Paper wise Learning Outcomes of the Course

Annual (1+1+1) System (All Years)

Subject: Botany (UG)

Session: 2016-17

Programme Outcome	Students will gain the knowledge of the diverse biological functions of plants and the role plants play as a major group of living organism.
Programme Specific Outcomes	Students will learn about the diverse biological functions of plants and the role plants play as a major group of living organism as well as learn how to use that knowledge for the use of the common masses.

Paper wise Learning Outcomes

Paper 1	Phycology, Mycology, Bryology, Pteridology: Study of nutrition, growth, range of thallus organization, classification, metabolism, reproduction, systematic position and economic importance of algae. Fungi, Bryophyte & Pteridophytes. Identification of various algae Fungi, Bryophyte & Pteridophytes.
Paper 2	Gymnology, Palaeobotany, Morphology, Anatomy: Study of different characteristics, reproductive structures and economic importance of gymnosperms. Concepts about different kinds of tissues in plants, difference between meristematic and permanent tissues, simple and complex tissues. Structures of dicot and monocot root, stem, leaves.

	Concept and mechanism of secondary growth in plants, concepts about embryo and endosperms, are discussed.
Paper 3 (Practical)	Corresponding to Paper-I and Paper-II: This Practical paper includes hands on training of the students to cut section of plant specimens for the preparation of both temporary as well as permanent slides after suitable staining. Fossil slides and morphological aspects of angiosperms are studied.
Paper 4	This paper is completely in line with the UGC Model Curriculum 2011 and provides integrated knowledge about the different molecules found not only in plants as well as other domains of life in addition to the range of structures found inside the different types of living cells along with the knowledge of their corresponding functional roles.
Paper 5	The range of the most diverse and the most highly evolved group of plants i.e. the Angiosperms is addressed in this paper, with respect to their systematic positions, their economically important members and their phylogenetic and evolutionary nuances as well as a portion being dedicated to the interactions of different plants with and in the environment they inhabit.
Paper 6 (Practical)	Includes a cumulative analysis and study of important experiments of plants pertaining to their Cell Biology, Biochemistry, Systematics, and Ecology.
Paper 7	Intensively dealing with the study of the composition and behaviour of genes as well as the different molecules they influence and regulate and the biology of the latter.

Paper 8	A very interesting mixture of the physiological as well as the numerical aspects of the plants.
Paper 9	In tune with the current trends in biological methods, topics like rDNA technology and tissue culture are taught. Along with the aforementioned topics of Biotechnology, this paper also includes topics related to plant diseases and an additional portion on the different types of microbes and certain aspects of their biology.
Paper 10 (Practical)	In this paper, knowledge is imparted to the students about different mechanical section cutting techniques as well as techniques used in plant breeding. Along with the above students also learn methods to estimate the rates of various life processes of plants and also, the different methods of biostatistics prevalent in plant sciences.
Paper 11 (Practical)	Practical aspects of Microbiology and Plant Pathology are found in this paper.

Year-2016-17

Program Outcomes

Annual 1+1+1 system

(Part-I) Honours Paper 1	Classes in molecular and cellular biophysics, thermodynamics, microscopy and studies on biomolecules prepare students to start tackling the unsolved problems plaguing scientists at the intersection of life sciences and physical sciences. Our laboratory paper prepares students to conduct independent research and write scientific papers. Our experiences enable students to explore the frontiers of biophysics research, learn valuable scientific communication skills, and develop quantitative problem-solving skills. On completion of the paper, students are able to: 1.Get an idea about the historical events in microbiology 2. Understand the diversity in microbiology 3. Know the scope of Microbiology 4. Understand the taxonomic classification of microorganisms 5. Know parts of microscope and its types and understand principle, working, ray diagram and application of advance microscopes. 6. Develop fundamental knowledge about various biomolecules 7. Concept of bioenergetics
Paper 2	On completion of the paper, students are able to: 1.Understand concepts of growth and reproduction of bacteria 2. Know anatomy of prokaryotic cell 3. Know structural detail of eukaryotic cell 4. Understood various parts of cell and its importance
Paper-3 (Practical)	On completion of this paper, The students will define principle and Handling of Basic Microbiological Instruments Students will describe the fundamental understanding of the working of instruments, various staining techniques and its applications. Students can demonstrate an usage of different techniques for analysis and detection

	Critical analysis and evaluation of published research in the field of microbial techniques and biochemistry.
(Part-II) Honours Paper 4	The microbe use many different types of metabolic strategies and species can often be differentiated from each other based on metabolic characteristics. On completion of the paper, students are able to: 1.Get acquainted with various sterilization techniques 2. Use various method to control microbes. 3. Gather theoretical background of microbial cultivation 4. Understand various specialized techniques such as pasteurization 5. Understand the basic concepts related to enzymes 6. Qualitative and quantitative enzyme assay 7. Effect of environmental factors on enzyme 8. Enzyme kinetics and various biochemical pathway Microbial Metabolism 10. Anabolism and catabolism with examples.
Paper 5	This paper includes molecular biology and virology. It comprises of the interactions of different biomolecules in cells and their roles in life processes. The studies of genes and different molecules they regulate have been also included in this paper. On completion of the paper, students are able to: 1.Understand concept of genes and chromosomes, 2. Familiar with concept of mutations 3. Acquire knowledge and understanding the concepts of Microbial genetics, Molecular biology, 4. Concept of tumor immunology, type of tumors, immune mechanisms against tumors.
Paper-6 (Practical)	This paper includes the study of the growth curve of *E. coli* by tubidiometric and standard plate count methods, calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data, effect of temperature on growth of *E. coli*, effect of pH on growth of *E. coli* and demonstration of minimum inhibitory concentration by Phenol coefficient test.
Part-III Honours Paper 7	By studying immunology students are able to learn how immunology-the study of human immune system which controls infections and provides immunity against microorganisms-can apply to a range of areas in the biomedical sciences. The goal of this paper is to provide students basic knowledge of environment and their role in life sustenance. The students can identify and analyze environmental problems as well as the risks associated with them.

Paper 8	Upon successful completion of the paper, students are expected to be able to: 1. Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products 2. Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods 3. Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage 4. Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods. 5. Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries 6. Identify ways to control microorganisms in foods and thus know the principles involving various methods of food preservation 7. Understand of the basis of food safety regulations and Discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food 8. Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
Paper 9	After completion of the paper the students will be able to: 1. To know the basics and concepts of various biotechnological related terms 2. Elucidate the significance of transgenic plants as bioreactors for the production of enzymes, plant bodies, edible vaccines and therapeutic proteins 3. Address bioethical and biosafety issues related to plant transgenics Explain the basics of animal biotechnology 4. Elucidate the molecular techniques involved in gene manipulation and rDNA technology 5. Explain the gene transfer methods for the production of transgenic animals 6. Address bioethical and biosafety issues related to animal transgenics 7. Gain experimental knowledge to perform animal biotechnology related experiments 8. Explain the application of biotechnology in medical and its allied fields, gene therapy , genetic counseling 9. Acquire knowledge about antisence technology, Pharmacogenetics, Toxicigenomics, Tissue engineering, Boimolecular engineering and the impact of these novel strategies on human population.

	10. Address the bioethical issues & concerned linked to medical biotechnology 11. Understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – waste water treatment and bioremediation. 12. Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission • Comprehend the various methods to determine the Sanitary quality of water and sewage treatment methods employed in waste water treatment. 13. Know how viruses can be used as tools to study biological processes, as cloning vectors and for gene transfer.
Paper-10 (Practical)	1. Basic Understanding of Immunology and antibiotic sensitivity test. 2. Principles and hand-on experience of immunoassays.
Paper-11 (Practical)	Students will be able to: 1. Identification of the quality of food and water. 2. Basic understanding of fermentation techniques.

Annual 1+1+1 system (Part-III) General

Part-I General Paper-1	The students will be directed about the history, fundamentals of microbiology and current research in bacteriology. Students will be acquainted to the fundamental understanding of the biological machinery of bacteria along with systematic and evolutionary life. Students will be demonstrated to an understanding and ability for deployment of scientific methods including observation, hypotheses testing, data collection, and analysis. Students will be acclimatized to critical analysis and evaluation of published research in the field of bacteriology.
Paper-2	On completion of the paper, students are able to: 1. Get acquainted with different types of cell structure. 2. Use various method to control microbes. 3. Gather theoretical background of microbial cultivation 4. Understand various specialized techniques such as pasteurization 5. Understand the basic concepts related to enzymes 6. Qualitative and quantitative enzyme assay

	7. Effect of environmental factors on enzyme 8. Enzyme kinetics and various biochemical pathway of Microbial Metabolism 10. Anabolism and catabolism with examples 11. Bacterial photosynthesis.
Paper-3 (Practical)	The practical paper also aims to demonstrate fundamental knowledge of staining techniques, examination of bacteria from natural habitat and preparation of standard bacteriological medium.
Part-II General Paper-4	The paper will give an overview of medically important virus families, their replication strategies and mechanisms for development of viral infectious diseases. Topics will include taxonomy, replication strategies, pathogenicity and transmission of viruses and, additionally, diagnosis, prevention and treatment of viral diseases. Antiviral immunity and viral evasion will also be covered. Common human viral infections will be the main focus of the paper, and emphasis will be put on virus-host interactions as a key to understanding the diversity of viruses and viral diseases. This paper will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in both prokaryotes and eukaryotes.
Paper-5	This paper gives an applied aspect of Microbiology, which includes role of microbes in industries, various industrial processes and industrial research. This paper aims to impart fundamental knowledge of metabolic reactions in microbial cell, genetic engineering, their growth, development and its relevance to applied microbiology.
Paper-6 (Practical)	The objective of this paper is to train students practically in basic and applied principles of pure culture and their preparation. The paper involves demonstration and on-hand training of various microbiological techniques and enumeration of bacteria by Breed's method.
Part-III General Paper 7	By studying immunology students are able to learn how immunology-the study of human immune system which controls infections and provides immunity against microorganisms-can apply to a range of areas in the biomedical sciences. The goal of this paper is to provide students basic knowledge of environment and their role in life sustenance. The students can identify and analyze environmental problems as well as the risks associated with them.
Paper 8 (Practical)	1. Basic Understanding of Immunology and antibiotic sensitivity test. 2. Principles and hand-on experience of immunoassays and identification of bacteria from root nodules.

Learning Outcomes

CHEMISTRY

Syllabus

PART- I, II AND III

B.Sc. Honours & GENERAL Course

Chemistry (Honours) Part-I			
YEAR	**PAPER**	**TOPIC**	**LEARNING OUTCOMES**
1	**PAPER-I**	**GROUP-A** **(ORGANIC)**	**After successful completion of these chapters students will have the knowledge of:** **Classification, and Nomenclature, Hybridization, Shapes of molecules,Influence of hybridization on bond properties.** **Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges;Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.** **Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers,** **Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.** **The chemistry of aliphatic and aromatic hydrocarbons:Aliphatic Hydrocarbons: Alkanes- Preparation : catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: mechanism forfree radical substitution: halogenation. Alkenes : elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes. Reactions: cis-addition (alkaline KMnO4) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and antiMarkownikoff's**

			addition], hydration, ozonolysis. Alkynes: Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alkaline KMnO4. **Benzene and its reactivity , Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Alkyl halides in detail.**
		GROUP-B **(INORGANIC)**	**After successful completion of these chapters students will have the knowledge of:** **Bohr's theory for hydrogen atom, atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations.** **Characterize bonding between atoms, molecules, interaction andenergetics. Hybridization and shapes of atomic, molecular** **orbitals, bond parameters, bond- distances and energies.** **Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.**
		GROUP-C **(PHYSICAL)**	**In this course the students are expected to learn:** **Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical**

			state, relation between critical constants and van der Waals constants, law of corresponding states. **Postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.** **Intensive and extensive variables; state and path functions; isolated, closed and open systems. First law: Concept of heat, Q, work, W, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of Q, W, ΔU and ΔH for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Thermochemistry: Heats of reactions: standard states; enthalpy of formation and enthalpy of combustion and its applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics. Calculation of entropy change for reversible and irreversible processes. Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Joule-Thomson coefficient and inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state. Partial molar quantities, Gibbs Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases. Statement of Third Law of thermodynamics and calculation of absolute and residual entropies of substances.**
1	**PAPER-II**	**PRACTICAL**	**Students will have the experience of Organic qualitative analysis and organic compounds preparation with melting point determination through this course.**
			Chemistry (General) Part-I
1	**PAPER-I**	**GROUP-A** **(ORGANIC)**	**In this course the students will have the following knowledge:** **Understand hybridisation,electronic displacement, cleavage of bonds,empirical and molecular formula determination.**

			Understand preparation, properties and various reactions of alkanes, alkenes , alkynes,alcohols,aldehydes and ketones. Detect extra elements in organic compounds.
		GROUP-B **(PHYSICAL)**	**In this course the students will learn:** **Deviations from ideal gas behaviour, Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.** **Postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path ,their temperature and pressure dependence, variation of viscosity with temperature. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) .** **Concept of heat, Q, work, W, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of Q, W, ΔU and ΔH for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions Joule-Thomson coefficient and inversion temperature.Heats of reactions: standard states; enthalpy of formation and enthalpy of combustion and its applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. statement of the second law of thermodynamics. Carnot cycle. Concept of entropy. Gibbs free energy.**
1	**PAPER-II**	**GROUP-A** **(INORGANIC)**	**In this portion students will learn:** **Natural radioactivity; group displacement law, law of radioactive decay, half-life and average life of radio-elements, radioactive equilibrium, Stability of atomic nucleus, n/p ratio, nuclear binding energy, nuclear forces, nuclear reactions, fission, fusion, transmutation of elements, Age determination, radiocarbon dating.** **Bohr's theory for hydrogen atom, atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle** **Hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies. Atomic and ionic radii, ionization potential, electron affinity, and**

			electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.
		GROUP-B **(PHYSICAL)**	**In this course the students are expected to learn:** **Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (Le Chatelier Principle, Quantitatively). Clausius-Clapeyron equation and its applications.Phase rule and its application to one component system. Nernst distribution law.** **Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid.** **Relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.**
1	**PAPER-III**	**PRACTICAL**	**Students will have the experience of Organic qualitative analysis and organic compounds preparation with melting point determination through this course.**
Chemistry (Honours) Part-II			
2	**PAPER-III**	**Organic Chemistry**	**After successful completion of these chapters students will have the knowledge of:** **Preparation of Alcohols, Phenols and Ethers by reduction of aldehyde, ketones, carboxylic acids, esters. Reaction with hydrogen halides, phosphorus trihalides. Oppeneaur oxidation, oxidative cleavage of dihydric alcohols. Pinacol-Pinacolone rearrangement.** **Electrophilic substitution reactions, Fries rearrangement, Reimer Tiemann reaction. Preparation, cleavage and autoxidation of Ethers** **Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3 dithianes. Nucleophilic addition to carbonyl group; Benzoin, Aldol condensation, Benzilic acid rearrangement. Cannizzaro reaction. Meerwein-Pondorf-Verley, Michael, haloform reaction.** **Preparation and general reactions of carboxylic acids, acid chlorides, esters. Decarboxylation, esterification.** **Structure, physical properties, identification of primary, secondary and tertiary amines (the Hinsberg method).**

			Hofmann, Curtius, Lossen and Schmidt reaction. Diazomethane and their uses. **Isomerism, types of isomerism, chirality, enantiomerism, optical activity, specific rotation, diastereomers, racemic mixture, resolution** **Kinetics of nucleophilic substitution of alkyl halides: SN1 and SN2 mechanism- effect of solvent, structure, leaving group. 1,1 (α) and 1,2 (β) elimination: mechanism, E1, E2, E1cB, elimination versus substitution.**
2	**PAPER-IV**	**Inorganic Chemistry**	**On successful completion of the course students will be able to:** **Basic principles of G-M counter, Separation of isotopes.** **Natural radioactivity; group displacement law, law of radioactive decay, half-life and average life of radio-elements, radioactive equilibrium, Stability of atomic nucleus, n/p ratio, nuclear binding energy, nuclear forces, nuclear reactions, fission, fusion, transmutation of elements, Age determination, radiocarbon dating, medicinal and agricultural applications of radioisotopes.** **Comparative study:** **For all the groups - with regard to electronic configuration, atomic, ionic radius, valence states.** **Gr I A: Li, Na, K, Rb, Cs** **Hydration energy of the ions, Softness of the metals;** **Hydrides - stability; Difference of the Li from other members.** **Gr V B: N, P, As, Sb, Bi** **Inert pair effect in Bi.** **Hydrides - Stability, variation of basic character, variation of bond angles. Halides - hydrolysis and Oxy-acids.** **Gr. VI B: O, S, Se, Te** **Hydrides - stability, acid character, bond angle, Halides, Oxy-acids.** **Gr: VII B: F. Cl, Br, I** **Reactivity, Bond dissociation energy, Colour;** **Hydrides - stability, acidic character.** **Basic character of halogens; Oxy-acids.**

			Gr IB, Gr. IIB - Complexes, Oxidation states, and abnormal valence states. **Compounds of Noble gases.** **Per acids of S. Classification of hydrides, Diborane, Borazole. Phosphonitriles, Interhalogen compounds, Pseudohalogens, Silicones.** **Arrhenius, Bronsted-Lowry, Lewis concepts of acids and bases. Hard soft and base (HSAB) concept.**
2	**PAPER-V**	**Physical Chemistry**	**By the end of this course, students will be able to learn:** **Thermodynamic derivation of equilibrium constant, The reaction isotherm. Pressure and temperature dependence of equilibrium constant; vant's Hoff equation, Principle of Le Chatelier and Braun; Effect of pressure, temperature, Concentration and Inert gas on equilibrium; Study of a few important homogeneous reactions.** **Thermodynamic criterion of phase equilibria, Clausius-Clapeyron equation, Phase rule & its application to one component systems Water,Sulphur, two components systems** **Surface tension - capillary action formation & stability of bubbles, determination. Viscosity of liquid - temperature dependence, determination. Dipole moment - application of dipole moment for structure determination.** **Chemical Potential of solute & solvent in solutions; Relative lowering of vapour pressure, Elevation of boiling point, Depression of freezing point, Osmotic pressure-their measurements, colligative properties of strong and weak electrolytes, Solution of gases in liquids, Henry's law and Raoult's law, Duhem-Margules equation. Ideal solutions of liquids in liquids, non-ideal solutions of liquids in liquids, Azeotropes. Nernst distribution law applications.** **Reversible and irreversible cells, emf and its measurements, Galvanic cell, Electrical and electrochemical potential, Different types of half cells, cell reactions, Nernst equation, Reference electrodes, Concentration cell, Liquid junction potential; Determination of E0 from EMF measurements.** **Ionic equilibria: Solubility products, common-ion effect, ionic product of water, pH, Hydrolysis of salts, Buffers and Neutralization indicators.** **Electrolysis, Arrhenius theory of dissociation, Ostwald dilution law. Metallic and electrolytic conduction, conductance of**

			solutions, variation of conductivity with concentration, Determination of Λ, transference numbers and ionic mobility, Hydration of ions. The Walden's rule. Applications of conductance measuments e.g. conductometric titrations.
2	**PAPER-VI**	**Practical**	**Inorganic Qualitative Analysis**
			Chemistry (General) Part-II
2	**PAPER-IV**	**GROUP-A** **(ORGANIC)**	**By the end of this course, students will be able to learn:** **1. Preparation and application of Grignard reagent, ethyl acetoacetate 2. Primary, Secondary and Tertiary amines: Basic concept, separation, preparation of primary amines: Hofmann hypobromite, Schmidt and Curtius reactions (mechanism omitted)** **3. Optical isomerism: Chiral Centre, optical isomerism of lactic acid and tartaric acid, geometrical isomerism of maleic acid and fumaric acid.** **4. Carbohydrates: Definition, classification, structure and properties of glucose. 5. Benzene: Rule of aromaticity, halogenation, Nitration, Friedel-Crafts reaction. 6. Aromatic amines: Diazonium salts, Benzoin condensation.**
2	**PAPER-IV**	**GROUP-B** **(INORGANIC)**	**By the end of this course, students will be able to understand:** **1. Characteristics of transition metal, reason for their differences from representative metals. Comparative study: Gr. VB: N, P, As, Sb, Bi. Electronic configuration, valence. Hydrides- preparation, stability, basic properties. Gr. VI B: O, S-valence, Hydrides-boiling points, acidic character. Gr. VII B: Special properties of Fluorine and Iodine.** **2. Oxyacids: Name, structural formula, one method of preparation for each, nature of existence, basicity of (1) Chlorine (2) Per acids of sulphur.** **3. Extraction and chemistry of Ni, Sn.** **4. Chemistry of: Hydrazine, Sodium nitroprusside, Silicone, Borazene.** **5. Carbonisation of coal: Superphosphate; Detergent Soap.**
2	**PAPER-V**	**GROUP-A** **(INORGANIC)**	**After the completion of this part students will be able to learn :**

			1. Simple idea of Double salt and Complex salt. Perfect and imperfect complex, Nomenclature (IUPAC), Werner's coordination theory, ligand-monodentate, tri and **tetradentate, ambidentate, Chelate, Innermetallic complex (first order), Geometrical and optical isomerism in inorganic complexes.** **2. Principles of Fe++- K2Cr2O7 titration, estimation of Cu2+. Calculation of errors - mean, median, mode, standard deviation.**
		GROUP-B **(PHYSICAL)**	**After the completion of this part students will be able to learn the following:** **Order and molecularity, Integrated rate laws for zero, first & second order reactions, Determination of order of reaction, Elementary treatment of opposing, consecutive, parallel reactions. Effect of temperature on reaction rate** **Laws of photochemistry, quantum yield, Lambert-Beer's law and its application. Elementary ideas of Fluorescence, Phosphorescence.** **Reversible and irreversible cells, emf and its measurements, Galvanic cell, Electrical and electrochemical potential, Different types of half cells, cell reactions, Nernst equation, Reference electrodes.** **Ionic equilibria: Solubility products, common-ion effect, ionic product of water, pH, Hydrolysis of salts, Buffers and Neutralization indicators.** **Photoelectric effect, Wave particle duality, Uncertainty Principle , Principle of Pure Rotational and vibrational Spectroscopy .** **Adsorption of gases by solids, Types of adsorption, Effect of temperature and pressure, Freundlich and Langmuir adsorption isotherm, Theory of homogeneous Catalysis. Colloids: Classification, Preparation, Stability, Purification.**
2	**PAPER-VI**	**Practical**	**Inorganic Qualitative Analysis**
			Chemistry (Honours) Part-III
3	**PAPER-VII**	**Organic Chemistr**	**After the completion of this portion students will be able to learn the following:**

			Bonding, antibonding and nonbonding MO's. Electronic configuration of H2 and N2. MO's of π systems: 1,3-butadiene, benzene. HOMO, LUMO. **Electrocyclic reactions-disrotation, conrotation, Diels-Alder reaction.** **The electromagnetic spectrum , Range of ultraviolet region, units of wavelength. absorption laws, molar absorptivity, types of electronic transitions, effect of conjugation (visible region), colour of conjugated organic compounds, chromophore, auxochrome, bathochromic, hypsochromic, hypochromic shifts, Woodward Fieser empirical rules for λmax calculation of dienes.** **Infrared (IR) region-Relation between bond order and position of IR bands, effect of resonance, fingerprint region, identification of intramolecular and intermolecular hydrogen bonding, characteristic absorption of various organic functional groups in IR spectra. Proton magnetic resonance and spectrum, number of signals, equivalent and non-equivalent protons, position of signals, chemical shift, nuclear shielding and deshielding, proton counting, splitting of signals, spin spin coupling, coupling constant, interpretation of 1HNMR spectra of ethyl bromide, ethanol, acetophenone.** **Structure determination of naphthalene and phenanthrene.** **Aromatic characteristics of pyrrole, furan, thiophene and pyridine, mechanism of nucleophilic substitution reaction in pyridine, preparation and reaction of indole with special reference to Fisher indole synthesis.** **Introduction to proteins, classification, structure, zwitter ion, isoelectric point, Gabriel phthalimide, synthesis of amino acids.** **Proteins: classification, denaturation, partial hydrolysis, determination of primary structure sequence of amino acids.** **Synthesis of ethyl acetoacetate, Claisen condensation, keto-enol tautomerism. 7. Baeyer strain theory: Shortcomings of relative stability of the cycloalkanes, conformational analysis of cyclohexane, mono and dimethyl substituted cyclohexane, decalin.**
3	**PAPER-VIII**	**Inorganic Chemistry**	**After the completion of this paper students will be able to learn the following:**

			Wave-particle duality, de Broglie equation, Heisenberg uncertainty principle, Schrodinger wave equation. : **Basic postulates, setting up of trial wave function for H2 molecule (brief introduction), success of M.O. theory over V.B. theory in explaining the paramagnetism of O2 molecule, energy diagram of the MO of N2, CO, NO. Explanation of monatomic He and Ne.** **Characteristics of bonding metals, failure of classical theory of valence, Brief and qualitative approach of band theory (M.O.), classification of alloy system and Hume Rothery rule.** **Werner theory with illustrative examples, nomenclature, theory of coordination bond - valence bond approach, detection of complex formation, factors affecting the complex formation, dependence of stability on chelation, magnetic property of the complexes, isomerism including geometrical and optical, inner metallic complexes.** **Splitting of the d-orbitals in octahedral, tetrahedral and square planar crystal field; crystal field stabilization energy, magnetic property, 'd-d' spectra including brief introduction to selection rules.** **The thermodynamic stability of metal complex and factors affecting the stability.** **Definition of π-acid ligands, Carbonyls – structure and bonding. Nitrosyls, Brown ring compound, Roussin's salt structure, nitropruside.** **σ-bonded organometallic, structure of dimeric trimethyl aluminum, π-bonded organometallic compound - Zeise's salt, Ferrocene.** **Chemistry of U, Pt and their Important Compounds** **Reaction in Non-aqueous Solvents: Liq. NH3, liq. HF.** **Classification of essential elements in human body system, trace and ultramicro trace elements, preliminary ideas composition and functions of Hemolglobin, Myoglobin and Metaloenzymes (Containing iron, copper and zinc: 2 examples of each type.** **Chemistry of Lanthanides and Actinides:** **Electronic structure, oxidation states, Lanthanide contraction, isolation (ion exchange method), similarities between the later actinides and the later lanthanides with respect to oxidation states.**

3	**PAPER-IX**	**Physical Chemistry**	**By the end of this course, students will be able to learn:** **Structural distinction between solids and liquids, Types of solids, Laws of crystallography, Crystal systems, Bravais, lattices, Point groups, Space groups, designation of planes and faces, Diffraction of X-rays by crystals - Bragg's equation, density of cubic crystal, Crystal structures of NaCl & KCl, radius ratio rules, classification & structure (elementary idea).** **Adsorption of gases by solids, Types of adsorption, Effect of temperature and pressure, Freundlich and Langmuir adsorption isotherm, Theories of homogeneous and heterogeneous catalysis, Acid- base catalysis.** **Extent of reaction, order and molecularity, Integrated rate laws for zero, first & second order reactions, Determination of order of reaction, Elementary treatment of opposing, consecutive, parallel, chain reactions. Effect of temperature on reaction rate, Collision and transition state theories.** **Laws of photochemistry, quantum yield, Lambert-Beer's law and its application. Steady state approximation, Kinetics of photochemical reactions: Decomposition of HI and Reaction between H_2, and Br_2, Elementary ideas of Fluorescence, Phosphorescence, Photo-sensitized reaction and Chemiluminescence.** **Colloids: Classification, preparation, purification, stability, colloidal electrolytes and their properties. Emulsion: preparation; emulsifier.** **Concepts of permutation, combination, factorials & probability. Thermodynamic probability and entropy. Boltzmann Distribution (No derivation), Partition Function.** **Black body radiation, photoelectric effect, Compton effect, Planck's quantum theory, Wave particle duality, Uncertainty principle, Wave mechanics- Schrodinger equation and its solution for free particle and particle in a box, interpretation of Ψ , degeneracy; Postulates of quantum mechanics, Hamiltonian Operator, Eigen value, Eigen function, Hydrogen atom (elementary idea), Pauli Exclusion principle.** **Regions of electromagnetic spectrum, Born Oppenheimer Approximation. Rotational spectrum of diatomic molecules: energy levels of rigid rotator, selection rules, applications.**

			Vibrational (infrared) spectrum: energy levels of Simple Harmonic Oscillator, selection rules, applications. **Raman Spectrum.** **Enzyme Catalysis: Lock & Key theory, Michaelis - Menten equation.** **Nucleic acids: constituents of DNA, RNA, elementary ideas of structure of DNA & RNA. Study of energy rich compound ATP.**
3	**PAPER-X:**	**Group A (Analytical Chemistry)**	**After the completion of this part students will be able to understand the following:** **1. (A) The Treatment of Analytical Data:** **Accuracy, Precision, classification of errors, minimization of errors, mean , medium, mode, standard deviation; method of least square (y = mx + c).** **(B) Computers:** **General introduction to computers, different components of a computer, binary numbers & decimal numbers.** **2. Principle of Gravimetric Analysis, co-precipitation and post-precipitation and their removal (condition for precipitation), efficiency of washing.** **3. Gas Chromatography, Column chromatography- Types, Principle Process, Separation of mixture; paper chromatography and thin layer chromatography.** **4. Solvent Extraction: Theory, efficiency, percentage extraction, separation factor, complexing agent in solvent extraction, selection of solvent.** **5. lon-exchange: Principle, quality of resins, ion exchange equilibrium, ion-exchange capacity process, deionization of water.** **6. Electroanalytical Chemistry: Standard electrode potential, Sign conventions, electrochemical series of its significance, Redox potentials, Formal potential, Theory of redox indicators, Elementary idea of voltammetry.**
		Group B (Industrial Chemistry)	**After the completion of this part students will be able to learn the following:** **1. Fuel: Definition and calorific value, classification of fuel:**

			(a) Solid fuel: High and low temperature carbonization of coal. Objects and products of high and low temperature carbonization of coal. **(b) Liquid fuel: Flash point, aniline point, knocking, anti-knock compounds, Octane number, cetane number, types of gasoline - natural, straight-run, reformed, Aviation and synthetic gasolines.** **(c) Gaseous fuel: Water gas, producer gas and LPG .** **2. Manufacture and uses common glass, Difference between glass and porcelain. Manufacture, composition and uses of Potland cement - setting of cement. Manufacture and uses of Stainless Steel.** **3. Fibres: Requirement of fibre forming polymer. Difference between natural and synthetic fibres. Manufacture and uses of Nylon 66.** **Synthetic rubber: Difference between natural and synthetic rubber. Vulcanisation. Manufacture and uses of Buna-S.** **4. Oils and fats: Differences, Hydrogenation of oils, Production of Vanaspati. Rancidity of oil. Soap and detergents: Difference between Soap and detergents. Mechanism of cleaning action of detergents. Bio-degradability and biodegradable polymers.** **5. Drugs: Defination, Preparation and uses of some common drugs: Sulphathiazole, Sulpha guanidin, Aspirin, Novalgin and penicillin-G.** **Insecticides: Definition, Classification according to the mode of action. Preparation and uses of D.D.T., Dithion and Dithocarbamte.** **6. Paints: Constituents of paints and varnishes. Manufacture, Setting and requirements of a good paint.** **7. Fertilizers: Defination and necessity of Fertilizers. Manufacture of Urea.**
3	**PAPER-XI**	**Practical**	**Students will also have hands on experience of standard solution preparation in different concentration units and learn quantitative inorganic estimation of Fe3+ and Ca2+, Fe3+ and Cu2+ and Fe3+ and Cr3+ in mixtures through acid-base and redox reactions .**
3	**PAPER-XII**	**Practical**	**From these Physical Chemistry Experiments , students will be able to learn how to do the following experiments:**

			1. Determination of composition of given unknown solution by the measurement of viscosity using Ostwald's viscometer **2. Determination of composition of given unknown solution by the measurement of surface tension using Stalagmometer** **3. Conductometric titration: Oxalic acid vs. NaOH, HCl vs. NaOH, CH3COOH vs. NaOH 4. Determination of rate constant for the acid hydrolysis of methyl acetate at room temperature** **5. Determination of pH of the supplied CH3COOH-CH3COONa buffer solution colorimetrically using bromocresol green indicator**
			Chemistry (General) Part-III
	PAPER-VII	**Industrial Chemistry**	**Students will be able to learn the following:** **1. Fules: (i) Gaseous fuels: Manufacture & uses of Producer gas, Water-gas and Bio-gas. (ii) Liquid fuels: Crude of oil-refining, Gasolene, Octane number, Cetane number, Antiknock compounds.** **2. Non-Conventional Sources of Energy; Solar energy, Wind energy.** **3. Paints and Pigments: Methods of Preparation & uses of Ultramarine blue. 4. Ceramics: Manufacture of glazed porcelain (household items).** **5. Insecticides: Different classes of insecticides - organophosphorous, carbamates.** **6. Oils and fats: Distinction between oils & fats, Saponification value, Iodine value, Hydrogenation of fats & oils.** **7. Polymers: Preliminary ideas of polythene, PVC (composition & uses).** **8. Cement: Cement-its composition, manufacture & uses, setting of cement.**
	PAPER-VIII	**Practical**	**Students will also have hands on experience of standard solution preparation in different concentration units and learn quantitative inorganic estimation of Fe3+ and Cu2+ through acid-base and redox reactions . Also will have the idea to do and report Project Work**

Course Outcomes:

B.Sc. Zoology (Honours)

Part - I

Paper – I - Origin of Life - Systematics - Animal Diversity – Non-chordates

- Develops concepts regarding various theories and experiments about organic evolution
- Understanding of general taxonomic rules on animal classification
- Knowledge of classification of Non-chordates along with studies on various physiological functions and interactions of non-chordate organisms with examples

Paper – II - Animal Diversity – Chordates – Structural Adaptation – Zoogeography

- Knowledge of classification of protochordates and chordates along with studies on various physiological functions and interactions of chordate organisms with examples
- Imparts conceptual knowledge of vertebrate adaptations in relation to their environment
- Gather knowledge about distribution of fauna in different zoogeographical realms

Paper – III – Practical

- First-hand knowledge about identification of non-chordate and chordate specimens (fresh and preserved) along with larval forms and study of endoskeleton of vertebrates

Part - II

Paper – IV – Cell & Molecular Biology – Laboratory & Analytical Techniques – Biochemistry

- Basic concepts of Cell and Molecular Biology along with various cellular functions
- Knowledge about different techniques used in Cell and Molecular Biology
- Knowledge of different biochemical processes of cells

Paper – V - Genetics – Immunology – Animal Physiology – Endocrinology & Reproductive Biology

- Develop idea about Mendelian & non-Mendelian inheritance, genetic disorder, gene mutations and sex determination
- Gather knowledge on types of immunity, antigen-antibodies and their properties, vaccines, diseases
- Students are taught the detailed concepts of digestion, respiration, excretion, the functioning of nerves and muscles of animals
- Gain knowledge about hormones and endocrine mechanisms and relation with Developmental Biology

Paper – VI – Practical

- Students are able to handle microscopes, work with camera lucida and micrometers
- Students are able to conduct *Paramoecium* culture, tissue preparation, isolation and estimation of DNA
- Students can perform histological, analytical and biochemical techniques

Paper – VII – Practical

- Students are able to study meiosis and pedigree analysis
- Students are able to conduct Blood grouping and immunological techniques
- Students are taught about various parameters of haematology

Part - III

Paper – VIII – Histology & Histochemistry – Developmental Biology & Teratology – Adaptation, Behaviour & Evolution

- Description about histological and histochemical details of organs of body

- Imparts the knowledge about developmental processes of different animals along with teratology
- This course helps students to gain fundamental knowledge about theories and nature of evolution, speciation, mimicry and colouration

Paper – IX – Ecology – Environmental Biology and Toxicology – Animal Behaviour

- Imparts knowledge to the student regarding various laws of ecology, types of ecosystem, population and community characteristics and dynamics
- Students gain fundamental knowledge of environmental pollutions due to toxic materials and their effects over ecosystem and learns about sustainable development
- Gains knowledge in the areas of animal behavior and sociobiology

Paper – X – Applied Zoology – Conservation Biology & Wildlife – General Informatics & Bio-informatics

- Understands concepts of fisheries, sericulture, apiculture, poultry, dairy along with tissue and cell culture techniques
- Gains understanding of wildlife, biodiversity and conservation Biology
- Students will gain knowledge about Bio-informatics

Paper – XI – Practical

- Students gain skill to prepare different stages of embryos of chick
- Students gain skill about quantification of various ecological parameters

Paper – XII – Practical

- Field visits to various ecological areas like sea-shore, tea plantations, zoological gardens allowed students to prepare reports on them
- Dissertation works on the biodiversity resources in and around the college made students aware of the biodiversity of their locality
- Students gain skill in operating different statistical softwares

Course Outcomes:

B.Sc. Zoology (General)

Part - I

Paper – I - Structural Diversity of Non-chordates and Chordates

- Knowledge of classification of Non-chordates along with studies on various physiological functions and interactions of non-chordate organisms with type specimens
- Knowledge of classification of chordates along with studies on various physiological functions and comparative anatomy of organs of chordate with examples

Paper – II - Biochemistry –– Cell Biology – Genetics

- Students gain knowledge of different biomolecules and biochemical processes of cells
- Gather basic concepts of Cell Biology along with various cellular functions
- Idea about Mendelian, non-Mendelian inheritance, genetic disorder, gene mutations and sex determination

Paper – III – Practical

- Students will gain skill about slide preparation, staining and mounting
- Identifications of non-chordate and chordate specimens (fresh and preserved) along with larval forms and sections

Part - II

Paper – IV – Histology – Developmental Biology– Endocrinology & Immunology

- Basic concepts of histology of various organs of body
- Basic concepts of developmental biology regarding developmental processes of frog
- Gain knowledge about hormones and endocrine mechanisms
- Imparts knowledge about types of immunity, antigens-antibodies and their properties, vaccines, diseases

Paper – V - Animal Physiology – Molecular Biology – Biotechnology & Biostatistics

- Students are taught the detailed concepts of circulation, respiration, the functioning of nerves of animals
- Basic concepts of Molecular Biology along with functions of DNA and RNA and study of Genetic Engineering
- Students gain knowledge about statistical analysis in biological fields

Paper – VI – Practical

- Students are able to identify bones, histological sections, embryological stages of chick
- Students performed biochemical and statistical techniques

Part - III

Paper – VII – Ecology – Evolution – Applied Zoology

- Imparts knowledge to the student regarding various factors of ecology, types of ecosystem, population and community characteristics and dynamics
- Gains knowledge in the areas of animal behavior, wildlife, biodiversity and conservation Biology
- Understands processes of fisheries, sericulture, apiculture, poultry, dairy along with crop pest management techniques
- Students gain knowledge about various disease related vectors and their impact on human

Paper – VIII – Practical

- Identification of zooplanktons and phytoplanktons
- Gain skill about histological slide preparation, staining and mounting

- Students gain skill about determination of pH and quantitative analysis of blood cells
- Students are able to parasites from rectal and fecal contents of animals
- Students are able to collect parasite and pest specimens.

PROGRAMME OUTCOMES FOR THE SESSION 2016-17:-

- Explaining physiological processes of all body systems in detail and on an appropriate level (knowledge, comprehension, application and analysis)
- Understanding the role of body systems and mechanisms in maintaining homeostasis
- To explain how the activities of organs are integrated for maximum efficiency
- Demonstrating higher level critical thinking skills, solving problems, and following directions.
- To manipulate equipment and carry out analytical procedures
- Observation phenomena, record and analyze data, and infer from data
- To construct graphs from data and obtain information from graphs
- To work effectively in a group and work safely in a lab setting
- Using computer hardware and software to obtain information, analyze data, and communicate with the instructor and other students
- Directing their own learning activities to meet course objectives

PROGRAMME SPECIFIC OUTCOMES:-

- Students develop a strong foundation in the Fundamental concepts of Biology and Human Physiology.
- Students can function successfully in a laboratory and field setting.
- Students can employ the scientific method to generate new information.
- Students can synthesize a cogent argument in the language of science.
- Demonstrate a working knowledge of the foundational concepts of biology, including cellular, organismic, tissue level, biochemical and biostatistical physiology.
- Rigorously and ethically apply the scientific methods to questions in biology by formulating testable hypotheses, and gathering and analyzing data to assess the degree to which they support the hypotheses.
- Employ quantitative reasoning skills to present results and explain their significance.
- Demonstrate information literacy by locating, critically analyzing, and discussing primary literature.
- Clearly communicate, orally and in writing, using a standard scientific format with accurate use of conventions such as citations, graphs, and statistics.

Course Outcomes:-

PART-I		
Course Code	Course Name	Course Outcomes
Paper 1	i)Physiology:- an introduction ii)Cellular Basis of Physiology iii)Human body & its constituents	1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles 2. Students will understand how these cellular components are used to generate and utilize energy in cells 3. Students will understand the cellular components underlying mitotic cell division. 4. Students will apply their knowledge of cell biology to selected examples of changes in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation. 1. 5.Learn about the structure and function of membranes and explain how cells target the transport of proteins and other molecules within the cell. 2. 6.Concept of the cellular and molecular basis of the excitability of the nervous system. 3. 7.Differences between channels and transporters and the role of these proteins in the uptake of nutrients and neurotransmitters, and in ion homeostasis and signalling; 4. 8. Understand the molecular basis of a range of diseases in which membrane transport proteins play a role.
	Nutrition: Nutritional Physiology	1. Utilize knowledge from foundational sciences as a basis for understanding the role of food and nutrients in health and disease. 2. Integrate scientific information, research, and critical thinking into evidence- based practice. 3. Demonstrate professionalism and ethical behavior in all areas of practice. 4. Engage in advocacy on issues that affect public health and nutrition policy. 5. Establish a basis for lifelong learning and interprofessional collaboration.

	Gastrointestinal Physiology	6. Utilize the Nutrition Care Process to deliver state-of-the-art, safe and effective nutrition care. 7. Provide culturally competent nutrition services for diverse individuals and communities using a variety of communication strategies. 8. Facilitate health behavior change using nutrition counseling techniques with patients and clients. 9. Apply basic principles of entrepreneurship to dietetics practice. 10.Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients and groups. 11.Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas. This unit contains chapters on Oral Cavity, Esophagus and Stomach, Accessory Organs of Digestion, and Small and Large Intestines. At the conclusion of this unit, students will be able to: • Identify the major components of the digestive system and describe their functions. • Describe the overall structure, sections and layers of the alimentary canal. • Describe the components and functions of major digestive juices, and explain where they are produced. • Explain how oral cavity structures contribute to the digestive process. • Locate and identify major structures of the oral cavity. • Describe the process of chewing and swallowing. Locate and identify the salivary glands and ducts. • Locate and identify the muscles of mastication. • Identify the epiglottis and describe its function during swallowing. • Describe the process of peristalsis. • Describe the location and pathway of the esophagus. • Locate and identify the regions of the stomach • Describe the role of the liver, gallbladder, and pancreas in producing, transporting, and storing digestive juices. • Identify the bile ducts and describe their function. • Identify the pancreatic ducts and duodenal papillae and describe their function. • Locate and identify the major arteries supplying the liver, gallbladder, and pancreas. • Describe the process of absorption that occurs in the small intestine. • Describe the function of circular folds and villi in the small intestine. • Locate and identify the regions of the small intestine. • Describe the digestive processes that occur in the large intestine, including the role of bacteria.

	Biophysics and Physiochemical principles in Physiology	1. Learning about the structure and function of important biomolecules and cellular systems. 2. Problems in medical physics, and techniques for radiation therapy of cancer and diagnostic use of magnetic resonance tomography. 3. Knowledge about various biophysical techniques like chromatography, autoradiography, electrophoresis, cell fractionation, tracer's technique, nanoparticles and its applications. 4. Cellular phenomenons following biophysical principles like, diffusion, osmosis, viscosity, surface tension, laminar and streamline flow of liquids etc. • 5.Define enzyme structure and define differences between enzymes and normal catalytic substances. 6.To recognize the catalytic substances, explain chemical structure of enzymes and recognize the enzymes chemical structure. • 7. cofactor and coenzymes chemical structure recognize chemical structures of biological cofactor and coenzymes, express important coenzymes and the groups they transfer, to recognize biologic coenzymes and explain activity of catalytic center. 8.To recognize catalytic center and define factors that effect enzyme activity. To explain heat, pH , concentration and the other factors on the effect of activity. • 9.To define enzyme kinetics, recognize Km, define conformation changes of enzyme, recognize conformation, define enzyme specifity, recognize specifity, explain allosteric enzymes, recognize allosteric enzymes, define activators and inhibitors and recognize activators and inhibitors. •

Course Code	Course Name	Course Outcomes

Paper II	Nerve and Muscle Physiology	1. To identify the major components of the nervous system and describe their functions. 2. Describe the composition and location of nervous tissue. And locate and identify the parts of a neuron. 3. To describe the structural types of neurons. 4. Learn about the types of neuroglia and their functions. 5. Explain how resting and action potentials contribute to nerve function. 6.Describe the process of neurotransmission and identify major neurotransmitters and describe their functions. 7.To identify the three types of muscle and describe the muscular system's functions. 8. Describe the location and function of skeletal muscles and locate and identify smooth muscle in the body. 9. Locate and identify the blood vessels and conduction system that supply and innervate cardiac muscle. 10. Describe the distinguishing features of each of the three types of muscle. and identify the major skeletal muscle regions of the body. 11.Describe the blood supply and innervation of skeletal muscles. Describe the microscopic structure of skeletal muscle tissue. 12.Explain how an impulse generated by the central nervous system results in the contraction of a skeletal muscle. 13. Describe the location and function of smooth muscle, identify smooth muscle layers of the stomach and describe the location and function of cardiac muscle.
	Biochemistry	1.Identify their chemical elements and the difference between simple sugars and complex carbohydrates. Compare and contrast the structure and function of the following carbohydrates and where they are found: glucose, glycogen, starch, cellulose, chitin. 2. Identify their chemical elements and functional groups .Recognize the structure of an amino acid and the peptide bond that connects di-, tri, and polypeptides. 3. Recognize the presence of 20 amino acids and that not all are essential amino acids. Summarize the function of proteins and recognize the importance of the three dimensional shape of a protein on its function and the role of non-covalent bonds in maintaining the shape of a protein.

		4. Identify their chemical elements and learn their property of insolubility in water. Identify the three groups of lipids. Compare and contrast saturated, mono-unsaturated, and poly-unsaturated fatty acids. 5.Explain the importance of poly-unsaturated fatty acids and why omega-3 and omega-6 fatty acids are considered essential. List sources of polyunsaturated fatty acids. 6. Identify their chemical elements and components of a nucleotide. Describe the function of DNA o Compare and contrast the 2 types of nucleic acids: DNA and RNA. 7. Students will explain/describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways like glycolysis, glycogenolysis, TCA cycle, beta-oxidation of fatty acids, deamination, transamination, urea cycle etc along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation. Regulation by non-coding RNAs will be tied to the developmental and physiological functioning of the organism.

Course Code	Course Name	Course Outcomes
	Haematology & Physiology of Body Fluids	1.To identify the components of blood and describe the components and functions of plasma. 2. Describe the production of red blood cells and their role in oxygen transport. 3. Identify the different types of white blood cells and describe their functions. 4.Explain how platelets contribute to the formation of blood clots and describe the production of platelets. 5. Describe the circulation of lymph throughout the body and locate and identify the major vessels of the lymphatic system also dentification lymphatic tissues and describe their functions. 6. Knowledge about various blood and blood group related disorder like, leukemia, leukocytosis, purpura, leukopenia and erythroblastosis foetalis.

	Cardiovascular Physiology	1.Description the functions of the heart and the pericardium, the heart's location relative to the lungs, diaphragm, thoracic cage, and ribs. 2.Identification the layers of the heart wall and describe each layer's function, location and identification the four chambers of the heart. 3. to describe the flow of blood through the heart and the role of each atrium, ventricle, and valve in this process and identify the four valves of the heart. 4. Locate and identify the systemic and pulmonary vessels that enter and exit the heart, the arteries and veins of coronary circulation and describe their function, the function of the conduction system. 5. Students will lear about the steps of electrical conduction that lead to ventricular contraction and the major structures of the conduction system and the purpose of an electrocardiogram. 6. Gain knowledge about the steps of the cardiac cycle and learn how cardiac output is determined. 7. They will learn to locate and identify the autonomic nervous system structures that control and innervate the heart and identify the five major types of blood vessels and describe their functions. 8.Know about the structure and function of arteries, veins, arterioles, venules, and capillaries an 9.Know the structural differences between arteries and veins. • Describe the relationship between blood pressure and resistance. • Explain how arterial blood pressure is measured. • Describe systolic and diastolic pressure. • Identify the major routes of circulation and describe their functions. • Locate and identify the vessels of pulmonary circulation. Explain how pulmonary veins and arteries differ from systemic veins and systemic arteries.

Paper:- IV	Respiratory Physiology	This unit contains chapters on the Upper Respiratory System, Lower Respiratory System, and Respiration. At the conclusion of this unit, students will be able to: Locate and identify each lobe and external feature of the lungs. • Describe the location and structure of alveoli. • Describe the location and functions of type I alveolar cells, type II alveolar cells, and alveolar macrophages. • Describe the internal structures of the lungs. Explain how the respiratory and circulatory systems work together during external respiration. • Describe external respiration and identify the structures involved. • Using Dalton's Law, explain why oxygen and carbon dioxide are exchanged between the lungs and the bloodstream. • Describe internal respiration and identify the structures involved. • Explain how imbalances of oxygen and carbon dioxide in the bloodstream affect respiratory rate. • Locate and identify the nervous system structures that regulate respiration.
	Renal Physiology	This unit contains chapters on Kidney Anatomy and Physiology, Urine Production, and Urine Storage and Information. At the conclusion of this unit, students will be able to: • Describe the position of the kidneys relative to other anatomical structures. • Locate and identify structures of the kidneys and describe their functions. • Locate and identify blood vessels that supply the kidneys. • Describe the path of blood flow through the nephron. • Describe the location, structure, and function of a nephron. • Describe the process of glomerular filtration. • Locate and identify structures involved in glomerular filtration. • Explain how the filtration membrane filters blood plasma to create filtrate. • Describe the processes of reabsorption and secretion, and explain why they are important. • Describe the composition of normal urine. • Explain how urine concentration is hormonally regulated. • Locate and identify the structures involved in urine storage and elimination, and trace the pathway of urine from the kidneys out of the body. • Describe the position of the bladder relative to other structures in the male and female. • Describe the internal anatomy of the bladder. • Describe the process of micturition. • Explain how micturition is controlled by the nervous system. • Locate and identify urinary system structures involved in maintaining urinary continence. In this chapter the students will:-

	Comparative Physiology And Physiology of Body defences and Immunology	1. The students will be able to identify the cellular and molecular basis of immune responsiveness. 2. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease. 3. The students will be able to describe immunological response and how it is triggered and regulated. 4. The students will be able to demonstrate a capacity for problem-solving about immune responsiveness. 5. The students will be able to transfer knowledge of immunology into clinical decision-making through case studies presented in class.
	Microbiology	This unit will prepare the students to:- 1.Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures. 2.Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes. 3.Understand the structural similarities and differences among various physiological groups of bacteria/archaea. 4. Know various Culture media and their applications and also understand various physical and chemical means of sterilization. 5. Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae. 6.Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively comprehend the various methods for identification of unknown microorganisms. 7.Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and Heterotrophy. 8.Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Paper:-V	Functions of The Nervous System	This unit contains chapters on Nervous Tissue, Spinal Cord and Spinal Nerves, Brain, Cranial Nerves, Somatic and Autonomic Nervous Systems, and Special Senses. At the conclusion of this unit, students will be able to: • Identify the major components of the nervous system and describe their functions. • Describe the composition and location of nervous tissue. • Locate and identify the parts of a neuron. • Describe the structural types of neurons. • Describe the types of neuroglia and their functions. • Explain how resting and action potentials contribute to nerve function. • Describe the process of neurotransmission. • Identify major neurotransmitters and describe their functions. • Locate and identify the spinal cord and its meninges. • Locate and identify the cross-sectional structures of the spinal column. • Describe the distribution and function of gray and white matter in the spinal cord. • Explain how sensory signals and motor commands are relayed through the spinal cord and spinal nerves. • Locate and identify the spinal nerves and nerve plexuses. • Explain what a dermatome is and identify skin regions innervated by each spinal nerve. • Locate and identify major spinal nerves and structures they innervate. • Describe the somatic reflex arc. • Locate and identify anatomical regions of the brain. • Locate and identify anatomical structures that surround and protect the brain. • Identify the ventricles of the brain and describe their function. • Locate and identify blood vessels that supply the brain. • Identify structures of the brain stem and describe their functions. • Identify the parts of the cerebellum and describe their functions. • Identify structures of the diencephalon and describe their functions. • Identify structures of the limbic system and describe their functions. • Identify structures of the cerebrum and describe their functions. • Locate and identify the anatomical features of the cerebrum. • Locate and identify functional regions of the cerebral cortex. • Locate and identify the 12paired cranial nerves by name and number. • Locate and identify the cranial nerves that transmit special sensory signals. • Locate and identify the cranial nerves that transmit motor signals. • Locate and identify the cranial nerves that transmit both sensory and motor signals. • Describe the pathway and functions of each cranial nerve. • Describe the functions of the somatic and autonomic nervous systems. • Identify structures of somatic sensation and describe their functions. • Describe the motor functions of the somatic nervous system. • Describe the sensory and motor pathways of the somatic nervous system. • Describe the roles of the basal ganglia and cerebellum in somatic nervous system function. • Describe the functions of the somatic and

		autonomic nervous systems. • Describe the structure of the autonomic nervous system. • Describe the roles of the sympathetic and parasympathetic nervous systems. 1. Demonstration of familiarity with intermediate statistical theory and methods, Statistical Inference, Linear Regression, Categorical Data Analysis and Modern Causal Methods, Epidemiology, Longitudinal Data Analysis, and Survival Analysis. 2. Demonstration of familiarity with core content of at least one area in health sciences: for example- genetics. Students will be able to: • Formulate and perform a descriptive and inferential analysis of a public health or other health sciences study using statistical software. • Reshape data for analysis using a programming or statistical language. • Interpret the findings from a moderately complex analysis.
	Biostatistics	• Identify distribution form relating to the variable/variables. • recognize normal distribution. • interpret data via normal distribution. • define the principal concepts of probability. • recognize the binomial distribution. • interpret data via binomial distribution. • Apply hypothesis testing via some of the statistical distributions. • define some concepts about hypothesis testing. • apply hypothesis testing to the data through these concepts. • arrange the results of the hypothesis testing and make a statistical decision. • Define the principal concepts about biostatistics. • recognize the definition of statistics, its subject and its relation with the other sciences. • restate the principal concepts about biostatistics.

		• Collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data. • identify data relating to variable/variables. • identify convenient sample by using sampling theory.
	Environmental Physiology	The student knows the principles of living species environmental physiology (how the living organism obtains and maintains the homeostasis at molecular, cellular and tissue levels, in the context of changes in the surrounding environment; the nutritional characteristics of foods, nutritional status, expenditure and energy needs, the physiological use of nutrients in the diet, the psychophysiological and neurobiological foundations of the behavior and cognitive and emotional interaction between the subject and the environment). In this unit the student will learn about Circulation, blood transport of oxygen and carbon dioxide, tissue gas exchange, and tissue use of oxygen. Effects of Low Oxygen Pressure on the Body, Effects of Acceleratory Forces on the Body in Aviation and Space Physiology, Physiologic Problems of Weightlessness (Microgravity). Direct effects of pressure on decent associated with the ears, sinuses, lungs, and eyes, Direct effects of pressure during ascent including reverse block, pneumothorax, mediastinal and subcutaneous emphysema, and arterial gas embolism. Indirect effects of pressure during descent including inert gas narcosis, high pressure nervous syndrome, CNS oxygen toxicity, and whole-body oxygen toxicity.
	Aviation and deep sea physiology	In this chapters students will learn that as a significance of the earth's rotation about its axis approximately every 24 hours, most organisms on this planet are subjected to probable variations of light and temperature. A diverse range of species, from cyanobacteria to humans, evolved internal biological clocks that allow for the anticipation of these daily variations. The field of chronobiology, the study of the rhythms in plants and animals, was limited to botanists for centuries. Only recently during the last decades, the research was expanded to include animals and later even human beings. Rhythms have been recognized and associated to the fluctuation of day and night and to the succession of the seasons. Nowadays, chronobiology has developed into a multidisciplinary field in

	Chronobiology and Biomedical instrumentation & biosensor	which scientists are involved in basic research as well as in applied topics.

Part:- III		
Course Code	Course Name	Course Outcomes
Paper:- VII	Sensory Physiology	After completion of this unit students will be able to:- • Locate and identify anatomical structures of the special senses. • Describe the process of olfaction. • Identify cranial nerves and describe the pathway of sensory impulses for each special sense. • Describe the process of taste. • Describe the process of vision. • Explain how eye shape affects vision. • Describe the role of the optic chiasm in binocular vision. • Describe the process of hearing. • Describe the process of equilibrium.
	Endocrine Physiology	This unit contains chapters on Hormone Action and Regulation and Endocrine Organs and Functions. At the conclusion of this unit, students will be able to: • Identify the major components of the endocrine system and describe their functions. • Locate and identify the primary and secondary endocrine organs. • Describe the mechanisms of hormone action and the role hormones play in body functions. •

	Work Physiology and Ergonomics	Identify the hypothalamus and pituitary gland and describe their role in hormone production. • Identify hormones produced by the hypothalamus and describe their functions. • Identify hormones produced by the anterior lobe of the pituitary gland and describe their functions. • Identify hormones released by the posterior lobe of the pituitary gland and describe their functions. • Locate and identify target organs of pituitary hormones. • Locate and identify the thyroid gland. • Identify hormones produced by the thyroid gland and describe their functions. • Locate and identify the parathyroid glands. • Identify hormones produced by the parathyroid glands and describe their functions. • Locate and identify the adrenal glands. • Identify hormones produced by the adrenal glands and describe their functions. • Locate and identify the pineal gland, and describe its functions. • Locate and identify the pancreas. • Describe the location and function of pancreatic islets, and identify hormones they produce. • Describe how pancreas hormones blood glucose level. • Identify hormones produced by secondary endocrine organs and describe their functions. • Describe how hormones regulate the stress response. In this chapter the students have to:- Understand the mechanisms of reaction and adaptation of the organism to physical effort and to submaximum or maximum work, (area of Physiology of the work) apprehend the components of a work system, seeking to adapt the work to the worker and describing the limits to be respected in the performance of work (area of Labor Ergonomics) to highlight the interrelationship between Ergonomics and organizational efficiency, aiming at maintaining worker safety and health, especially in the prevention of musculoskeletal injuries assimilate the main interventions in Ergonomics, namely in the identification and recognition of the risks potentially induced by the inadequacy of equipment and jobs identify the objective, scope and applicability of the main ergonomic checklists in the area of Occupational Health recognize the importance of ergonomic intervention at the level of the workers' postures, physiological dynamics of the sequential movements of the work, design of workplaces and tools. (1) Describe fundamental concepts of drug-receptor interactions (2) Describe the intermolecular energies that allow drug molecules to bind to proteins and how these interactions dictate binding specificity (3) Describe the principles of dose-response relationships and their use in quantifying drug action (4) Describe

	Pharmacology and mathematical Physiology	the relation between cell membrane or intracellular drug targets and intracellular signaling systems which mediate cellular response (5) Demonstrate an understanding of acid-base equilibria (pH, pKa, buffers) and the partition coefficient concept as they apply to pharmacology (6) Describe the impact of drug accessibility to biological compartments on drug action. (7) Describe the mechanism of therapeutic action of a selected drug at the molecular, cellular, organ system and whole body levels (8) Describe the common adverse effects of a selected drug and their mechanism of production (9) Describe the purpose as well as the detailed mechanisms of the biochemical reactions that render drug and xenobiotic compounds more suitable for elimination from the body (10) Predict possible metabolic outcomes of a given drug based on its chemical structure (11) Describe the fundamental mechanisms responsible for various types of drug interactions (12) Given the chemical structure of a given drug or xenobiotic, predict possible toxicity or mutagenicity due to the substance's metabolic conversion to a problematic product (13) Demonstrate an understanding of the basic terminology of genetics and the inherited basis of variations in drug response. (14) Identify and describe the genetic elements responsible for much of the clinical resistance to antibiotics. (15) Describe the mechanisms of transfer and of manipulation of the genetic elements involved in antibiotic resistance. (16) Demonstrate an understanding of gene therapy concepts, approaches, and limitations. This unit contains chapters on the Male Reproductive System, Female Reproductive System, and Sexual Reproduction and Development. At the conclusion of this unit, students will be able to: • Identify the major components of the male and female reproductive systems and describe their functions. • Locate and identify the structures that make up the male reproductive system. • Describe the role of each male reproductive structure in producing, storing, and transporting semen. • Describe blood supply and innervation of the testes. • Describe the process of spermatogenesis. • Locate and identify the regions of the male urethra. • Describe the composition and functions of semen. • Describe the physiological changes that occur during erection and ejaculation. • Identify the hormones involved in male reproductive functions. • Locate and identify the structures that make up the female reproductive system. • Identify the hormones involved in female reproductive functions. • Describe the process of oogenesis. • Locate and identify blood vessels that supply the uterus and ovaries. • Describe the phases of the female reproductive cycle. • Describe the role of each female

Paper:-VIII	Reproductive Physiology	reproductive structure in sexual reproduction. • Locate and identify structures involved in lactation. • Describe the process of lactation. In this chapter the students will learn to develop understanding of the development of embryology; basic human development (fertilization, implantation, bi- and trilaminar embryo, placentation, development of three germ layers); of the main cellular, subcellular and molecular processes (induction, determination, differentiation and growth), and of processes at all stages of embryogenesis and fetogenesis. Students develop understanding of histogenesis and organogenesis of particular tissues and organs. Students acquire knowledge of critical periods, critical factors and different congenital and developmental anomalies that arise at different periods of intrauterine life. Students acquire knowledge of achievements in modern experimental embryology and their practical use in daily work of a doctor, and of the elements and significance of comparative embryology. (1) Demonstrate an understanding of the processes involved in absorption, distribution, metabolism and excretion of toxicants, including an understanding of the toxicokinetic behavior of toxicants in mammals. (2) Demonstrate an understanding of the principles and approaches used to investigate the metabolism of toxicants in laboratory mammals and in humans and of the metabolic activation of chemicals to toxic metabolites. (3) Demonstrate an understanding of target organ toxicity involving the following organ systems: liver, kidney blood, cardiovascular, immune, skin, gastrointestinal, pulmonary, reproductive, endocrine, ocular, and central and peripheral nervous systems. What are the typical mechanisms through which chemical toxicants affect the structure and function of these systems? What are the common consequences of toxicant action on these systems? (4) Demonstrate an understanding of lipid peroxidation as a mechanism of chemical-induced toxicity and an understanding of metal induced toxicity. (5) Demonstrate an understanding of chemical-induced, receptor-mediated toxicity, and the role of steroid receptors and the Ah receptor in mediating chemical induced toxicity. (6) Demonstrate an understanding of the use of genetics and genomics in toxicology. (7) Demonstrate an understanding of the role of inflammation and apoptosis, in chemical-induced toxicity. (8) Understand the role of epidemiology and animal studies for the identification of chemical carcinogens in humans. (9) Demonstrate an understanding of the fundamental process of cancer, cell proliferation, chemical-induced DNA damage and DNA repair mechanisms. (10) Demonstrate an understanding of the roles of cell signaling

	Developmental Physiology	mediated by membrane receptors and of the nuclear effects of signaling cascades in chemical induced toxicity. (11) Demonstrate an understanding of hormonal carcinogenesis and hormone-dependent cancers. (12) Describe the mechanisms through which radiation produces cellular and systemic toxicity. (13) Describe the fundamental mechanisms through which toxicants initiate abnormal development of cells and tissues in the developing embryo and fetus (teratology and developmental toxicity). (14) Describe methods involved in evaluating the toxic effects of chemicals on selected organ systems (e.g., lung, eye, CNS, reproductive, kidney, liver). (15) Demonstrate an understanding of the factors which underlie species differences in response to potential toxicants. (16) Describe mechanisms through which toxicants are dispersed throughout the ecosystem. (17) Describe methods for evaluating the hazards associated with environmental exposure to toxicants
	Toxicology	1. Describe and assess the basic psychological theories, principles, and concepts explaining social cognition, attitude formation, decision making, group processes, pro-social behavior, aggression, conformity/obedience and stereotyping/prejudice.* 2. Relate knowledge of theory as well as current and past research in social psychology to situations in everyday life such as interpersonal and group relations.* 3. Explain how human behavior is influenced by such social factors as groups, authority figures, in-group bias, gender roles, cognitive dissonance, etc.* 4. Predict the outcomes of various social situations through application of social psychology principles (for example, attributions, cognitive dissonance, in-group/out-group behavior, etc.).* 5. Relate major concepts and methods of the field to understand interpersonal and group relationships.* 6. Assess and critically analyze theories, research methods and findings (outcomes), and applications developed by psychologists and made available through textbooks, newspapers, professional and lay periodicals, and the internet.* • Cognitive Knowledge: To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.

		• Information and Computer Literacy: To educate and make them up to date with the current scientific literature, computer programs and web information. • Experimental Skills: To provide broad based training in technical skills in methods of biotechnology. • Critical Thinking: To empower students with the ability to think and solve problems in the field of biotechnology. • Scientific Communication: To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals. • Professional Attitude: To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields. This course aims to the following learning outcomes : 1. Knowledge of the historical background for Clinical Biochemistry. 2. Explain the basic elements of core Biochemistry and specialized tests of biochemistry. 3. Compare and contrast the basic differences between carbohydrate, lipid and protein metabolism abnormalities. 4. Describe and identify the main characteristics of diagnosis, screening, and prognosis of disease. 5. Apply the processes of scientific research to use in emergency services in clinical biochemistry. 6. Distinguish scientific explanations that show the hormonal disorders during disease. The students will also be able to develop their:- ***Knowledge***: 1- To describe and outline of branches of clinical biochemistry. 2- To Recall and differentiate between morphological changes in liver, kidney and other organs. 3- To define the different types of disease. 4- To able differentiate clinically diabetes mellitus, renal failure, and liver disease. 5- To get acquainted with the basics of abnormalities inside the cells during disease. 6- To memorize how the endocrine control. ***Cognitive Skills:*** 1- To refer different abnormalities affecting liver, kidney, and other organs. 2- To recognize an overview of the general metabolism disorders. 3- To know characteristics of liver failure and kidney failure. 5- To identify lipoprotein disorders. 6- To contrast the pattern of different types of mineral metabolism disorders.

	Social Physiology Biotechnology	***I. HUMAN NUTRITION*** I. **Community** Students will be able to interpret and apply nutrition concepts to evaluate and improve the nutritional health of communities. I. **Medical Nutrition Therapy (MNT)** Students will be able to interpret and apply nutrition concepts to evaluate and improve the nutritional health of individuals with medical conditions *V*. **Food** Students will be able to identify and apply food principles to food and nutrition systems *V*. **Education/Communication** Students will be able to demonstrate a variety of communication strategies in nutrition and food education emphasizing information technology I. **Management** Students will be able to apply management principles to evaluate human, physical and fiscal resources in organizations I. **Professional Issues** Students will be able to integrate knowledge and skills in food and nutrition with professional issues affecting the nutrition and/or dietetics fields. ***DIET SURVEY*** After studying this course, you should be able to: • List the six key nutrient groups and explain their role in a healthy diet • Understand and calculate body mass index (BMI), and use such calculations to predict desirable weight ranges for individuals • Explain the importance of a balanced diet in terms of energy intake • Explain how genetic and environmental variables may interact to produce variability in human body weight and adiposity both within and across generations • Apply an understanding of gene–environment interactions to possible explanations of variability in body weight and adiposity.

	Clinical Dietetics and Applied physiological Chemistry	

Statistics Department (2016-17)(Annual System)

UG Part I General

Sl. No.	Paper	Learner's Out Come
1.	Paper I	After completion of the course, students learn about mean, median, mode, range, variance, and standard deviation. Demonstrate an understanding of descriptive statistics. Explain the difference between descriptive statistics and inferential statistics.

Sl. No.	Paper	Learner's Out Come
2.	Paper II	On successful completion of the course students will be able to: 1. Calculate probabilities by applying probability laws and theoretical results. 2. Identify an appropriate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities. 3. Calculate statistics such as the mean and variance of common probability distributions. 4. Calculate probabilities for joint distributions including marginal and conditional probabilities. 5. Determine whether random variables are independent and find their covariance and correlation. 6. Apply results from large-sample theory and the Central Limit Theorem to approximate a sampling distribution.

Sl. No.	Paper	Learner's Out Come

3.	Paper III (Practical)	After completion of the course, students acquire knowledge of practical problem solving techniques on different measures of Statistics and Probability trials.

UG Part II General

Sl. No.	Paper	Learner's Out Come
1.	Paper IV	After completion of the course, students learn about the characteristics of a sampling distribution. Describe the general properties of sampling distributions and the use of standard error in analyzing them. Also learn the difference between a frequency distribution and a sampling distribution and the difference between discrete and continuous sampling distributions.

Sl. No.	Paper	Learner's Out Come
2.	Paper V	On successful completion of the course students will be able to: 1. Explain the concept of estimation of parameters. 2. Calculate the problems related to point estimation and interval estimation. 3. Explain the concepts of Testing of Hypotheses, (Large Sample Tests small sample test). 4. Solve the problems related to Testing of Hypotheses, (Large Sample Tests small sample test). 5. Hypothesize various advanced statistical techniques for modelling and exploring practical situations.

Sl. No.	Paper	Learner's Out Come

3.	Paper VI (Practical)	After completion of the course, students acquire knowledge of practical problem solving techniques on sampling methods and methods of statistical inference.

UG Part III General

Sl. No.	Paper	Learner's Out Come
1.	Paper VII	After completion of the course, students learn about Statistical quality control, Indian Statistical System, Population Statistics, Different design models, Index number and also Time series analysis.

Sl. No.	Paper	Learner's Out Come
2.	Paper VIII (Practical)	After completion of the course, students acquire knowledge of practical problem on CRD, RBD and LSD model also of Statistical quality control Index number and Time series analysis.

Paper Wise Outcomes

Department of Philosophy

Siliguri College

Session: 2016-2017

I+I+I System

The B.A Philosophy Honours course of I+I+I system provides a multidimensional syllabus for the students, which brings certain positive outcomes into their life. The paper wise outcomes of the I+I+I system can be narrated in the following way.

PART-I

The first year of the B.A Philosophy Honours course of I+I+I system contain two paper (paper-I & paper-II).

Paper-I (Indian Philosophy): The paper one is concerned about the great Indian Philosophical School, both the theistic and atheistic schools. This paper provides a wide overview on Philosophical issues of ancient and medieval India. Such study also helps the students to have an understanding about the meaning of life and reality.

Paper –II (Ethics and Western Logic- part-i): Paper two is concerned about the ethics and Logic. The Study of ethics makes students aware about the meaning and purpose ethical principles which ultimately helps students to live a sound life. The paper two also provides a comprehensive idea about the basic notion of propositional logic. The study of logic helps students to enhance their logical understanding.

PART-II

The Second year B.A Honours syllabus provides two papers (paper-III & paper-IV).

Paper-III (Western Philosophy): The paper three is concerned about Western Philosophy. In that paper students obtain a wide understanding about the philosophical idea of certain Greek Philosophers like Socratic, Plato and Aristotle and some Western Philosophers like Locke, Berkley, Hume, Descartes, Spinoza, Leibnitz and Kant. Such study helps the students to acquire an understanding about the meaning of life and reality.

Paper-IV (Western Logic part-ii & Philosophy of Religion): The paper four contains some advance notions of western logic like quantification logic, which helps students to become aware the developments into the field of logic. The paper four also contains some philosophical understanding about nature of religion. The understanding about the nature of religion makes students able to understand the role of religion in human life.

PART-III

The Third year B.A Honours syllabus provides four papers (paper-V, VI. VII, VIII) among which there is a special/ optional paper.

Paper-V (*Tarkasamgraha*) : Fifth paper is concerned about one of the most fundamental text of Nyaya Philosophy namely, *Tarkasamgrah.* The study of *Tarkasamgrah* makes students aware about some certain epistemological concern of Nyaya Philosophy.

Paper VI- (Analytic Philosophy): the paper six of the 3rd year B.A Philosophy Honours course actually concerned with certain analytic philosophical understanding of J. Hospers. The study his book namely *An Introduction to Philosophical Analysis* helps students to become aware about certain analytical concepts of language. It also helps students to analyse certain metaphysical concepts like causality.

Paper-VII (Social & Political Philosophy): Paper seven is concerned about the certain social and political concepts like Society, Community, Democracy, Equality etc. The study of this paper makes students aware about the social and political relationship, notion, ideas etc.

Paper-VIII (Optional Paper): Paper eight is an optional paper. The 3rd year B.A Philosophy Honours course provides some papers like Phenomenology, Problems of mind etc. All this optional papers are comprehensive and thought provoking. The study of this optional paper enhances the intellectual capacity of the students.

Paper wise outcome General Course

I+I+I=System

Session-2016-2017

Department of Philosophy

Siliguri College

PART-I

Paper-I Indian Philosophy: The paper one is concerned about the very fundamental concepts of some Atheistic Indian Philosophical Schools namely Charvaka, Jaina and Buddhism. This paper provides a wide overview on Philosophical issues of ancient Atheistic schools. Such study helps the students to get acquainted with the certain argumentative traditions.

Paper-II Western Philosophy- This paper is concerned with the certain western epistemological and metaphysical issues. This paper helps students to have a proper idea concerning the western conception about the sources knowledge, nature of knowledge.

Paper-III Psychology- This paper is concerned about certain theories and conceptions of Psychology. The successful study of this paper makes students able to understand certain psychological concepts like, interception, perception etc.

PART-II

Paper-IV Indian Philosophy- The paper four is concerned about the very fundamental concepts of some Theistic Indian Philosophical Schools namely Nyaya, Vaishesika, Yoga etc. This paper provides a wide overview on Philosophical issues of ancient theistic schools.

Paper-V Western Logic- This paper is concerned with western logic. This paper provides a comprehensive idea about the basic notion of propositional logic. The study of logic helps students to enhance their logical understanding.

Paper-VI Social and Political Philosophy- this Paper is concerned about the certain social and political concepts like Society, Community, Democracy, Equality etc. The study of this paper makes students aware about the social and political relationship, notion, ideas etc.

PART-III

Paper VII Ethics- Paper Seventh is concerned with basic notion of Western and Indian ethical issues like moral and non-moral actions, Niskama Karma etc. the study of such ethical concepts makes students able to have a systematic understanding of ethics.

YEAR 2016-17

Department of Nepali Syllabus Outcoms of I+I+I system

B.A. Honours (16-17)

1st year

Paper 1- Nepali Kavita ra Nepali Upanayas- *Study of selected Nepali poem and Novel to initiate their ability to appreciate Nepali literature*

Paper 2- Nepali Katha ra Nepali Natak - *Analysis and study of Nepali short stories and Play written by different writers .*

2nd Year

Paper 3-Sahityaka Tatwa ra Nepali Kavita- *Awareness about significant literary ideologies (Eastern and Western) that influenced Nepali literature. Study of selected Nepali poem.*

Paper4- Nepali Katha ra samanaya Bhasa vigyan Ko Parichya- *Study of selected Nepali short stories. Understand and analyse Nepali linguistic technicalities and grammar.*

3rd year

Paper 5- Sahitya sidhant ra pramukh vaadharu ra samakalin Nepali Kavita - *Analysis and study of different literary ideologies that influenced Nepali literature. Analysis and study of contemporary Nepali poem.*

Paper 6- samakalin Nepali Upanayas ra Aakhaneter Nepali gadhya sahitya- *Analysis and study of contemporary Nepali Novel and essay.*

Paper 7- Nepali Natak Ra Nepali Basha Vigyan- *Understand and analyse Nepali linguistic technicalities and grammar.*

Paper 8- Nepali Sahityatihasko parachya ra (i) Nepali Prabandha Kabya (ii)Nepali Anudit Sahitya (iii)Nepali Lok Sahitya [any one]- *Comprehensive understanding of growth and signification of Nepali literary history*

B.A. General

1st. Year

Paper1- Bashako Payichya- *Understand and analyse Nepali linguistic*

Paper 2-Aakhaneter Gaydhya ra Nepali Sahityako itihas –*Comprehensive understanding of growth and signification of Nepali literary history.*

Paper 3-Nepali Kavita- *Analysis and study of contemporary Nepali poetry.*

2nd Year

Paper 4- Sahitya Tatwa - *Awareness about significant literary ideologies (Eastern and Western) that influenced Nepali literature.*

Paper5- Nepali Katha- *Analysis and study of contemporary Nepali short stories.*

Parer 6 -Nepali Natak- *Concise introduction to Nepali play and Analysis and study of some contemporary Nepali play.*

3rd Year

Paper 7- Nepali Kavita ra Nepali Upanayas- *Analysis and study of selected Nepali poem and Novel written by different writers that develops their creativity, critical understanding of social influences and an ability to appreciate the rich heritage of Nepali literature.*

MIL Nepali- *Understand and analyse of Nepali grammar.*

LEARNING OUTCOMES OF ECONOMICS (HONOURS) 2016-17 (ANNUAL 1+1+1 SYSTEM-ALL YEARS)

ECONOMICS (HONOURS) COURSE

PART-I

PAPER I: GR. A- MICROECONOMICS:

- Understand the fundamentals of microeconomics
- Understand how economists use economic models to solve basic microeconomic problems
- Learn to use mathematics and graphs in common economic applications
- Understand the problem of decision making of an individual or firm
- Analyze the effects and causes of government policies
- Use the fundamental techniques to think about a number of policy questions related to the operation of the real economy.
- Good standards of employability.

GR. B- MACROECONOMICS:

- Explain the concepts of Macroeconomics and its interrelations with Microeconomics.
- Associate the current economic phenomenon with existing theory and put their views on contemporary economic issues.
- Apply the principle of Macroeconomics in explaining the behavior of Macroeconomic variables at national as well as global level.
- Use mathematics in common economic applications
- Analyze the effects and causes of government policies and provide suggestive policy measures
- Good standards of employability

PAPER II: GR. A- MATHEMATICAL ECONOMICS

- Demonstrate the role of quantitative techniques in the field of business/industry, illustrate different types of equations, solve equations and system of equations, understand the concept of sets, illustrate and apply basic set operations.
- Explain the rules for calculating derivatives, uses and application in calculating inter-relationship among total, marginal and average cost and revenue, calculate maxima, minima, elasticity, decide the optimal level of production for a firm.

- Demonstrate the rules for calculating integration; describe the importance and application of integration in consumers' and producers' surpluses, total revenue and cost.
- Illustrate matrix operation, minors, cofactors, use cofactor method to find inverse of a matrix, use Cramer's rule to solve systems of equations.
- Demonstrate knowledge of basic concept of linear program, duality, capacity to solve linear programming problems', familiar with the basic techniques most commonly used in economic problems.

GR. B- STATISTICS:

- Have the versatility to work effectively in a broad range of analytic, scientific, government, financial, health, technical and other positions
- Have a broad background in Mathematics and Statistics
- Be familiar with a variety of examples where mathematics or statistics helps accurately to explain abstract or physical phenomena.
- Recognize and appreciate the connections between theory and applications
- Perform statistical inference in several circumstances and interpret the results in an applied context
- Design experiments, carry them out, and analyze the data they yield.
- Demonstrate understanding of the concepts of time series and its applications in different areas.

PART-II

PAPER III: GR. A- MICRO ECONOMICS

- Demonstrate marginal productivity theory of distribution, theory of wages, identify different types of rent, illustrate different theories of interest and profits.
- Understand how factor market works, identify the various determinants of firm's demand for factor services, bilateral monopoly, demonstrate monopsony in factor market and factor market equilibrium.
- Understand how factor market works, illustrate basic tools in welfare economics, and illustrate the concept of social welfare functions and compensation principles.
- Identify the various types of investment function analysis and understand the elements of social cost benefit analysis.
- Understand international and inter regional trade, identify and understand various trade theories, analyze the various types of restrictions of international trade.

GR. B- MACRO ECONOMICS

- Define and explain the process of calculating national income, identify its components, demonstrate circular flow of income, analyse the various income identities with government and international trade, define the concept of green accounting.
- Understand Say's law of market, classical theory of employment and Keynes objection to the classical theory, demonstrate the principle of effective demand and income determination.
- Explain the meaning of consumption function, relationship between APC and MPC, consumption and income, concept of multiplier and analyse the theories of absolute and relative income hypotheses.
- Understand the relationship between investment and savings, demonstrate investment multiplier, and understand the meaning of MEC and MEI.
- Illustrate the meaning of interest, analyse the various theories.

PAPER IV: GR. A- MATHEMATICAL ECONOMICS

- Improve the mathematical skills necessary to study economics.
- Identify, solve and interpret the characteristics of each family of functions: linear, polynomial, exponential, logarithmic and quadratic.
- Analyze nonlinear functions using differential calculus.
- Use integration and matrix algebra techniques in economic analysis.
- Find the solution for constrained optimization problems using methods of substitution and Lagrange multiplier for both equality and inequality constraints.
- Generates good standards of employability.

GR. B- STATISTICS:

- Collect appropriate data needed, manipulate and draw inferences, describe the concept of statistical averages, use and apply central tendency, dispersion, skewness, and kurtosis.
- Demonstrate the basic concept of probability, theoretical distribution, probability theorems; solve probability problems by applying probability concept.
- Explain concept of correlation, analyze and interpret covariance and correlation coefficient, illustrate ordinary least squares and use it to estimate regression coefficient.
- Describe the components of time series, apply time series analysis in business scenarios, illustrate the different types of index numbers, and calculate index numbers.

- Measure mortality rates, population growth, reproduction rate, rate of natural increase, net reproduction rate, knowledge in understanding how the population profile of a country is changing, estimate population trend.

Part-III

PAPER V: GR. A- DEVELOPMENT ECONOMICS:

- Demonstrate familiarity with some central themes and issues of economic development.
- Demonstrate the understanding of the difference between growth and development, major growth theories, the measurement of inequality, significance of agriculture in developing countries, poverty and population issues facing the world, international trade, and importance of foreign aid.
- Analyse empirical evidence on the patterns of economic development.
- Read critically the journal literature in the area of economic development.

GR. B- ENVIRONMENTAL ECONOMICS:

- Realize the importance and influence of environment on the economy including the quality of manpower. Arouse their feelings to make cleaner environment so as to achieve harmonious development.
- Understand that environmental problem is not the problem of a single country or region but a global problem/issue. Hence, policy formulation may be for all countries.
- Demonstrate the scientific management of waste materials; realize the role and importance of individuals to keep the environment clean.
- Understand the causes and victims of environmental pollution like poverty, population explosion, and over-use of resources, careless or unscientific dump/management of wastes.
- Suggest appropriate measures to correct environmental degradation, aware of those ingredients such as healthy climate, quality of human beings, domestic and other natural habitats and biodiversity levels, productivity and productions, sustainability, etc. are all influenced by environment.

PAPER VI: GR. A- INTERNATIONAL ECONOMICS:

- Have a good conceptual understanding of the key concepts and practical applications of both international trade and international finance.
- Outline the development of trade theory historically, differentiating standard classical and orthodox trade theories.
- Analyze the links between trade, international finance, economic growth and globalization, with a particular emphasis on the experiences of developing countries.
- Critically comment on and participate in current debates on international economic policy.
- Generates good prospects of employment.

GR. B-PUBLIC ECONOMICS:

- Understand the sources of finance both public and private; demonstrate the role of government to correct market failures and possible advantage of public financing.
- Attain the advantages and knowledge of public investments and other government expenditures. Understand the causes of growing public expenditures for various programmes and policies within and outside the country.
- Understand the possible burden, benefits and distribution of various types of taxes among various classes of people, know the general trend and impact on general welfare and arouse them to suggest good and bad tax system.
- Understand the needs of public borrowing from all possible sources to meet necessary public investment/expenditures. Also be alerted to find sources for repayment.
- Deliver effectively the preparation of budget and how they are passed in the house. Understand the changes in size and flexibility of state and central budget along with the role played by Finance Commission.

PAPER VII: GR. A- INDIAN ECONOMIC HISTORY:

- Basically, the course focuses the idea of Indian Economic system during British colonial period during 1857-1947.
- Can find the overall condition of Agriculture and industry more specifically agricultural activities and the production process prior to the 1890's and the condition of the farmers, land, labour exploitation, condition of credit market etc. Students more able to know the degree of brutality under colonialism through the incidence of resource extraction and economic drain and biased trade policies.
- Understand Broader and prolonged impact of colonialism/imperialism by the British govt. on Indian economy.

GR.B- INDIAN ECONOMIC PROBLEMS AND PLANNING:

- To comprehend the basic characteristics of economic development and economic growth.
- To understand the indices of economic development.
- To analyze the demographic trends in India.
- To realize the causes and measures of poverty inequalities and unemployment.
- Grasp the importance of planning undertaken by the government of India
- Understand the foundation of economic reforms and also the ongoing planning undertaken by the government.
- Analyze the effects and causes of government policies and provide suggestive policy measures.

PAPER VIII: GR. A- FINANCIAL ECONOMICS:

- Explain the broad features of Indian financial institutions with its apex banks' objectives and purview. Also understand the instruments to control credit in the country.
- Effectively narrate the kinds and components of money with its regulatory system, be aware of the functions, objectives and limitations of commercial banks.
- Identify the existence and development of non-banking financial institutions, know the important role of Mutual funds, LIC, investment companies etc., utilize and effectively participate in the development process.
- Understand the conditions of financial markets and its impact in the economy.
- Demonstrate the role and significance of foreign exchange rate and its markets with its impact on various sectors in the economy.

GR. B- INDIAN ECONOMIC POLICY AND PERFORMANCE:

- Develop ideas of the basic characteristics of Indian economy, its potential on natural resources.
- Understand the importance, causes and impact of population growth and its distribution, translate and relate them with economic development.
- Grasp the importance of planning undertaken by the government of India, have knowledge on the various objectives, failures and achievements as the foundation of the ongoing planning and economic reforms taken by the government.
- Understand agriculture as the foundation of economic growth and development, analyse the progress and changing nature of agricultural sector and its contribution to the economy as a whole.

LEARNING OUTCOMES OF ECONOMICS (GENERAL) 2016-17 (ANNUAL 1+1+1 SYSTEM-ALL YEARS)

ECONOMICS (GENERAL) COURSE

PART-I

MICRO ECONOMICS (GROUP A):

- Understand the fundamentals of microeconomics

- Understand how economists use economic models to solve basic microeconomic problems
- Learn to use mathematics and graphs in common economic applications
- Understand the problem of decision making of an individual or firm
- Analyze the effects and causes of government policies
- Use the fundamental techniques to think about a number of policy questions related to the operation of the real economy.
- Good standards of employability.

MACRO ECONOMICS (GROUP A):

- Explain the concepts of Macroeconomics and its interrelations with Microeconomics.
- Associate the current economic phenomenon with existing theory and put their views on contemporary economic issues.
- Apply the principle of Macroeconomics in explaining the behavior of Macroeconomic variables at national as well as global level.
- Use mathematics in common economic applications
- Analyze the effects and causes of government policies and provide suggestive policy measures
- Good standards of employability

INDIAN ECONOMICS (GROUP A):

- To comprehend the basic characteristics of economic development and economic growth.
- To understand the indices of economic development.
- To analyze the demographic trends in India.
- To realize the causes and measures of poverty inequalities and unemployment.
- Grasp the importance of planning undertaken by the government of India
- Understand the foundation of economic reforms and also the ongoing planning undertaken by the government.
- Analyze the effects and causes of government policies and provide suggestive policy measures.

PART-II

MICRO ECONOMICS (GROUP B):

- Demonstrate marginal productivity theory of distribution, theory of wages, identify different types of rent, illustrate different theories of interest and profits.
- Understand how factor market works, identify the various determinants of firm's demand for factor services, bilateral monopoly, demonstrate monopsony in factor market and factor market equilibrium.
- Understand how factor market works, illustrate basic tools in welfare economics, and illustrate the concept of social welfare functions and compensation principles.
- Identify the various types of investment function analysis and understand the elements of social cost benefit analysis.
- Understand international and inter regional trade, identify and understand various trade theories, analyze the various types of restrictions of international trade.

MACRO ECONOMICS (GROUP B):

- Define and explain the process of calculating national income, identify its components, demonstrate circular flow of income, analyse the various income identities with government and international trade, define the concept of green accounting.
- Understand Say's law of market, classical theory of employment and Keynes objection to the classical theory, demonstrate the principle of effective demand and income determination.
- Explain the meaning of consumption function, relationship between APC and MPC, consumption and income, concept of multiplier and analyse the theories of absolute and relative income hypotheses.
- Understand the relationship between investment and savings, demonstrate investment multiplier, and understand the meaning of MEC and MEI.
- Illustrate the meaning of interest, analyse the various theories.

INDIAN ECONOMICS (GROUP B):

- Develop ideas of the basic characteristics of Indian economy, its potential on natural resources.
- Understand the importance, causes and impact of population growth and its distribution, translate and relate them with economic development.
- Grasp the importance of planning undertaken by the government of India, have knowledge on the various objectives, failures and achievements as the foundation of the ongoing planning and economic reforms taken by the government.

- Understand agriculture as the foundation of economic growth and development, analyse the progress and changing nature of agricultural sector and its contribution to the economy as a whole.

PART-III

DEVELOPMENT ECONOMICS:

- Demonstrate familiarity with some central themes and issues of economic development.
- Demonstrate the understanding of the difference between growth and development, major growth theories, the measurement of inequality, significance of agriculture in developing countries, poverty and population issues facing the world, international trade, and importance of foreign aid.
- Analyse empirical evidence on the patterns of economic development.
- Read critically the journal literature in the area of economic development.

ELEMENTRY STATISTICS:

- Collect appropriate data needed, manipulate and draw inferences, describe the concept of statistical averages, use and apply central tendency, dispersion.
- Organize, manage and present data.
- Analyze statistical data graphically using frequency distributions and
- cumulative frequency distributions.
- Analyze statistical data using measures of central tendency, dispersion
- and location.

2016-17

BCA (Old)

- **1st SEMESTER:**
- **11: (English Language- N/A)**
- **12: (Mathematics- N/A)**

- **CC 13: (Introduction to Information Technology)**

By the end of the course, successful students can use digital technology like internet , wifi, routers, LAN etc. with ease. That will be helpful in real life understanding.

- **14: (Basic Electronics and Introduction to Logic & Organization)**

To give knowledge of some basic electronic components and circuits. It also helps to study logic gates and their usage in digital circuits.

- **15: (Physics- N/A)**

- **16: (Laboratory I- Windows and Office Tools)**

It helps students to become familiar to work in thewindows computer with the help ofits basic tools.

- **2nd SEMESTER:**
- **21: (Mathematics- N/A)**
- **22: (Data Structure through C Language)**

Data structures and algorithms (DSA) goes through solutions to standard problems in detail and gives students an insight into how efficient it is to use each one of them using a start up language like C. It also teaches you the science of evaluating the efficiency of an algorithm. This enables you to choose the best of various choices.

- **23: (Business System Analysis, MIS and ERP Fundamentals)**

On completion of this course the studentsare able to Explain what systems are and how they are developed .Explain the need for and value of a formalized step-by-step approach to the analysis, design, and implementation of computer information systems. Use tools and techniques for process and data modelling.

- **24: (Computer Architecture)**

On completion of this course the students are able to understand the structure, function and characteristics of computer systems, also can understand the design of various functional units and components of computers, identify the elements of modern instructions sets and their impact on processor design.

- **25: (Alternative English- N/A)**

- **26: (Laboratory II- Data Structure through C)**

Can understand Data Structure properties practically using C language.

- **3rd SEMESTER:**
- **31: (System Programming)**

Understand basic concepts in systems programming. Understand basic concepts in UNIX file systems and process control. Understand UNIX system calls. Develop skills to write programs using system services.

- **32: (Computer Oriented Numerical & Statistical Methods)**

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. Analyse and evaluate the accuracy of common numerical methods.

- **33: (Microprocessor and Assembly Language)**

Microprocessor gets an understanding of microprocessor based machine works and what are the roles of the main IC in modern Computer.

In Assembly language programming, students learn to develop low level or hardware level language specially 8085 microprocessor.

- **34: (DBMS with ORACLE)**

Enhance the knowledge and understanding of Database analysis and design. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.

- **35: (OOP with C++)**

Understand programs using objects and data abstraction, class, and methods in function abstraction. Analyze, write, debug, and test basic C++ codes using the approaches introduced in the course.

- **36: (Laboratory III- Programming using C++)**

Analyze problems and implement simple C++ applications using an object-oriented software engineering approach on practical life problems.

- **4th SEMESTER:**
- **41: (Computer Graphics)**

After learning the course the students should be able to explain fundamental concepts within computer graphics such as geometrical transformation, illumination models, removal of hidden surfaces and rendering, etc.

- **42: (Visual Programming with VB)**

VB, a GUI Programming language. Upon completion of this course, the student will be able to design, create, build, and debug Visual Basic applications.

- **43: (Windows Programming)**

The students can develop windows applications and GUI using structured and object-based programming techniques.

- **44: (Data Communications and Computer Networking)**

Be familiar with the architecture of a number of different networks. Understand the principles of protocol layering. Be familiar with modern communication systems. Understand the basic aspects of packet-based protocol design and implementation.

- **45: (Laboratory IV- Windows Programming)**

Students learn GUI design practically.

- **46: (Laboratory V- VB & ORACLE)**

Students should be able to design, create, build, and debug Visual Basic applications and Database applications practically.

- **5th SEMESTER:**
- **51: (Optimization Techniques)**

Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems.

- **52: (Web Technology with Java)**

At the end of the course, students should be able to design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's. Also get introduced in the area of Online Game programming.

- **53: (UNIX and Shell Programming)**

On completion of this course the student should be able to identify and use UNIX/Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

- **54: (Software Engineering)**

An ability to work in one or more significant application domains. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.

- **55: (Laboratory VI- Unix and Networking)**

Shell scripts are used here to write scripts or develop programs in UNIX/LINUX based systems.

- **56: (Laboratory VII- Java and Internet Lab)**

Students learn to develop java programs and small Apps.

- **6th SEMESTER:**
- **61: (Environmental Studies- N/A)**

- **62: (AI and Expert Systems)**

Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems. Analyze the structures and algorithms of a selection of techniques related to searching, reasoning, machine learning, and language processing.

- **63: (Compiler Construction)**

At the end of the course, students will understand different considerations and phases of compilation, the impact of language attributes upon the compilation process, the effect of hardware feature on the generated code and the practical fundamentals of compiler implementation.

- **64: (Human Resource Management- N/A)**

- **65: (Project)**

It helps students to choose a specific problem and reproduce its computerized version of that, which provides a real life working environment.

- **66: (Presentation of Project & Viva Voce)**

It makes them confident for their upcoming future.

2016-17

Under 1+1+1 system

Computer Science (Hons):

- **First Year:**
- **Paper 1: (Digital Electronics and Computer System Architecture)**

Gives the core knowledge about computer hardware and the working of its components. On completion of this course the students are able to understand the structure, function and characteristics of computer systems, also can understand the design of various functional units and components of computers, identify the elements of modern instructions sets and their impact on processor design.

- **Paper 2: (Numerical Analysis, LPP,Basic Electronics)**

Students learn the mathematical formulation to solve real life problems and also write program codes to implement various algorithms.

- **Second Year:**
- **Paper 3:(Programming in C, Operating system,Data Structure, Theory of Computation)**

Programming in C helps to learn a very powerful computer language which lays the foundation of learning other modern computer languages easily.

Operating System gives an idea about how system software works. Students gets better idea about hardware, software co-ordination.

Data structure lays the foundation of maintaining data in computer with cost effectiveness. Thus Students get the idea of which data structure to use under circumstances.

Theory of Computation lays the foundation of learning about various kinds of machines and grammar's and languages associated with it.

- **Paper 4:(Practical on C programming)**

Earns to develop computer programs which can be used to solve various kinds of daily life problems.

- **Third Year:**
- **Paper 5:(Microprocessor, Advance System Architecture, Network, Digital Graphics)**

Microprocessor gets an understanding of microprocessor based machine works and what are the roles of the main IC in modern Computer.

In Networking, interconnectivity among computers is of utter importance these days. Students get knowledge about various components in Networking.

In Computer Graphics, after learning the course the students should be able to explain fundamental concepts within computer graphics such as geometrical transformation, illumination models, removal of hidden surfaces and rendering, etc.

- **Paper 6:(Object Oriented Programming using C++, DBMS, Software Engineering, Internet Technology, VB)**

Understand programs using objects and data abstraction, class, and methods in function abstraction. Analyze, write, debug, and test basic C++ codes using the approaches introduced in the course.

Enhance the knowledge and understanding of Database analysis and design. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.

An ability to work in one or more significant application domains. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.

VB, a GUI Programming language. Upon completion of this course, the student will be able to design, create, build, and debug Visual Basic applications.

- **Paper 7:(Practical on Assembly Language, VB,HTML)**

In Assembly language programming, students learn to develop low level or hardware level language specially 8085 microprocessor.

Students should be able to design, create, build, and debug Visual Basic applications and Database applications practically.

In HTML, students should be able to design and develop webpages.

- **Paper 8:(Practical on C++, PL/SQL, Shell Script)**

Analyze problems and implement simple C++ applications using an object-oriented software engineering approach on practical life problems.

Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.

Shell scripts are used to write scripts or develop programs in UNIX/LINUX based systems.

Computer Science (General):

- **First Year:**
- **Paper 1: (Computer Fundamental, Digital Logic)**

To give knowledge of some basic electronic components and circuits. It also helps to study logic gates and their usage in digital circuits.

- **Paper 2: (Data and File Structure)**

Data and File structure lays the foundation of maintaining data in computer with cost effectiveness. Thus Students get the idea of which data structure to use under circumstances.

- **Paper 3: (Windows and Office Tools Lab)**

It helps students to become familiar to work in the windows computer with the help of its basic tools.

- **Second Year:**
- **Paper 4: (C Programming, Operating System)**

Programming in C helps to learn a very powerful computer language which lays the foundation of learning other modern computer languages easily.

Operating System gives an idea about how system software works. Students gets better idea about hardware, software co-ordination.

- **Paper 5: (Computer Architecture, System Analysis and Design)**

On completion of this course the students are able to understand the structure, function and characteristics of computer systems, also can understand the design of various functional units and components of computers, identify the elements of modern instructions sets and their impact on processor design.

In System Analysis and Design, the students are able to explain what systems are and how they are developed .Explain the need for and value of a formalized step-by-step approach to the analysis, design, and implementation of computer information systems. Use tools and techniques for process and data modelling.

- **Paper 6: (C Programming Lab)**

Earns to develop computer programs which can be used to solve various kinds of daily life problems.

- **Third Year:**

- **Paper 7: (DBMS, Visual Basic, Network and Internet)**

Enhance the knowledge and understanding of Database analysis and design. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.

VB, a GUI Programming language. Upon completion of this course, the student will be able to design, create, build, and debug Visual Basic applications.

In Networking, interconnectivity among computers is of utter importance these days. Students get knowledge about various components in Networking.

- **Paper 8: (DBMS, Visual Basic Lab)**

Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.

Students should be able to design, create, build, and debug Visual Basic applications and Database applications practically.

Department of History (1+1+1) system

B.A. History Hons and Programme course

Programme Outcome	Developing intellectual and social skills through a nuanced understanding of historical concepts; creating individuals who comprehend the fundamental socio-economic bases of the social matrix; creating socially conscious citizens who are aware of the rich cultural tradition and heritage of our county.
Programme Specific Outcome	a. On successful completion of the Programme, the students will have a sound understanding of the varied forces that shape society.
	b. A strong command over the current historiographical trends seen across the world.
	c. A comparative understanding of different societies and their cultural practices which would sensitize them to accept diversities.
	d. An in depth understanding of history would also prepare them to sit for various competitive exams as well as to pursue a career in academia.

COURSE OUTCOMES

Courses	Outcomes
Indian History (Papers 1-4 taught in First Year and Second Year History Hons.)	To acquire a comprehensive understanding of the history of India from the earliest period to 1947. There are 5 papers which deal with the political, social, economic and cultural history of India. For Programme course students Indian History is taught through 6 papers over their first two years .
European History (Papers 5-6 taught to Third Year History Hons.)	This course aims at providing students an understanding of the dynamics of European history . Through 2 courses the attempt is to identify students with some of the most important historical events that shaped Europe to become what it is today. Programme course students have one paper in their third year dealing with European History.
History of China and Japan (Paper 7 taught to Third Year History Hons.)	This course is an area-specific course, which explores the social and cultural formations of two major East Asian nations. Through an examination of their history, the aim is to educate students about the similar histories that shaped most countries across Asia. The final

	objective is to create a sense of shared legacy amongst the students with other cultural traditions.
International Relations (Paper 8 taught to Third Year History Hons.)	This course is aimed at providing students a look at the emerging discourses that have shaped relations between nation states in the post world war 2 era. It is hoped that students would come to terms with some of the social forces that affect our contemporary world now: ranging from global warming to terrorism to cyber crime.

LEARNING OUTCOMES FOR UG-(1+1+1) PROGRAMME

B.Sc. (PHYSICS)

DEPARTMENT OF PHYSICS

SILIGURI COLLEGE, SILIGURI

OUR DEPARTMENT AIMS TO PROVIDE THEORETICAL AND PRACTICAL KNOWLEDGE FOR STUDENTS.

MISSION : As a Department, we are committed to

- Achieve academic excellence through a combined theoretical and experimental teaching of the subjects, proper internal assessment, constant evaluation process followed by written examination and practical examination along with viva-voce.
- Students will be able to demonstrate their understanding in physics (Mathematical method in physics, classical mechanics, properties of matter, electricity and magnetism, thermodynamics, basic electronics, modern physics, waves and optics, statistical mechanics, quantum mechanics, electromagnetic theory and special theory of relativity) through appropriate home assignment and examinations.

- Students will show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions.

- To prepare the students to be competent enough to face the challenge in appearing different examinations in National level and for higher studies.
- To promote quality and ethics among the students

Learning Outcomes for Different Topic

Students who have completed this course should be familiar with the main topics which are taught during the three years degree course of Honours in physics .

Part-I
Paper-I Full Marks -70
Group-A: Mathematical Methods of Physics
Group - B: Classical Mechanics-I
Group-C: General Properties of Matter

METHODS OF MATHEMATICAL PHYSICS.

COURSE CONTENT:

Central topics are Vectors, Orthogonal Curvilinear coordinate system, ordinary differential equations , partial differential equations, Fourier series, Matrices, probability and statistics

LEARNING OUTCOMES:

Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.

CLASSICAL MECHANICS & PROPERTIES OF MATTE.

The main goal of the course is to introduce students to *classical mechanics*and its applications and for them *to learn the fundamentals of all important topic.*

COURSE CONTENT:

: Unit and Dimensions, Kinetics, Kinematics (Concept of Newton's laws of motion and it's application), System of particles, Rotational motion, Rigid bodies, Central forces and Gravitation, Elasticity, surface tension and Viscosity.

LEARNING OUTCOMES:

Students who have completed this course should have a deep understanding of Newton's laws,

They will be able to solve the Newton equations for simple configurations using various methods,

Student will have a better understanding about these topics and capable of tackling different physical problems related to above topics.

Paper-II Full Marks -70
Group-A: Heat
Group - B: Sound(Acoustics & waves)
Group-C: Electricity & Magnetism

THERMAL PHYSICS :

COURSE CONTENT: Kinetic Theory of Gases,Transport phenomena, Real Gasews, Conduction of Heat, Radiation, Thermometry, Basic concept of thermodynamic and variable, 1st Law of Thermodynamics, 2nd law of thermodynamics and entropy,

Maxwell's Thermodynamic Relations, Heat engine and Refrigerator, Thermodynamic equilibrium and change of state, Chemical Thermodynamics, 3rd law of Thermodynamics and Low temperature Physics.

LEARNING OUTCOMES:

Student should be able to develop the understanding of various laws of kinetic theory, conduction and radiation of heat and their application in various systems and processes.Student should be able to develop the basic understanding of the concepts and underlying principles of Thermodynamics and their application in different thermodynamic system and natural processes.

WAVES AND OPTICS:

COURSE CONTENT: Vibrations (Linear Harmonic Oscillator, Superposition principle, Damped and forced vibration, Coupled Oscillations, Fourier analysis of complex vibration, acoustic filter), Waves, Sound waves, Doppler effect.

Learning Outcome

They understand the phenomena of simple harmonic motion and the properties of systems executing such motions.

Students will Develop an understanding of different vibrating systems Solve many types of problems involving wave motion.Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems. Understand the formation of Lissajous figures, formation of bits by combinations of harmonic motions with different frequencies and behaviour of transverse, longitudinal waves.Understand the principle of superposition of waves, so thus describe the formation of standing waves. Understand the behaviour of sound wave in dispersine and non-dispersive media and propagation characteristics in different media. They can learn the application of Fourier's series to study different vibrations of string.

ELECTRICITY-I *COURSE CONTENT:* *Ele*ctrostatics in vacuum, Electric Dipoles, Dielectrics, Capacitance, Electrostatic energy, Boundary value problems, Method of Images.

LEARNING OUTCOMES :

After going through the course, the student should be able to

Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics. Apply Gauss's law of electrostatics to solve a variety of problems. Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

Understand the dielectric properties of materials

Demonstrate a working understanding of capacitors. Solve different potential problems using the Method of Images and Bpundary value problems. Apply Kirchoff's law different bridges ond potentiometers.

Paper-III Full Marks -70
PRACTICAL

Group – A

Determination of moment of inertia of a metallic cylinder/rectangular bar about an axis pasing through its centre of mass.

Determination of acceleration due to gravity with Kater's pendulum.

Determination of the rigidity modulus of the material of a wire by static method.

Determination of the rigidity modulus of the material of a wire by dynamic method.

Determination of the surface tension of a liquid by capillary rise method.

Determination of the coefficient of viscosity of water by Poiseuille's method.

Verification of the laws of vibrating string with a sonometer.

Determination of the coefficient linear expansion of a solid by optical lever method.

Measurement of pressure coefficient of air with a constant volume gas thermometer.

Group – B

Determination of the Young's modulus of the material of a metallic beam by the method of flexure. (At least three lengths of the beam to be taken)

Determination of the surface tension by Jaeger's method and study of its variation with temperature.

Determination of the coefficient of viscosity of a highly viscous liquid by Stoke's method. (Density of the material of the spherical body and the liquid to be determined).

Determination of the thermal conductivity of a bad conductor in the shape of a disc by Lee and Chorlton's method.

Determination of the thermal conductivity of glas in the form of tube.

Determination of the boiling point of a liquid with a platinum resistance thermometer.

Determination of the melting point of a solid by thermocouple.

Measurement of J by Callendar and Barnes method.

Determination of the ECE of silver using potentiometer.

Paper-IV Full Marks -70
Group-A: Geometrical Optics
Group - B: Physical Optics
Group-C: Electronics-I

Geometrical Optics: Fermat's principle, Optical Systems: Optical Instruments, Dispersion. Seidel Aberrations.

Physical Optics: Wave Nature of Light, wave front, Huygen's principle, Interference, Diffraction, Interferometry, Optical instrument

LEARNING OUTCOMES:

They develop knowledge of ray optics & wave optics and an understanding of different properties of light such as reflection, refraction, interference, diffraction and polarization.

The student will learn to use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces. The student will be introduced to the design of optical systems and aberrations, with an emphasis on image forming systems.

The wave optics part of the course will give the student a thorough fundamental knowledge within interferometry, coherence and diffraction. Understand the formation of interference fringe pattern due to division of wave front and division of amplitude in biprism, Lloyd's mirror and formation of newton's ring. Understand the working of interferometer, diffraction grating, and holograms.

The student will get acquainted with Fresnel's and Fraunhofer's diffraction. The student will be able to calculate the diffraction from gratting, including the use of the convolution theorem for analyzing complex systems. The student will learn the connection between numerical aperture, F-number, spatial resolution and image quality for optical systems. Finally, the student will get a thorough introduction to image forming systems with emphasis on the human eye, the camera, the telescope and the microscope.

ELECTRONICS

COURSE CONTENT :Voltage source, Current source, active element, passive element. Network theorems (Thevenin’s, Norton’s, superposition, maximum power transfer).

Semiconductor Devices and applications(different types, different conduction and properties) , p-n junction diode, zener diode, avalanche and zener breakdown, applications of p-n junction diode, zener diode.

DIGITAL ELECTRONICS; Different number system and their conversion, Boolean alzabra, De Morgan’s theorem and their application, Properties of basic gates AND, OR, NOT, NAND and their realization using diodes and transistors

LEARNING OUTCOMES

Secure first-hand idea of different components including both active and passive
components to gain a insight into circuits using discrete components
Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity,Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis,
Understand the basic concepts of Semiconductor diodes such as pn junction diode, Zener diode with their characteristics and application.To apply the basics of diode to describe the working of rectifier and regulator circuits such as Full and half wave rectifiers. To solve examples on rectifiers for parameters such as Capacitance, load and source effect, line and load regulations, and circuit current.
Understand the basic concept of Bipolar Junction Transistor and it's different mode of biasing to act as an amplifier, a current source and a switch.
Learn about different number system their conversions and arithmetic operations used in digital system. Understand logic functions and logic gates and their realization by using diodes and transistors.

Paper-V Full Marks -70
Group-A: Thermodynamics
Group - B: Electricity-II

THERMODYNAMICS :

COURSE CONTENT: Basic concept of thermodynamic and variable, 1st Law of Thermodynamics, 2nd law of thermodynamics and entropy, Maxwell's Thermodynamic Relations, Heat engine and Refrigerator, Thermodynamic equilibrium and change of state, Chemical Thermodynamics, 3rd law of Thermodynamics and Low temperature Physics.

LEARNING OUTCOMES:

Student should be able to develop the basic understanding of the concepts and underlying principles of Thermodynamics and their application in different thermodynamic system and natural processes.

Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, working of heat engines and refrigeration system, the thermodynamic potentials and their physical interpretations. Learn about Maxwell's thermodynamic relations and associated relations with phase changes of matters and phenomenon occurring at low temperature.

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ELECTRICITY -II

COURSE CONTENT:

Electromagnetism, Source of magnetic field, Lorentz force, magnetic scalar and vector potential, electromagnetic induction, Magnetic field in material medium

Stationary Currents and DC circuits, Transients in DC circuit, Alternating Currents (LR, CR, LCR circuits, Q-factor,Power, Three phase system , AC & DC generator and motors all types of AC bridge for measurement of L and C, AC meters), Thermoelectricity.

LEARNING OUTCOME

:Student will be able to develop Both conceptual ideas and mathematical treatment in electricity and magnetsim . They will be able to describe and explain the fundamental physical principles and apply these principles together with logical and mathematical reasoning, to situations of the physical problems.

Learn the concept and origin of magnetic field and it's description.

Describe the magnetic field produced by magnetic dipoles and electric currents.

Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.

Understand the magnetic properties of materials and the phenomena of electromagnetic induction. Describe how magnetism is produced and list examples where its effects are observed.

Apply Kirchhoff's rules to analyze transient phenomenon in DC circuit and study the response across a resistor, inductor or capacitor and their graphical relationship between them when the circuits (series or parallel combination of L C R) is excited by AC source.

Understand the working of DC /Ac motor and generator AC bridges, meters and measuring instruments.

Learn different thermoelectric effect and their applications.

Paper-VI Full Marks -70
PRACTICAL

Group – A

1. Measurement of focal length of a convex lens by displacement method and hence to determine the focal length of a concave lens by combination method.
2. Determination of the refractive index of the material of a lens and that of a liquid using a convex lens and a plane mirror. (Radii of curvature of lens surfaces to be measured with the help of a spherometer).
3. Verification of the inverse cube law of magnetic dipoles. Comparison of moments of two magnetic dipoles and measurement of the earth's magnetic field with deflection and oscillation magnetometers.
4. Determination of end corrections of a metre bridge and to measure the specific resistance of a material in the form of a wire.
5. Determination of the resistance per unit length of the wire of a Carey-Foster's bridge and to measure an unknown resistance.
6. Determination of the temperature coefficient of the material of a coil using metre bridge.

Use of potentiometer- (a) comparison of two emfs, (b) measurement of low resistance.

Determination of the resistance of a mirror galvanometer by half deflection method and determination of its figure of merit.

Calibration of a suspended coil ballistic galvanometer by (a) direct method, (b) standard capacitance method and (c) standard solenoid method.

Group – B

1. To study the L-R circuit: to draw the phase diagrams, to study the current-voltage relationship across L and to study the variation of reactance of L with frequency and hence to find its value.
2. To study the C-R circuit: to draw the phase diagrams, to study the current-voltage relationship across C and to study the variation of reactance of C with frequency and hence to find its loss factor.
3. To study a series/parallel L-C-R ac circuit: to draw its response curve, to find its resonance frequency and to study the variation of Q with C (and L if possible).
4. Determination of the constant of a ballistic galvanometer and to measure the value of the capacitance by discharge and a high resistance by leakage.
5. To measure the flux of a magnetic field with a search coil and a ballistic galvanometer.
6. To measure the mutual inductance of two coaxial coils at various relative orientations using ballistic galvanometer.
7. Tracing the B-H loop of a ferromagnetic specimen in the form of an anchor ring using ballistic galvanometer and to determine the area under the hysteresis loop and finding the energy loss.
8. To measure the capacitance of a capacitor by an AC bridge (Wien Bridge).

   To measure the self-inductance of two coils separately by Anderson's bridge and the total inductance of the above two coils when they are connected in series and hence estimate the coefficient of coupling between the two coils.

Paper-VII Full Marks -70

Group-A: Classical Mechanics-II & Fluid Mechanics

Group - B: Statistical Mechanics

Group - C: Electronics-II

CLASSICAL MECHANICS – II & FLUID MECHANICS

COURSE CONTENT :

classical Mechanics: Degree of freedom, constrains, generalized coordinates. Virtual displacement and virtual work, D'Alembert's principle and it's application, Lagrangian dynamics, Hamiltonian Dynamics, Variational principle, Principle of least action, Poisson brackets, symmetry and conservation principles in classical mechanics, Small oscillations.

Learning Outcomes By the end of the module, students will have a solid knowledge of the central concepts of Classical Mechanics and will have acquired and trained important problem-solving skills. They will be able to establish the Lagrangian, and to derive and solve the equations of motions for many systems.Subject to the Principle of Least Action they can calculate conserved quantities from symmetries.They can calculate the Hamiltonian and establish the Hamilton equations.They will be familiar with canonical transformations and Hamilton-Jacobi theory.

Fluid Mechanics: Streamline flow, rotational and irrotational motion, velocity potential, Equation of continuity, Euler's equation of motion for an ideal fluid; NavierStoke's equation, Bernoulli's theorem and applications, Torricelli's theorem.

LEARNING OUTCOMES:

Understand the concepts of rotational vs. irrotational flows; stream functions, velocity potentials. Laplace equation and its relation to elementary plane flows of inviscid fluids: sinks, sources, vortex flows, and superposition of these flows.

Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.

STATISTICAL MECHANICS:

COURSE CONTENT :

Basic concept:Phase space, macrostates, microstates, statistical weight, different types of system, ensembles, statistical definition of temperature, pressure, entropy and chemical potential.

Maxwell – Boltzmann statistics and it's application, Bose-Einstein statistics and it's application to lattice specific heat, Bose-Einstein condensation. Fermi-Dirac statistic and it's application.

LEARNING OUTCOMES:

On completion of this course a student should be able to:
1)define and discuss the concepts of microstate and macrostate of a model system
2)define and discuss the concepts and roles of entropy and free energy from the view point of statistical mechanics
3)define and discuss the Boltdsmann distribution and the role of the partition function
4)apply the machinery of statistical mechanics to the calculation of macroscopic properties resulting from microscopic models of magnetic and crystalline systems
5)discuss the concept and role of indistinguishability in the theory of gases; know the results expected from classical considerations and when these should be recovered
6)define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltzman
distribution
7)apply the Fermi-Dirac distribution to the calculation of thermal properties of elctrons in metals
8)apply the Bose-Einstein distribution to the calculation of properties of black body radiation

ELECTRONICS-II

COURSE CONTENT :Voltage source, Current source, active element, passive element. Network theorems (Thevenin's, Norton's, superposition, maximum power transfer).

Semiconductor(different types, different conduction and properties) , p-n junction diode, zener diode, avalanche and zener breakdown, applications of p-n junction diode, zener diode.

BJT transistors, two port network analysis, biasing, h-parameters, equivqlentckt, transistor characteristic forCE, CB, CC configuration, load line , Q-point , application of transistor as amplifier, emitter follower, current source.

Multistage amplifier, RC-coupled amplifier, Gain and frequency response of amplifier, power amplifier, push-pull amplifier; Feedback amplifier, Oscillator, power supply, operational amplifier and it's application.

Field effect transistor, JFET, MOSFET, FET amplifier, Source Follower.

Communication principles: propagation of EM –wave in atmosphere, ground wave, sky wave, microwave transmission and communication. Modulation and demodulation- theory of AM, FM, channel bandwidth, detection of AM and FM.

Electronics Instruments;(Electronic voltmeters, multimeters, CRO and it's application.

DIGITAL ELECTRONICS; Different number system and their conversion, Boolean alzabra, De Morgan's theorem and their application, Basic gates and their applications, Combinational logic systems, Sequential logic systems, Microprocessor, programming in assembly language.

Course Outcome :

After completion the course student are able to

- Identify the unique vocabulary associated with electronics and explain the basic concepts of Semiconductor diodes such as pn junction diode, characteristics and ammeters, DC loadline, Zener diode.
  To apply the basics of diode to describe the working of rectifier circuits such as Full and half wave rectifiers. To solve examples on rectifiers for parameters such as Capacitance, load and source effect, line and load regulations, and circuit current.
- Draw and explain the structure of bipolar junction transistor. Explain the operation of each device in terms of junction bias voltage and charge carrier movement. Identify and explain the various current components in a transistor.
- Describe the application of transistors for Current and voltage amplification. Also to describe the characteristics of different configurations of the transistor. Describe DC load line and bias point. List, explain, and design and analyze the different biasing circuits.
- Sketch, explain and design the amplifier circuit for given specification and analyze them discuss oscillator principles, oscillator types, and frequency stability as it relates to its operation. Analyze and Design the different types of Oscillators. Discuss ideal and practical operational amplifier (op amp)

their electrical parameters, need for op amp. Explain and design different application circuits using op amp.

- Sketch and explain the basic block of communication system. State the principles of modulation and explain the different modulation techniques. Describe the theory and operation of radio systems and superheterodyne receivers. Solve simple examples.
- List and explain the different number system. Solve examples on converting one form of number system to another form. State Boolean laws and theorems. State and explain the different logic gates using truth table. Analyze and design different adder circuits.
- **explains half and full adders**
- **designs half and full adders**
- **explains half and full subtractors**
- **identifies combinational logic circuit**
- **explains the working principles of decoder, encoder,**
- **explains the working principles of multiplexer ,demultiplexer'**
- **recognize 7-segmented displayers**
- **shows the applications of combinational circuits**
- **use flip-flpos**
- **recognizes the working flip-flops**
- **prepares time flow chart ,logic symbol and truth table of R-S,JK,D and T type flip-flpos**
- **demonstrates flip-flop applications**
- **explains counters and registers**
- **recognizes asynchronous and synchronous counters**
- **designs up and down conters.**
- **explains memory units.**
- **recognizes RAM,ROM,PROM,EPROM,EEPROM**
- **recognizes the properties of memory units.**
- **Develop various types program me in assembly language.**

Paper-VIII Full Marks -70

Group-A: Physical Optics-II

Group - B: Electromagnetic Theory

Group - C: Special Theory of Relativity

Group - D: Solid State Physics

OPTICS:

COURSE CONTENT : POLARIZATION; Different types of polarization, production of polarized light, double refraction, optical axis, principal section and principal plane, uniaxial crystal, Polaroids, Production detection of and analysis of different types of polarization, Nicol prism, Babinet's compensator, Rotatory polarization and optical activity,polafimeters.

COHERENT OPTICS; Tempioral and spatial coherence, absorption and spontaneous and induced emissions of radiation in atom and molecules, Einstein A and B coefficients, population inversion, optical resonators, quality factor, principal of LASAR, Ruby lasar, He-Ne lasar; basic principles of holography.

FIBRE OPTICS; Optical fibre; Different types of optical fibre, communication through optical fibre, energy loss, bandwidth and channel capacity, attenuation and dispersion, splicing and couplers.Fibre sensor.

Student Learning Outcomes & Enabling Objectives

a. Explain polarization and Malus's Law. b. Describe birefringent optical devices and liquid crystal displays. c. Explain the principles of integrated optical modulators and acousto-optic modulators.

- Understand the laws of reflection and refraction and to calculate the reflection and transmission coefficients at plane interface in bounded media.
- Understand the linear, circular and elliptical polarisations of em waves. Production as well as detection of waves in laboratory.
- Analyze the Elliptically Polarised light using Babinet's Compensator

- Understand propagation of em waves in anisotropic media, uni-axial and biaxial crystals phase retardation plates and their uses.
- Understand the concept of optical rotation, theories of optical rotation and their experimental rotation, calculation of angle rotation and specific rotation.
- Understand the features of planar optical wave guide and obtain the Electric field components, Eigen value equations, phase and group velocities in a dielectric wave guide.
- Understand the fundamentals of propagation of electromagnetic waves through optical fibres and calculate numerical apertures for step and graded indices and transmission losses.

Understand coherence of light different types of lasers, its principle, properties of laser beam

- Understand the spontaneous and stimulated emission of radiation, optical pumping andpopulation inversion. Three level and four level lasers. Ruby laser and He-Ne laser indetails.

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ELECTROMAGNETIC THEORY;

COURSE CONTENT :

Generalization of ampere's law, displacement current, Maxwell's field equations, wave equation for electromagnetic field and its solution (plane and spherical wave), gauge invariance, transverse nature of field, Poynting vector and Poynting's theorem. Boundary conditions.Electromagnetic waves in isotropic dielectric medium; reflection and Refraction at plane boundary, reflection and transmission coefficients, Fresnel's formulae; change of phase on reflection, polarization on reflection and Brewster's law, total internal reflection. Electromagnetic waves in conducting medium; Maxwell's equation in homogeneous media, general wave equation, plane wave equations-harmonic wave solution, phase lag between electric and magnetic fields, exponential damping, skin depth, electrical and magnetic energy densities, their ratio; reflecting power of a metallic surface, wave guide. Equation of motion of an electron in a radiation field, Lorentz theory of dispersion (normal and anomalous), Sellmeier's and Cauchy's formulae; Scattering of radiation by a bound charge, Rayleigh scattering, absorption of light.

Learning outcomes of Electro Magnetic Theory :

After successful completion of this course, students will be able to: 1) Understand electric and magnetic fields in matter 2) Apply Maxwell's equations to various physical problems 3) Calculate EM wave propagation

- Achieve an understanding of the Maxwells equations, role of displacement current, gauge transformations, scalar and vector potentials, Coulomb and Lorentz gauge, boundary conditions at the interface between different media.
- Apply Maxwell's equations to deduce wave equation, electromagnetic field energy, momentum and angular momentum density.
- Analyse the phenomena of wave propagation in the unbounded, bounded, vacuum, dielectric, guided and unguided media.

・ Understand the laws of reflection and refraction and to calculate the reflection and transmission coefficients at plane interface in bounded media.

. Understand poynting theorem and its physical significance.
. Analyze Fresnel relations- Reflection (R) and Transmission (T) coefficients. Brewster's angle.
. Have an idea on skin depth , poynting vector and the concept of EM radiation of Inhomogeneous wave equation, harmonically oscillating source. Have an idea of the origin of dispersion and scattering phenomena.

Special Theory of Relativity;

COURSE CONTENT :

Velocity of light and it's measurement. Inertial frame, Gallilean principal of relativity, failure of principal in electrodynamics; aether drag hypothesis, aims and outcomes of Michelson – Morley experiment.Postulates of special theory of relativity, Lorentz transformation, length contraction, time dilation and simultaneity; velocity addition theorem, Relativistic Doppler effect.Variation of mass with velocity, form of relativistic momentum, force, kinetic energy; transformation relation for momentum, energy and force.Proper time and light cone; Minkowaski space; spacelike and timelike four vectors, causality.

LEARNING OUTCOME

STUDENT SHOULD BE ABLE TO

- Describe special relativistic effects and their effects on the mass and energy of a moving object.
- appreciate the nuances of Special Theory of Relativity (STR)

SOLID STATE PHYSICS;

COURSE CONTENT :

Different types of crystal structure, translational symmetry, lattice and basis, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, simple cubic, fcc and bcc lattices; Laue and Bragg equations, Determination of crystal structure by X-ray diffraction. Different types of bonding (ionic, covalent, metallic and van der Waals. Band theory of solid, energy band structure, electrons and holes, conductors, semiconductors and insulators; free electron theory of metals, effective mass, drift current, mobility, conductivity (electrical

and thermal), Wiedemann and Franz law, Hall effect, thermoelectricity, Seebeck, Peltier and Thomson effect, Thermoionic emission, Richardson equation, field emission.

DIELECTRIC PROPERTIES OF MATERIAL; Electronic, ionic and dipolar polarisability, local fields, induced and orientational polarization, molecular field in a dielectric, Clausius-Mosotti relation, ferroelectricity, piezoelectricity.

MAGNETIC PROPERTIES OF MATERIAL; Dia, para and ferromagnetism, Langevin's theory of diamagnetism, theory of paramagnetism, Curie's law; spontaneous magnetization and domain structure; Curie-Weiss law, hysteresis; ferri and antiferromagnetism.

LEARNING OUTCOME

On succcessful completion of course student will:

1. Understand different types of crystal structures in terms of the crystal lattice and the basis of constituent atoms.

2. Understand the theory of X-ray diffraction in the reciprocal lattice (k-space) formalism.

3. Apply the theory of lattice vibrations (phonons) to determine thermal properties of solids.

4. Study the problem of electrons in a periodic potential, examine its consequence on the band-structure of the solids.

5. Gain knowledge about the experimental techniques for crystal growth from solution and melt.

At the end of the course the student is expected to learn and assimilate the following.

- A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.
- Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.
- At knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.
- Secured an understanding about the dielectric and ferroelectric properties of materials.

- Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.
- Understand the basic idea about superconductors and their classifications.

Paper-IX Full Marks -70

Group-A: Atomic Physics
Group - B: Quantum Mechanics
Group - C: Nuclear and Elementary Particle Physics

ATOMIC PHYSICS;

COURSE CONTENT :

Structure of atom: Discovery of electron, Millikan's oil drop expt. And Thomson's expt., discovery of proton, Rutherford's experiment on the internal structure of atom, isobars, isotopes; mass spectrometers- Aston & Bainbridge and their use.

Atomic Spectra: Classical theory, Bohr- Sommerfeld atomic model and quantum condition, characteristics of atomic spectra, Balmar's formula, different spectral series and Rydberg constant. Hydrogen spectrum, excitation and ionization of atoms, Frank & Hertz expt., Stern-Gerlach expt and the intrinsic spin of the electron; magnetic moment of the electron; Lande g-factor, gyromagnetic ratio. Vectro atom model, space quantization; alkali spectra, screening effect, selection rules. Pauli exclusion principle; shell structure of the atom, the periodic table, X-ray (continuous and characteristic spectra); Mosley's law , Normal and anomalous Zeeman effect. Faraday effect, Stark effect and Kerr effect.

Learning outcome

This course will enable the student to get familiar with quantum mechanics formulation starting from Bohr model to Stern-Gerlach expt .
to have the idea of space quantization.

- Study of influence of electric and magnetic fields on atoms will help in understanding Stark effect and Zeeman Effect respectively.

・Syudy of vector atom model for many electron atomic system and their spectral analysis.

QUANTUM MECHANICS;

COURSE CONTENT :

Old quantum theory:Black body radiation, Photo-electric effect, Thomson scattering and Compton scattering , dual nature of light. Electron diffraction experiment.

Basic Quantum mechanics; de Broglie hypothesis; group velocity, phase velocity, particle velocity, Schroedingrt wave equation; equation of continuity, probabilistic interpretation of the wave function.Quantum number, Eigen function and eigen value, hermition operator, momentum energy and angular momentum operator. Expectation value, Bohr's correspondence and complementarity principles; Ehrenfest's theorem, stationary and non-stationary states.Commutation relation, Heisenberg's uncertainty principle (illustration and applications) Application of Schroedinger's equation to simple problems.(One dimensional potential well, potential barrier, free particle in a box, Linear Harmonic oscillator, Hydogen atom and diatomic molecules), Raman effect and it's application.

Learning Outcomes for Quantum Mechanics I.

> Students who completed this course should have a deep understanding of the mathematical foundations of quantum mechanics, and be able to solve the Schr¨odinger equation for simple configurations.

This course will enable the student to get familiar with quantum mechanics formulation.

・ Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.

・ Understand the theory of quantum measurements, wave packets and uncertainty principle.

・ After an exposition of inadequacies of classical mechanics in explaining microscopic phenomena, quantum theory formulation is introduced through Schrodinger equation.

- The interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student.
- Through understanding the behavior of quantum particle encountering a i) barrier, ii)potential, the student gets exposed to solving non-relativistic hydrogen atom, Linear harmonic oscillator for their spectrum and eigenfunctions.
- This basic course will form a firm basis to understand quantum many body problems.

NUCLEAR PHYSICS & ELEMENTARY PARTICLE;

COURSE CONTENT :

Gross properties of nuclei; Discovery of neutron, nuclear mass, charge, size, binding energy, iso-spin, nuclear spin and magnetic moment. Liquid drop model and Shell model of nuclei. Radioactivity, alpha decay, beta decay, gamma decay, Nuclear reaction, compound nucleus, artificial radioactivity, Nuclear fission and fusion. Discovery of different particles and their lifetimes and decay width.Four basic types of different natural interaction, quantum number, mass, spin, intrinsic parity, hypercharge and charge conjugation; conservation laws. Classification of elementary particles, Cosmic rays, Different types of accelerators, detectors and counters.

Learning Outcomes:

Students who completed this course should be able to

Explain external and internal properties of the **atomic** nucleus.
Describe basic models of the **atomic** nucleus.
Explain **nuclear** decays and radioactivity.
Evaluate radiation energy losses by passage through matter
Explain the origin of elementary particle and cosmic rays.

Explain how accelerators , partical & radiation detectors are work and be able to use them for research purpose.

Explain processes of **nuclear** collisions and **nuclear** reactions.

- Learn the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, The reaction cross-sections, the types of nuclear reactions, direct and compound nuclear reactions, Rutherford scattering by Coulomb potential.

- Learn some basic aspects of interaction of nuclear radiation with matter- interaction of gamma ray by photoelectric effect, Compton scattering and pair production, energy loss due to ionization, Cerenkov radiation.
- Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state and semiconductor detectors.
- The students are expected to learn about the principles and basic constructions of particle accelerators such as the Van-de-Graff generator, cyclotron, betatron and synchrotron. They should know about the accelerator facilities in India.
- Gain knowledge on the basic aspects of particle Physics the fundamental interactions, elementary and composite particles, the classifications of particles: leptons, hadrons (baryons and mesons), quarks, gauge bosons. The students should know about the quantum numbers of particles: energy, linear momentum, angular momentum, isospin, electric charge, colour charge, strangeness, lepton numbers, baryon number and the conservation laws associated with them.

Paper-x Full Marks -70
PRACTICAL

Adjustment of a Spectrometer by Schuster's method and to calibrate the spectrometer (D - λ curve) and hence to determine an unknown wavelength.

To draw the μ-λ curve for the material of a prism using a spectrometer and to find the dispersive power.

To determine the wavelength of a monochromatic light by Fresnel's bi-prism.

To determine the wavelength of a monochromatic light by Newton's ring method.

Measurement of the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes using spectrometer.

To find the number of lines per centimeter of a plane transmission grating and hence to measure the wavelength of an unknown spectral line and to determine the resolving power of the grating.

7. To calibrate a polarimeter and hence to determine the concentration of a given sugar solution.

8. To verify the Brewster's law and Fresnel formulae for reflection of electromagnetic waves with help of a spectrometer, a prism and two Polaroid sheets.

9. To study the diffraction pattern of a crossed grating with the help of a laser source.

(At least two laboratory classes should be devoted to explain the functions and use of spectrometer and polarimeter at the beginning).

Computer Training and Experiments.

Few laboratory classes to be allotted for Computer fundamentals and Programming in C.

Computer Fundamentals: Block diagram, CPU, Memory, I-O devices, software-hardware, concepts of operating system (OS)- DOS, WINDOWS/LYNUX.

Programming in C: Variables type, operators and expressions, if-else, else-if, switch, loops-while, for and do, break and continue, go to and labels; array- one and two-dimensional.

Student will write five programs in C and execute them on a computer.

Paper-x Full Marks -70
PRACTICAL

Paper – XI

One experiment to be performed during the B.Sc. Part-II Practical Examination in Paper XI. (Distribution of Marks: LNB-5; Viva-20; Experiment- 40).

1. To verify Thevenin's theorem, Norton's theorem and maximum power transfer theorem using a resistive Wheatstone's bridge with a DC source.

2. (a) To draw the I-V characteristics of a p-n junction diode.

   (b) To draw the forward and reverse bias characteristics of a zener diode and to study its voltage regulation characteristics relating to the variation of load current, variation of line voltage and ripple.

3. To draw the characteristics of a bipolar junction transistor (BJT) in CE and CB modes and to find its parameters α and β.

4. To measure the hybrid parameters and leakage current of a transistor using an AC source.

5. To construct a single stage voltage amplifier using a transistor in CE mode on a breadboard and to measure its voltage gain, bandwidth, input and output impedances form the study of frequency response curve.

6. To construct an emitter follower on a breadboard using a BJT and to study its voltage gain, bandwidth, input and output impedances.

7. To construct a regulated power supply on a breadboard using feedback and a zener diode for voltage regulation and to study its characteristics.

8. To study the input offset voltage, input bias current, input offset current of an OPAMP and use it as an (a) inverting and no inverting amplifier, (b) differential amplifier (c) integrator and (d) differentiator.

9. To construct a Wien bridge oscillator using OPAMP and to study the waveform of the oscillator and calibrate it using a CRO.

10. (a) To construct the OR, AND and NOT gates using discrete components and verify the truth tables using them.

    (b) To verify the truth tables of NOR, NAND and Ex-OR gates using IC gates.

    (c) To verify that the NOR and NAND gates are universal gates

    (d) To Verify De Morgan's theorem using IC gates.

11. To study the Fourier spectrum of (a) a square wave, (b) a saw tooth wave and (c) a half sinusoidal wave with the help of CRO.

12. To study the 8085 microprocessor

DEPARTMENT OF SOCIOLOGY (2017-2018)
B. A. Honours in Sociology
Programmes and Outcome

Programme Outcome	To develop basic knowledge on the basic concepts and develop knowledge on sociology, rural and urban societies, especially on Indian perspective. Besides theories, it was tried to develop knowledge on different societies, culture, tribes of India for the students. Research methodology is another thirst area of the students.
Programe Specific Outcome	a. In the programme students will gather basic knowledge on basic sociological concepts and rural society, especially from Indian perspective.
	b. Indian society and its cultural aspects are to be studied here in brief but to get sound knowledge. Besides sociological theories are given importance for a brief study including Indian thoughts.
	c. Different communities and societies are designed here for the introductory knowledge. A comparative study on urban and industrial societies is given priority for the students. Population and their problems will give a highlight over here. Theoretical and practical knowledge of research is also framed for the student.

COURSE OUTCOMES

COURSES	*OUTCOMES*
Paper I for 1st year hons in Sociology ***Basic concepts on Sociology***	The main thrust area of the paper is the basic concepts on Sociology. The course aims to provide fundamental knowledge on Sociology at the beginning.
Paper II for 1st year hons in Sociology ***Rural Sociology in India***	The paper aims to provide some basic concepts on rural society and development agencies and programmes that are adapted by both State and Union Government.
Paper III for 2nd year hons in Sociology ***Society and Culture in India***	The paper is designed to know the society and culture of India from different aspects including different religions.
Paper IV for 2nd year hons in Sociology ***Sociological Thoery***	The paper is designed to give basic knowledge on Sociological theories and side by side Indian thoughts are added to the students.
Paper V for 3rd year hons in Sociology ***Sociology of Tribes, Minorities and other weaker sections***	The paper is dealt with the brief note on tribes and minority groups and communities and their problems.
Paper VI for 3rd year hons in Sociology ***Urban and Industrial society in India***	This paper is comprises with the basic concepts of urban and industrial society.
Paper VII for 3rd year hons in Sociology ***Social Demography and Social Problems in India***	To gain knowledge on Indian population and some of the Indian social problems and to provide the actual scenario of these aspects.
Paper VIII for 3rd year hons in Sociology ***Social Research methods, Field Work and Viva Voce***	To obtain knowledge on fundamental research techniques and research methodologies.

SILIGURI COLLEGE Coordinator IQAC COLLEGE PARA, SILIGURI

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Principal SILIGURI COLLEGE Siliguri, Darjeeling