Research project and thesis	15 0	-	6
	Learning Outcome: In this topic students will be supposed to carry out field/ laboratory training cum experimental works and prepare a corresponding report along with a research proposal for future career. The area should include from basics to latest developments and discoveries which will impart a broad training in various disciplines of life sciences and biotechnology, these students will be able to pursue careers in pharmaceutical industries, research laboratories, clinical research organizations, school colleges and Universities as researcher or academicians..			
IBS-902	Research Methodology	10 5	45	6
	Learning Outcome Student will learn about General research, Computer applications, GLP and Bio safety, IPRE and Bioethics, and laboratory courses.			
IBS-903	Biostatistics and Bioinformatics	10 5	45	6
	Learning Outcome: student will learn about general statistics and probability, population and sampling theory, experimental design and bioinformatics tools.			
IBS-904	Introduction to Computing	10 5	45	6
	Learning Outcome: student will learn about different programming languages which			

	are useful in various research fields.
Total Credits	24

10th Semester

Course Code	Course Title	Maximum Marks		Credits
		End Semester	Sessional	
IBS-1001	Research project and thesis continued	15 0	-	6
	Learning Outcome: Students will supposed to be carry forward their field/ laboratory training cum experimental works which they have done in IX semester.			
IBS-1002	Study tour	10 5	-	6
	Learning Outcome Students are required to visit research institute for real exposure in subject and qualitative interactions.			
IBS-1003	Viva-voce	10 5	-	6
	Learning Outcome: Students Will learn communication and expression ability			
IBS-1004	Field/ Industrial attachment	10 5	-	6
	Students are encouraged to undertake research on their area of interest , it acquaints students with identification of a research topic, research planning and its execution. Besides this student learn the morality and ethics in publication.			
	Total Credits			24

Total credits: 240 + 4

PROGRAMME SPECIFIC OUTCOMES (PSOS)

Students and parents are oriented at the time of admission about the outcome of the course, Students are made aware of the scope of the subject in industries, research institutes, entrepreneurship during teaching and practical hours. Interaction meetings with various visitors (subject expert) coming to the Department as well as examiners are arranged for the guidance of the students. Students are also encouraged to undertake societal development programmes by way of community service in selected villages (Bengali kheda, Raising kheda, Lucknow). Confidence level is enhanced by arranging seminars for students in the time table where students give seminars on popular topics in the subject, students are encouraged to think independently, plan research separately during dissertations, arranging subject based quiz competition, subject based rangoli and poster competition, current science based debate and cultural eve to bring out the in-built talent in the students. Students are encouraged to organise these activities under the guidance of faculty members. By this way, students are empowered not only in the subject but also in other extra-curricular activities. Interaction meeting with students are also planned to relieve the stress and sharing their problems, second week of the month or as the need arises. Students are encouraged to undergo summer training during vacations in their related fields. Students are also encouraged to participate in seminars, visit to research institutions is arranged where they get a chance to interact with the researchers. Various committees exist at the Course level where students are also the members right from grievance, gender parity, cultural , remedial coaching, alumni, parents teachers , admission promotion committee's etc. WEBINARS are also arranged by the experts for motivation.

Students are continuously encouraged to participate in various activities of the University like NCC, Social Service, cultural activities and sport activities and have brought laurels to the Department.

PROGRAMME SPECIFIC OUTCOME FOR ALL COURSES OF THE DEPARTMENT

Students coming out after completing the degree from the five year degree programme are equipped with basic as well as advanced knowledge. Besides this integration of science with society through community development programmes help students not only to become independent researchers, regain innovative ideas, plan and execute them but also become a good human being ready to help the society and help in the overall development of the nation. They are trained to take up self employment and thus help in job creation. Besides this, they can work in collaboration with industries, take up higher studies, provide consultancies, become academicians and take up higher research.