OUTCOMES

- PROGRAM OUTCOMES, PROGRAM SPECIFICOUTCOMES AND COURSE OUTCOMES IN M.Sc. BIOTECHNOLOGY

- PROGRAM OUTCOMES, PROGRAM SPECIFICOUTCOMES AND COURSE OUTCOMES IN M.Sc. CHEMISTRY

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- PROGRAM OUTCOMES IN B.C.A.
- PROGRAM SPECIFIC OUTCOMES IN B.C.A.
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- PROGRAM OUTCOMES IN B.A.
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M. Sc. Biotechnology

Program Purpose

This is a semester pattern,choice based, credit program. The program aims to prepare the students to begin careers as Biotechnologists. After completion of post-graduation, they can enter into job or research fields related to Food, Pharmaceutical, Agricultural Industries and also into Teaching. This course includes advanced and recent developments in the field of Biotechnology. A research project in the last semester of the course prepares them to develop an aptitude, inclination, analytical and critical thinking towards research. Presentation by students on recent developments in the subject, every semester, keeps them abreast of the developments and requirements for research. This also improves their communication, reading and writing skills.

In addition to the regular curriculum, the Institution gives added inputs to the students for their overall personality and skill development. These include programs for personality development, debates, model, poster and chart making, exhibitions, guest lectures, activities of various subject cells and associations, sports and cultural activities, etc. Students are also given exposure to use of ICT through Power Point presentations for their seminars and assignments. The efforts of the Institution are always to enable students to develop research aptitude, increase their competency and employability in the Global scenario.

Program Outcomes (PO)

Postgraduate Biotechnology students will be able to:

1. **Knowledge application**: Havefurther insight into facts and phenomena of Science, to which they have been already exposed at graduation level.Detailed understanding of Biological Sciences along with engineering technologies to manipulate living organisms and biological systems to make products that advance healthcare, medicine, agriculture, food, pharmaceuticals and environmental control. Capable of demonstratingcomprehensive knowledge andunderstanding of one or more disciplines that form a part of the postgraduateprogram.Apply the core concepts of the subjects learnt to a chosen scientific discipline, identify, design, generate and interpret scientific data using quantitative, qualitative and analytical methodologies and techniques, keeping in mind the specific needs for public health, safetyand environmental protection. Awareness of the major issues at the forefront of the discipline.
2. **Creative and Critical Thinking:** To apply logical reasoning to assume, inquire and analyze the problems at hand, integratingtheir knowledge in a wider perspective. Evaluate evidence, arguments, claims and beliefs to identify and formulate arguments. Critically evaluate policies and theoriesby following scientificapproach to knowledge development.
3. **Effective Communication:** Ability to express thoughts and ideas effectively through speaking and writing. Demonstrate the ability to listen carefully,read and write analytically, and present complex information in a clear and concisemanner to different groups.Communicate with others in one or more Indian languages using appropriate media; confidently share and express views. Communicate effectively with scientific community and society at large, through effective presentations.
4. **Leadership and Team Work:**Function effectively and respectfully as an individual, and as a member or a leader of diverse teams, and in multidisciplinary settings.Facilitate cooperation, coordination and work efficiently as a member of a team in the interests of a common cause.

5. **Effective Citizenship:** Ability to relate and to be aware of various social concerns leading to personal and national development. To participate in civic life by developing an empathetic mindset. Ability to apply reasoningto assess health, safety, legal, ethical and cultural issues of the society and the consequent responsibilities that it entails. Possess knowledge of the values and beliefs of multiplecultures in a global perspective.
6. **Moral Maturity and Ethical Behaviour:** Recognize different value systems including self, understand the moral dimensions of self-interested decisions, and accept responsibility for them.Ability to accept moral and ethical values inconducting one's life. Use ethical practices in all scientific work. Increased cognitive ability, appreciatingothers point of view, debate and promote interdependence to reach conclusions in a group of people.
7. **Environment and Sustainability:** Awareness with regard to current environmental problems and make a positive contribution towards sustainable development.
8. **Self-directed and Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent thinking and life-long learning in the broadest context of developmental trends and technological change.Ability to acquire knowledge and skillsthat are necessary for participating in learning activities throughout life and adapting to changing trends and demands of work place.
9. **Analytical, ScientificReasoning and Problem Solving:**Develope a sense of inquisitiveness and capability of asking appropriate questions and problem solving. Ability to evaluate the reliability of available evidence, identify flaws in the arguments, analyze the information from various sources and ability to collaborate with scientists. Capacity to apply one's knowledge to solve different kinds of problemsto real life situations.
10. **Information / digital literacy:**Capability touse ICT, to access, evaluate, and use a variety of informationsources. Ability to work independently, identify appropriate resourcesrequired for a particular task.
11. **Placement Opportunities:** The program helps the students to prepare for various competitive exams like GRE, GATE, MPSC, UPSC, NET / SET, etc. In addition, they can also opt for pursuing M. Phil or Doctoral studies in the subject. Wider Placement opportunities / jobs in research / administration in various Research Institutes, Food, Pharmaceutical, Agricultural Industries and also Teaching Profession.

Program Specific Outcomes (PSO) M. Sc. Biotechnology:

Curricular Structure

This course can be opted by a candidate who is a B. Sc. in Life Sciences / Veterinary / Fishery Sciences / Pharmacy / Engineering Technology / Medicine (MBBS) / B.D.S. graduates / B.Sc. Agriculture.

The course is divided into four semesters which includes the study of advanced aspects of the following subjects: Cell Biology,Enzymology, Molecular Biology, Biomolecules, Biophysical Techniques, Microbiology, Immunology, Fundamentals of Genetic Engineering, Applied Molecular Biology, Genetic Engineering & its Applications, Plant Biotechnology, Animal Biotechnology, Biostatistics, Bioinformatics, Ethics and Patenting.

In the third semester, students have a choice of selecting a specialization course in Industrial Biotechnology or Environmental Biotechnology which they have to continue in the fourth semester. Similarly, they have a choice of opting for a foundation course in any other subject like Chemistry, Physics, Computer science, Botany, Zoology, etc.

Every semester, the student has to perform laboratory courses relating to the theoretical aspects taught in that semester. In the fourth semester, students have to work for 4-6 months, as a project trainee at their Parent Institute or any other National Research Institute. During this training they carry out research work in Biotechnology and allied fields.

Teaching, Learning and Evaluation:

Teaching is in the form of conventional chalk and black board method, power point presentations, animations, demonstration of laboratory techniques, etc. Lectures by invited expert faculties acquaint the students about current research trends in the field. Laboratory courses are conducted along with related topics in theory for better understanding. In addition, students learn to use literature for their course study, recent trends in the subject and research.

This is a specialized course that emphasizes on Plant, Animal Biotechnology and Genetic Engineering and their Applications. This course includes advanced knowledge of Cell Biology, Enzymology, Molecular Biology, Biomolecules, Biophysical Techniques, Microbiology, Immunology, Genetic Engineering, Plant Biotechnology, Animal Biotechnology and Biostatistics, Bioinformatics, Ethics & Patenting. This course is recommended for students who wish to pursue their research / career in biotechnology and allied fields.

The examination in every semester shall comprise four Theory Papers, an Internal Assessment, a Seminar and Laboratory Courses. The syllabus is based on 16 hours of theory credits, 08 hours of practical credits and 01 credit for delivering a seminar per semester. Candidates are required to pass separately in theory and practical examination. The internal assessment marks assigned to each theory paper are awarded on the basis of attendance / home assignment / class test / project assignment / seminar / any other innovative practice / activity.

Seminars and Project work gives them an opportunity to learn literature survey, use of computers, research methodology, research culture, team work, communication skills etc.

During the course, students are continuously evaluated through internal examinations by the department and also through examinations conducted by the University at the end of every semester.

Students who graduate with a Degree in Master of Science in Biotechnology will:

1. Understand the function of biological molecules through the study of their molecular structure.Analyze the relationship between animals, plants and microbes. They also learn to manipulate living organisms through genetic engineering methods for the benefit of the society.
2. Demonstrate written and oral communication skills for discussions on relevant topics in Biotechnology. Understanding of the concepts is strengthened through preparing assignments, tests and laboratory experiments.
3. Understand the applications of Biotechnology in Agriculture, Medicine, Food and Dairy, Apiculture, Fisheries, and various other Industries.
4. Students acquire procedural knowledge about different types of professions related to Biotechnology, including research and development, teaching, government and publicservices. Development of technical skills in areas related to their interests and currentdevelopments in the academic field.
5. Read and understand original research including current issues in the discipline and present their findings through oral, written and visual presentations.
6. Students will be able to communicate scientific concepts, experimental results and analytical arguments precisely.
7. Solve area specific problems by identifying the essential parts of a problem, formulating a strategy for solving the problem, applying appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.
8. Perform advanced laboratory procedures used in the areas of Biochemistry, Microbiology, Immunology, Enzymology, rDNA technology, Environmental Biotechnology, Plant and Animal tissue culture techniques. Acquire and demonstrate competency in laboratory safety and in routine and specialized microbiology, biotechnology, plant and animal tissue culture

laboratory skills applicable to biotechnological research methods, including accurate reporting of observations and analysis.Acquainted with proper procedures and regulations for safe handling and use of chemicals and biological samples.

9. Able to handle sophisticated and modern laboratory instruments and equipment. Expertise in classical and advanced techniques to perform experiments, critically analyze and evaluate the experimental data through written, oral reports and technical graphics.
10. Collaborate and coordinate effectively as part of a team to solve problems, debate and discuss different points of view and interact productively with diverse groups.
11. Project work gives them an opportunity to learn literature survey, use of computers, research methodology, research culture, team work, communication skills, problem solving, etc. which helps them to analyze, interpret and validatetheir knowledge in different research projects.
12. Use basic knowledge of computers and library search tools to locate and retrieve scientific information about a topic,going beyond textbooks.
13. The program helps the students to prepare for various competitive exams like GRE, GATE, MPSC, UPSC, NET / SET, etc. In addition, they can also opt for pursuing M. Phil or Doctoral studies in the subject. Wider Placement opportunities / jobs in research / administration in various research institutes, food, pharmaceutical, agricultural industries and also as teaching professionals.Demonstrate subject-related and transferable skills that are relevant to some of thejob trades and employment opportunities.

Course Outcomes (CO) M. Sc. Biotechnology:

M. Sc. Biotechnology – Course Outcomes	
Course	Outcomes
Cell Biology and Enzymology	Student will gain in-depth knowledge about cell, structure and function of cell organelles, cell cycle and cell signaling, nomenclature and classification of enzymes, biological mechanisms of enzyme catalysis, kinetic studies, factors affecting rates of enzyme reactions, role of modulators, vitamins and coenzymes, allosteric, covalently modulated, immobilized enzymes and multienzyme complexes. Student will be able to explain the Michaelis-Menten model of enzyme kinetics, two substrate kinetics, effects of inhibitors, substrate concentration, temperature, pH, etc. Laboratory experiments focus on isolation of organelles, study of marker enzymes, isolation, purification and immobilization of enzymes, data analysis and interpretation.
Molecular Biology	By the end of this course, student will have detailed knowledge of prokaryotic and eukaryotic molecular processes of DNA replication, transcription and translation. They will have in-depth knowledge about regulation of these molecular processes. Students will be able to analyze structural-functional relationships of genes and proteins in prokaryotes and eukaryotes. Understand the instruments, analytical techniques and application of biophysical methods used in the study of these molecular processes.
Biomolecules	By the end of this course, student will have in-depthknowledge about major types of biological molecules like DNA, RNA, Proteins and their role in life related processes, denaturation and renaturation studies. Able to explain the impact of slight changes in the structure of macromolecules. Understand the structures and properties of the amino acids found in proteins. Able to describe the secondary, tertiary and quaternary structures of proteins, forces stabilizing their structures, models and methods of protein folding, role of chaperones and chaperonins. Thorough understanding of carbohydrate and lipid chemistry. Understand energetic and structural roles of carbohydrates and lipids in living organisms. Laboratory experiments are designed to strengthen theoretical knowledge of the subject. Students are given hands-on training in quantitative and qualitative analysis of various biological molecules, interpretation of results and handling of sophisticated instruments.

Biophysical Techniques	Enable the student to get in-depthknowledge of principles, applications, instrumentation and techniques of spectroscopy, chromatography, electrophoresis, centrifugation and isotopic tracers. Understand the instruments, analytical techniques and application of biophysical methods used in the laboratory. Demonstrate practical skills required to deal with the detection, identification, separation, and estimation of various biomolecules.
Microbiology	This course focuses on the structure and biotechnological applications of eukaryae, viruses, bacteria, their growth, Energy and nutrient requirements, microbial control and drug resistance. Laboratory experiments are designed to strengthen practical skills in fundamental microbiological techniques. The students will learn about microscopy and aseptic handling, isolation, pure culture preparation, staining procedures, external morphology, effect of antibiotics and UV radiations..
Immunology	At the end of this course, students will understand immunity, antigen, antibody, immune system, their function and regulation, active and passive immunization,immunoglobulins and their gene libraries, clinical immunology, cancer immunotherapy; immunosuppressive therapy etc. Laboratory experiments focus on the purification of immunoglobulins, antigen-antibody reactions and different diagnostic tests based on them. Handing of equipment required for the study of various immunochemical techniques.
Fundamentals of Genetic Engineering	By the end of this course, student will have detailed knowledge recombinant DNA techniques used in microbiological research, gene manipulation and gene transfer technologies, expression systems, methods of selection, use of various vectors and restriction enzymes in creating a recombinant DNA. Gain detailed knowledge about genomic and c-DNA library, methods of sequencing of genomes, phylogenetic relationships, PCR, etc. Students get hands-on training in various tools, techniques and methods used to study rDNA technology.
Applied Molecular Biology	By the end of this course, student will have in-depth knowledge ofrecombination, genome mapping, epigenetics, cancer biology, angiogenesis, metastasis, stem cells, antisense, and ribozyme technology. Students will be able to understand the various genetic and molecular changes to normal cells which convert proto-oncogenes into oncogenes.
Genetic Engineering & its Applications	By the end of this course, student will have detailed knowledge about transformation and transfection methods, somatic cell fusion, production of monoclonal bodies, gene therapyand expression of heterologous genes. Understand refolding and stabilizationof recombinant proteins and industrial products of protein engineering. Understandvarious aspects of plant transformation technology, mechanism of inter-generic DNA transfer and preparation of gene construct for its expression in plants. Laboratory experiments of molecular genetic techniques will provide practical knowledge in the field of molecular genetics. Development of an ability to design and conduct genetic engineering experiments, as well as to analyze and interpret data.
Plant Biotechnology	At the end of the course, student will have theoretical and practical knowledge of Plant Tissue Culture Techniques. Understand tissue culture, culture media, callus and suspension cultures, single cell clones, organogenesis, embryogenesis, shoot tip culture, embryo culture and embryo rescue, hybrid plants, production of haploid plants, germplasm conservation, Herbicide resistance and insect resistance. Gain knowledge about applications of plant transformation for productivity and performance, plant metabolic engineering and industrial products and Green House Technology Laboratory experiments focus on preparation of tissue culture media, surface sterilization, effect of hormones on cell division, organ culture, callus culture, anther culture, protoplast isolation and culture, hardening and cytological examination of plant.
Specialization Course in Semester III and IV (EITHER	**A) Industrial Biotechnology:** This course aims to provide fundamental insights to exploit enzymes and microbes for the manufacturing of products. Students will be able to understand the various aspects of bioprocess technology, principles underlying the

A. Industrial Biotechnology OR B Environmental Biotechnology)	design of a fermenter, fermentation process and downstream processing. Students learn the technique involved in the production of biologically and industrially important compounds such as alcohol, antibiotics, preparation and formulation of biopesticides. After completing this course, the student will be able to describe the equipment, materials and methods related to biotechnological processes, sterilization, microbial growth and cultivation. The student will be able mathematically compute, plan and analyze the bioprocesses. Performing laboratory experiments will make students more confident to use the knowledge of bioprocess engineering in industries. **B) Environmental Biotechnology:** Students are sensitized to focus on environmentalaspects of biotechnology for the benefit of the society. Understand types of pollutions, bioconversions, bioaccumulation, bioleaching, bioabsorption, biodegradation, biotransformation, bioremediation processes, biofuels, biosensors and xenobiotics. They also understand advantages, disadvantages and applications of the above. The students will have knowledge about waste water and sludge treatment. The laboratory course trains them in basic conceptsof Environmental Biotechnology and its application in research.
Foundation Papers from other subjects like Chemistry, physics, computer science etc.	Students can choose any one of these courses from various disciplines like Chemistry, Physics, Computer Science etc. in lieu of Core Subject centric papers like Diagnostic Medical Biotechnology or Therapeutic Medical Biotechnology. This course enables the students to have fundamental knowledge of other allied subjects which benefit them in interdisplinaryareas of research.
Diagnostic Medical Biotechnology(Core Subject Centric I))	Students can choose this paper in lieu of the foundation course, to study advanced courses in Biotechnology. The student understands the application of advances in molecular and cell biology in medicine, nano-biotechnologies, molecular and clinical diagnostics, genomics, and proteomics. Understand the genomics technologies used in study of gene functions and their disorders and array-based techniques in diagnosis.
(Core Subject Centric II) Therapeutic Medical Biotechnology	Students can choose this paper in lieu of the foundation course, to study advanced courses in Biotechnology. The student understandsthe types of diseases thatcan be treated by gene therapy, somatic and germline gene therapy, problems associated with these therapies and drug designing. Understand the principles underlying the preclinical and clinical development of new therapeutic drugs and procedures.
Animal Biotechnology	At the end of the course, student will have theoretical and practical knowledge of Animal Tissue Culture Techniques. Understand the preparation and composition of tissue culture media, suspension and monolayer cultures, their initiation and maintenance. In-depth knowledge of various techniques of animal cell and tissue culture, culture media, growth factors, laboratory facilities and design, characteristics of cells in culture, primary culture, cell lines and their maintenance in the laboratory andconcept of transgenic animals.
Biostatistics, Bioinformatics, Ethics & Patenting	At the end of this course, students understand the concepts of probability, mean, median, mode, standard deviation, standard error, methods of sampling, sampling error, non-sampling errors, Chi-square test, cluster analysis, phylogenetics, presentation of statistical data and research designs. Bioinformatics makes the student proficient in computer and internet, public domain resources in biology, database management, analysis of genetic sequences, identification of functional sequences, homology, BLAST, ENTREZ, and PuBMed. Student understands the benefits of biotechnology, ELSI, release of genetically engineered organisms, human embryonic stem cell research. Students will gain basic knowledge about patenting and trademarks, intellectual property rights, plant-breeder rights, biosafety and quality control. In the laboratory course, students will be able to explain the basic concepts of probability, mean, median and mode and their use in statistical analysis and retrieving biological data.
General outcomes of the Laboratory Courses.	At the end of laboratory courses, students will be able to implement the theoretical concepts studied, interpretationof experimental data, expertise in fundamental laboratory skills, laboratory safety protocols, classical laboratory techniques and modern

	instrumentation. Viva voce promotes analytical thinking and research aptitude.
Project in fourth semester	Program graduates will be able to draw on classroom and laboratory knowledge to make an individual contribution in research. Students will be able to independently carry out a complete scientific work process, including the understanding of theoretical background, hypothesis generation, collection and analysis of data, interpretation and presentation of results. Students will publish this research work after appropriate literature survey and analysis, evaluate methods and results within the field of specialization, apply relevant theory, methods and analytic approaches within the specialized field of biotechnology, including statistical methods. At the end of the project, the student will present the results of his/her work to an audience of examiners, peers and faculty at the college level, and be able to defend their research work.
Seminars in every semester	Seminar helps students to improve and refine their presentation and communication skills, public speaking, importance of appropriate body language and tone.They also learn literature survey and analysis.

Programme Specific Outcomes and Course Outcomes for M.Sc. in Chemistry

The objectives of the program are as follows:

- To give students a comprehensive understanding of the principles of Chemistry.
- To gain the skill to design and carry out scientific experiments and interpret the data.
- To understand the interdisciplinary nature of Chemistry and to be aware of the emerging fields in Chemistry.
- To build a scientific temper and to learn the necessary skills to succeed in research orindustrial field.
- To be able to define and resolve new problems in Chemistry and participate in the future development of Chemistry.

COURSE OUTCOMES

SEMESTER I

Theory

Code: 1T1 Inorganic Chemistry

- To study theStereochemistry andbonding in main group compound as well as to study the metal-ligand bonding.
- To study the metal – ligand equilibriainsolution and mechanism of transitionmetalcomplexes.
- To have an idea about classification, nomenclature, structure, bonding and topology of boron hydrides.
- To understand the basic concept, classification, structure and bonding of metal clusters.

Code: 1T2 Organic Chemistry

- To understand the basic concepts and mechanism in organic chemistry.
- To know stereochemistry and various possible conformations of organic compounds and how it affects the reaction outcome.
- To get an idea about the various kinetic and thermodynamic factors which control the organic reactions.
- To have an idea about various substitution reactions and their applications.

Code: 1T3 Physical Chemistry

- To know the basic concepts in classical thermodynamics and to learn the thermodynamic aspects of various processes and reactions.
- To study the basic concepts of Partial molar quantities and Phase rule,its derivation and applications.

- To study the chemistry of surfaces and different types of surface phenomena. To get an idea about the various techniques employed for the characterisation of surfaces. To know the general properties of colloids and macromolecules.
- To learn the different theories of reaction rates and factors affecting reaction rates. To have an idea about the different types of catalysis and their mechanisms.

Code: 1T4 Analytical Chemistry

- To understand the basic concepts of analytical chemistry and Statistical analysis.
- To study the Separationtechniques like chromatography, ion exchange and solvent extraction and their applications in industries.
- The students will get skill in the quantitative analysis by doing titrations in thedifferent branches of volumetric analysis and will get training in the quantitative analysis of metal ions and anions using gravimetric method.
- To learnabout electrochemical methodsofanalysis like conductometry and potentiomerty and their applications.

Practicals

Code: 1P1 Inorganic Chemistry

- To impart the students a thorough knowledge ofSystematic preparation of inorganic complexes and their characterization by Elemental analysis and physico-chemical methods Electronic and IR Spectra, magnetic susceptibility measurements, Thermal analysis and Molar conductance studies.
- To learn about quantitative analysis this includes separation and determination of two metal ions from the alloys by using volumetric, gravimetric and spectrometric methods.
- To impart skill to students in the systematic qualitative analysis of mixtures containing two acid and two basic radicals with interfering radical by Semimicro method.

Code: 1P3 Physical Chemistry

- To develop skills in doing experiments in kinetics, thermodynamics, conductometry, potentiometry and phase rule. Enable the students to prepare data analysis using spreadsheet programme.

Code: 1S1 Seminar-I

- It helps students with numerous benefits, including improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence.

SEMESTER II

Theory

Code: 2T1 Inorganic Chemistry

- To understand the electronic spectra and magnetic properties of transitionmetalcomplexes and to know how magnetic moments can be employed for the interpretation of their structure.
- To get an overview about the reaction mechanism of transition metal complexes.
- To gain the knowledge about Structure and bonding of metal carbonyls as well as to study vibrational spectra of metal carbonyls for bonding and structure elucidation.
- To get an idea about Structure and bonding of metal nitrosyls. Enable students to elucidate thebonding and structureof metal nitrosylsby using vibrational spectra.

Code: 2T2 Organic Chemistry

- To understand the mechanistic and stereochemical aspects of addition reaction of carbon-carbon multiple bondand carbon-hetero atom multiple bond involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity.
- To gain the knowledge about classification and general mechanistic treatment of electrophilic, nucleophilic and free radical moleculer rearrangement.
- To get insight into the chemistry of free radical reactions.
- The students will get a basic understanding of green chemistry. This will give idea about Synthesis involving basic principles of green chemistry, prevention or minimization of hazardous products, choice of solvents, sonochemistry, microwave induced reactions, polymer supported reagents, reactions in aqueous medium, solvent free reactions, biocatalysts in organic synthesis.

Code: 2T3 Physical Chemistry

- To study the basic postulates of quantum mechanics. To enable the students to solve the simple quantum mechanical models such as simple harmonic oscillator, particle in a 1D- box, rigid rotor, H atom etc.
- To understand the basic concepts of ideal and non-ideal systems in thermodynamics. To get idea about nonequilibrium thermodynamics.
- To get an overview about the solid state chemistry.
- To have a basic idea about nuclear Chemistry and its applications.

Code: 2T4 Analytical Chemistry

- To understand the criteria, techniques and hazards of sampling. To gain knowledge about safety aspects in handling hazardous chemicals.
- Enable the students to understand the concepts of modern separation techniques.
- To get an idea about optical methodsofanalysis including spectrophotometry, colorimetry and flame photometry.
- To get an overview about the Electrochemical methodsofanalysis which includes Polarography and amphometric titrations.

Practicals

Code: 2P2 Organic Chemistry

- To learn the separation, purificationand identification of an organic mixture by chemical/solvent separation methods.
- Enable the students to prepare organic compounds via single step and two step synthetic sequences.

Code: 2P4 Analytical Chemistry

- The students will develop basic skills in the techniques like calibrations of apparatus.
- The students will get skill in the quantitative analysis by doing titrations in the different branches of volumetric analysis.
- The students will get training in the quantitative analysis of metal ions and anions using gravimetric method.
- The students will develop basic skills in the separation techniques using chromatography, ion exchange.
- The students willget skill in handling instruments like, conductometer, potentiometer and colorimeter.

Code: 2S1 Seminar-II

- It provides various benefits like improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence to the students.

SEMESTER III

ORGANIC CHEMISTRY SPECIALIZATION

Theory

Code: 3T1 Special I-OrganicChemistry

- To be familiarize with the important photochemical reactions in Organic Chemistry.
- Enable the students to understand the concepts of pecicyclic reactions.
- To study the reactions involving oxidation and reduction in organic chemistry.
- To get insight into the Chemistry of P, S, Si,andBoroncompounds.

Code: 3T2 Special II-OrganicChemistry

- To get knowledge classification, nomenclature, occurrence, isolation, general methods of structure determination, stereochemistry and synthesis of terpenoids and porphyrins.

- To gain an idea about chemistry of alkaloids and prostaglandins.
- To study the fundamentals of steroids and plant pigments.
- To know the basic aspects of chemistry of natural products like carbohydrates, Amino acids, protein and peptides.

Practical

Code: 3P1 Organic Chemistry Special

- The students will get training in the quantitative analysis by estimation of some organic compounds.
- Enable the students to apply isolation techniques for organic compounds from natural source.
- To learn the separation, purification and identification of an organic mixture by chemical/solvent separation methods.

Theory

Code: 3T3 Medicinal Chemistry (Elective)

- The students will get knowledge of the connection between the structural features of the drugs and their physico-chemical characteristics, mechanism of action and use.
- Application they gained knowledge about the terapeutic classes of drugs.

Practical

Code: 3P3 Medicinal Chemistry Practical (Elective)

- The students will get knowledge of the important compounds which contain medicinal properties from drugs.
- Enable the students to understand the synthesis, purification and identification ofdrugs.

Code: 3T4 Spectroscopy– I(Core Subject Centric – I)

- To understand the idea of space groups and to learn the theory of molecular symmetry.To gain skill to apply group theory.
- To know the basics principle of different techniques employed in molecular spectroscopy.
- To study the origin, instrumentation and important applications of Microwave, Mössbauer, Raman, IR and EPR techniques.
- Enable the students to elucidate the structure of compounds by analysing the spectral data.

Code: 3S1 Seminar III

- It provides various benefits like improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence to the students.

SEMESTER IV

ORGANIC CHEMISTRY SPECIALIZATION

Code: **4T1 Special I-OrganicChemistry**

- To know the basics of Carbanions inorganicChemistry.
- To get insight into the Chemistry of organometallic reagents and transition metals in organic synthesis.
- To know the utility of protecting group strategy in organic synthesis.
- To know stereochemistry and various possible conformations of organic compounds and how it affects the reaction outcome.
- To get an idea about designing the synthesis based onretrosynthetic analysis.

Code: 4T2 Special II-Organic Chemistry

- To study the chemical and biological catalysis, remarkable properties of enzymes, mechanism of enzyme action and co-enzyme chemistry.
- To get insight into the chemistry of heterocycles.
- To impart the students thorough idea in the chemistry ofnucleic acids, lipids and vitamins.
- To get an idea about dyes, pharmaceutical chemistry and polymer chemistry with their applications in daily as well as industrial applications.

Practical

Code: 4P1 Organic Chemistry Special Practical

- Enable the students to understand quantitative analysis based on classical and instrumental technique of elements in organic compounds.
- The students will get knowledge of spectrophotometric/calorimetric and other instrumental methods of estimation organic compounds.
- Enable the students to prepare organic compounds via two step and three step synthetic sequences.
- The students will develop basic skills in structure elucidation of organic compounds on the basis of spectral data (UV, IR, ^{1}H and ^{13}CNMR and Mass)

Theory

Code: 4T3 Medicinal Chemistry (Elective)

- To study the drug rules and drug acts, overview of intellectual property right, indian and international framework for patentprotection.

- To get insight into the chemistry of antidiabetic agents, anti-viral agents, anti-malarial agents, local anti-infective drug, histamines, antihistamic agents, Antibiotics, anti-inflammatorydrugs, anthelminitics and antiamoebic drugs.

Code: **4T4 Spectroscopy – II (Core Subject Centric –II)**

- To get knowledge about basic principles and applications of UV-Visible and photoelectron spectroscopy.
- To study the basic principle and applications of nuclear magnetic spectroscopy.
- Enable the students to understand the problems based on structure determination of organic molecules by using NMR (^{1}H and ^{13}C nuclei) data, Structure elucidation using combined techniques including UV, IR, NMR and mass spectrometry (based on data and copies of the spectra).
- To get an idea about diffractiontechniques likes X ray diffraction, electron diffraction and neutron diffraction.

Practical

Code: 4PROJ1 Project

- Provides students with exposure to a variety of research projects and activities in order to enrich their academic experience.
- Provides opportunity for students to develop skills in presentation and discussion of research topics in a public forum.

Code: 4S1 Seminar IV

- It provides various benefits like improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence to the students.

Program Outcomes

Program: B.Sc.: Affiliated to and as per syllabus of RTM Nagpur University.

Program purpose:
The eligibility for the B.Sc. program is that the candidate should have passed the Std XII (10+2 level) examination with basic science subjects. The student has to opt for three major subjects in Science, along with two additional subjects in the form of one compulsory language, English, and one optional language- Supplementary English, Hindi or Marathi, at the Semester I and II level.

The major subjects available for the B.Sc. program in the institution are Chemistry, Biochemistry, Botany, Zoology, Biotechnology, Mathematics, Physics, Electronics and Computer Science. The students opt either for the Earth Sciences group (Mathematics, Physics, Electronics, Computer Science, Chemistry) or the Biology group (Chemistry, Biochemistry, Botany, Zoology, Biotechnology).

Apart from imparting the curriculum as prescribed in the Syllabi framed by the RTM Nagpur University, the institution gives added inputs to the students for their overall personality and skill development. These include programmes for personality development through the Training and Placement Cell UDAAN, debates, model, poster and chart making, exhibitions, guest lectures, activities of various subject cells and associations, Sports and cultural activities, etc. Students are also given exposure to use of ICT through Power Point presentation competitions and assignments. This enables the students to increase their competency and employability in the Global scenario.

The program, being of graduate level, opens new vistas of opportunity in the service sector: Public Service Commissions, Banking, PSUs, etc. where the minimum required qualification is graduation.
Thus, after the B. Sc. program, the student becomes employable, and also is well prepared for higher learning and research.

Program Outcomes (PO)
Students of all undergraduate B. Sc. degree programs at the time of graduation will be able to:

1. **Creative and Critical Thinking:** Apply logical reasoning to assume, inquire and analyse the problems at hand, integrating their knowledge in a wider perspective. Evaluate evidence, arguments, claims and beliefs to identify and formulate arguments. Critically evaluate policies and theories by following scientific approach to knowledge development.
2. **Effective Communication:** Express thoughts and ideas effectively through speaking and writing. Demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. Communicate with others in one or more Indian languages using appropriate media, confidently share and express views. Communicate effectively with scientific community and society at large, through effective presentations, and give, receive and implement instructions.
3. **Leadership and Team Work:** Function effectively and respectfully as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. Facilitate

cooperation, coordination and work efficiently as a member of a team in the interests of a common cause.

4. **Effective Citizenship:**Relate and to be aware of various social concerns leading to personal and national development. Participate in civic life by developing an empathetic mindset. Apply reasoning to assess health, safety, legal, ethical and cultural issues of the society and the consequent responsibilities that it entails. Possess knowledge of the values and beliefs of multiple cultures in a global perspective.
5. **Moral Maturity and Ethical Behaviour:** Accept moral and ethical values in conducting one's life. Use ethical practices in all scientific work. Increased cognitive ability, appreciating others point of view, debate and promote interdependence to reach conclusions in a group of people.
6. **Environment and Sustainability:**Have awareness with regard to current environmental problems and make a positive contribution towards sustainable development.
7. **Self-directed and Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent thinking and life-long learning of developmental and technological changes. Acquire knowledge and skills that are necessary for participating in learning activities throughout life and adapting to changing trends and demands of the work place.
8. **Knowledge Application:**Havefurther insight into facts and phenomena of Science, to which they have been already exposed at 10+2 level.Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study. Apply the core concepts of the subjects learnt during graduation to a chosen scientific discipline. Identify, design, generate and interpret scientific data using quantitative, qualitative and analytical methodologies and techniques, keeping in mind the specific needs for public health, safety and environmental protection.
9. **Analytical, Scientific Reasoning and Problem Solving:**Develop a sense of inquisitiveness and capability of asking appropriate questions and problem solving. Evaluate the reliability of available evidence, identify flaws in the arguments and analyse the information from various sources. Apply one's knowledge to solve different kinds of problems to real life situations.
10. **Information / Digital Literacy*:*** Use ICT, to access, evaluate, and use a variety of information sources. Ability to work independently, identify appropriate resources required for a particular task.

Program: Bachelor of Science

PROGRAM SPECIFIC OUTCOMES

(With Subject Combination from Earth Science subjects)

The institution offers a combination of any three of the earth science subjects: Mathematics, Physics, Chemistry, Electronics and Computer Science, for its B.Sc. Degree programs.

The program specific outcomes can be stated as below:

PSO1: Understanding of basic principles and theorems in the subjects learnt and their applicability.

PSO2: Ability to use laboratory and other instruments and equipment related to their subject to measure, analyze and troubleshoot problems in the real world.

PSO3: Development of skills to design and construct experiments and small projects for day-to-day applications.

PSO4: Orientation towards entrepreneurship to undertake independent business ventures related to their field of study.

PSO5: Equipped with hard and soft skills to work effectively as individuals and also as members of professional teams.

PSO6: Awareness of ethical concerns in accommodating diverging situations and environmental concerns.

COURSE OUTCOMES

Computer Science

C Programming	Students build the basic skills of programming through C. Develop their logic through this language. After studying this language the students learn to do programming in C independently. Creates a strong base for other advanced languages
Fundemental of Information Technology	Enables the students to understand the basics of computers including hardware, software and networking
C++ using OOPs Concept	Makes the students realize the importance of data and teaches them a way to protect the data. Teaches them object oriented concepts and brings them closer to the real world. Through C++ the students learn object oriented programming.
System Analysis and Design	To introduce software project management and to describe its distinctive characteristics and to discuss project planning and the planning process and show how graphical schedule representations are used by project management and the risk management process
Data Structure using C++	Makes the students aware about the manner in which the data can be stored in the memory of the computer so that different operations like traversing, insertion , deletion, searching sorting, merging copying can be performed on the stored data efficiently.
Operating System	Enable the student to get sufficient knowledge on utilizing efficiently the various system resources.
Java Programming	Gives the students an opportunity to work with a language which supports internet. Enables them to develop applications and applets. Helps them to develop GUI, handle events, draw graphs etc. This language is very important as it is used in the industry for the different applications like Mobile applications , Robotics etc
Linux Operating System	To provide a comprehensive introduction to Basic Linux Shell Programming Logic and enhance the students to write simple and complex shell scripts.
Visual Basic Programming	To introduce the concepts of visual programming. To introduce GUI programming using Microsoft foundation classes. To enable the students to develop programs and simple application using Visual Basic 6.0.
Database Management System	Makes them aware of different data models. Gives them an idea of storing the data in a centralized database. They also learn its advantages over traditional file system. They also learn the role played by database administrator.
Compiler Design	To introduce how the high level programming languages are handled by the system.
SQL AND PL/SQL	Practically they learn to work in a relational database management system. They learn to create, manipulate and control the data kept inside the database tables. They also learn the ways of normalizing tables.

Electronics

The B.Sc. Course with Electronics as a subject encompasses the domains of knowledge comprising:

1. Components and network theorems
2. Semiconductors
3. Analogue Electronics
4. Digital Electronics
5. Microprocessors and Microcontrollers
6. Instrumentation
7. Communication Electronics
8. “C” computer language

Course Outcomes:

C1: Components and Network Theorems

CO1: Identification of passive and active electronic components its coding schemes and deployment as circuit elements.

CO2: Make effective use of electronic instruments and systems for measurements and analyses.

CO3: Application of network theorems for circuit analysis.

CO 4: Use of semiconductor elements diodes and transistors circuits and their applications

C2: Semiconductor Electronics:

C01: Understanding of constructional details, working and applications of FETs and Thyristors

CO2: Use of hybrid parameter models for circuit analysis.

CO3: Understanding working and applications of power amplifiers.

C3: Analogue Electronics:

CO1: Understand electronic systems with a continuously variable signal. The proportional relationship between input –output signals.

CO2: Understand basic circuits using active components, construction and characteristics of components and circuits.

CO4: Design of amplifiers, oscillators and feedback circuits, understanding of working

principles

CO5: Basic design of differential amplifier, operational amplifier and its applications

C4: Digital Electronics

CO1: Understanding basic digital signals and logic elements their truth tables and

applications.

CO2: Boolean algebra and its applications in design of digital circuits. Use of Karnaugh maps for digital systems design

CO3: Design of digital circuits and systems using digital integrated circuit.

CO4: Working and design aspects of memory modules.

C5: Microprocessors and microcontrollers:

CO1: Understand basic architecture of 8 bit microprocessor 8085.

CO2: Acquire programming skills in assembly language for 8085 microprocessor.

CO3: Understand architecture of microcontroller its features and applicability.

CO4: Design of interface circuits using microcontrollers.

C6: Instrumentation:

CO1: understand basic analogue and digital meters for its effective use in systems measurements.

CO2: Use of test elements such as power supplies, function generators, CRO, DFM

CO3: Transducer principles, construction, working and applications in instrumentation

systems.

CO4: Understanding, design and development of conventional, PC based and Virtual instrumentation modules and systems.

CO5: Use of software platform for study and analysis of electronic circuits and systems.

C7: Communication Electronics:

CO1: Understanding various aspects of communication process, its components and types of communication.

CO2: Understand modulation and demodulation processesin communication systems. Understanding of analogue and digital communication systems and its processes.

CO3: understanding of Optical communication system elements and principles

CO4: Basic knowledge of mobile communication system.

C8: "C" Programming

CO1: Acquisition of basic programming skills in C language.

CO2: Application of C programming techniques to control electronic hardware systems and modules.

Mathematics

CO1: The set of elementary concepts of Algebra, Calculus, Trigonometry, Vector Calculus, Difference Equations, Solid geometry, Differential equations and their applications are introduced. These ideas assist students in understanding and solving the problems in variety of ways.

CO2: Convergence or divergence of the certain idea is an important tool in Mathematics. Students learn this through the study of sequences and series.

CO3: Laplace and Fourier transforms are being used in Engineering Mathematics to solve various Ordinary and Partial Differential Equations. These features of Mathematical Modeling are rigorously worked out by students.

CO4: The critical thinking of students is developed through the study of Group Theory, Ring Theory, Abstract Algebra,and theory of Riemann-Stieltjes Integral, etc.The assimilation of proofs and counter examples give ample opportunitiesto students to enhance their logical reasoning ability.

CO5: The equilibrium of coplanar forces, Virtual work and equations of motion of bodies, etc are introduced in study of Mechanics. This gives another dimension in learning,and solving the problems in Mechanics.

CO6: Real and Complex analysis are important studies in Mathematics that help students grow in analyzing the related problems.

CO7: The theory of Relativity is of great significance in Mathematical physics today. The notions of Classical and Special Relativity are introduced to the students. This paves way in understanding the non-gravitational fields in the system.

Physics

Course outcomes (CO) in Physics

SEMESTER –I

Paper I

- Types of motion existing in nature
- General properties of matter i.e elasticity, surface tension and viscosity
- Application of laws of conservation of Physics :macroscopic world, rocket motion

PaperII

- Understanding electrical laws of nature:coulombs law, Gauss law, electric field, electric potential.
- Understanding dielectric nature of material: polarization phenomena mechanism ,capacitor as application
- Current :A.C., D.C. its laws and various D.C. circuits
- Fundamentals and analysis of A.C. circuits

SEMESTER –II

paper I

- Concepts and different types of oscillations: free, damped and forced
- Understanding the laws of ideal gases, kinetic theory of gases
- Understanding the basic laws of thermodynamics
- Physical behavior of real gases and transport phenomena in gases

Paper -II

- Familiarization with gravitation phenomena and various gravitation laws : Keplers laws and Newton laws of gravitation.
- Introduction of constituents of universe: galaxy, stars, solar system, composition of constituents of universe.
- Magnetic behavior of materials:para, ferro,dia, Different magnetic laws Biot savart law, Amperes laws, Curie temp and Neel temp
- Superconducting behavior of materials, and its various effects.

SEMESTER –III

Paper I

- Concept of wave propagation.Classification of waves. Basic terminology of music science.
- Transducers with reference to acoustics, microphone, loudspeaker. Methods of Recording and reproduction of soundarchitectural acoustics of building.
- Ultrasonics: theory, production properties and application.

- Concepts of rectifier and power supply

Paper II

- Basic concepts of interference (Newton's rings and Michelson's interferometer)
- Basic theory of diffraction ,its application
- Basic concept of polarization, Nicol prism positive and negative crystals
- Fundamentals of E.M. waves: theoretical derivation.

SEMESTER –IV

Paper I

- Introduction to crystal Physics
- Theory and generation of X-rays, properties and usage of X Rays hard and soft X-rays
- Application of X-Ray in solid state Physics Braggs law and Bragg spectrometer.
- Lasers: concept, construction and application of Laser different types of Laser.

Paper II

- Semiconductor devices: Diodes , BJT and their characteristics
- Construction and characteristics, working of JFET and MOSFET.
- Concept of molecular spectroscopy: vibrational, rotational and electronic spectra of molecules. And its application
- Raman Effect: theory and its application.

SEMESTER –V

Paper I

- Vector model of atoms ,quantum no,Zeeman and stark effect
- Free electron theory of solid state and its application in electrical and thermal behavior.
- Origin of bands in solids and classification of materials based on band theory.
- Classical statistical Physics (M.B. statistics and its applications)
- Quantum statistical Physics (B.E and F.D and its application to free electron in metal and B.E condensation.

Paper II

- Need and developments of quantum mechanics, wave particle duality, De Broglie hypothesis, Heisenberg uncertainty principle
- Schrodinger's Wave equation and basic concepts of quantum mechanics (wave function operators, Eigen values Eigen function particle in a box
- Nano materials : general concepts of nano science , properties of nano materials
- Method of synthesis and characterization of nano materials and their application in various fields.

SEMESTER –VI

Paper-I

- Relativity: concepts and its consequences
- Detection and acceleration of nuclear radiation models of nucleus, nuclear reactor.
- Theory of nuclear radiation particles
- Bio-potentials of human body and basic principles of measuring signals of human body

Paper II

- Amplifiers ,OPAMP and oscillators
- Fibre optics :construction and working of optical fibers
- Communication: basic concepts of analogue communication (A.M., F.M. AND P.M.)
- Number system: different types and its interconversion, digital numbers and system, and their arithmetic. Various logic gates.

Chemistry

Semester I ChemistryPaper-I

After completing the course, the student will be able to:

- Explain the **atomic structure** based on quantum mechanics and explain **periodic properties** of the elements.
- Explain the structure and **bonding in covalent molecules**and **ionicsolids**and predict the structure of molecules.
- Explain selected crystal structures, and perform calculations of the lattice energy of ionic compounds.
- Explain the properties of **s block elements** and hydrogen bonding in compounds.
- Explain the properties of **Noble gases** and structure, bonding and applications of Xenon fluorides (XeF_2, XeF_4, XeF_6). Structure and bonding in $XeOF_2$ and $XeOF_4$.
- Explain the properties of**p-block elements** like Atomic and ionic radii, Ionization potential, electron affinity, electronegativity, redox properties and oxidation state.
- Explain about Hydrides:Comparative study with respect to structure of NH_3, PH_3, AsH_3 and SbH_3, Structure of P_2O_3,P_2O_5, Structure of H_3PO_3 and H_3PO_4, Preparation and structure of Caro's and Marshall's acids.

Structure and bonding of diborane, structure of borazine.

Semester 1 ChemistryPaper-II

After completing the course, the student will be able to understand Explain**Thermodynamics: fundamental concepts**

-ExplainStatements of first law of thermodynamics, definition of internal energy & enthalpy. Heat capacity, heat capacity at constant volume and at constant pressure & their relationship. Joule-Thomson experiment, Joule-Thomson coefficient & inversion temperature, calculations of w, q, ΔE & ΔH in isothermal & adiabatic expansion of ideal gases for reversible process.

- ExplainThermo chemistry: Standard states, Standard enthalpy of formation. Hess's law of constant heat of summation & its applications. Heat of reaction, relation between heat of reaction at constant volume and constant pressure. Average bond energy, bond dissociation energy and its calculations from thermo chemical data.
- Explain**Gaseous State** - Postulates of kinetic theory of gases, derivation of kinetic gas equation, deduction of various gas laws from kinetic gas. Effect of temperature on molecular velocities. Different types of molecular velocities (most probable, R.M.S. and average and expressions for them), their inter relationships. Definitions of collision diameter, collision number and Mean free path.
- Explain**Ideal gas and real gases**-Difference between an ideal and real gases. Deviations from ideal behavior. Explanation of the terms – Compressibility factors and Boyle temperature. Causes of deviation from ideal behaviors. Vander Wall's equation of state, explanation of behavior of real gases by Van der Waal's equation. Andrew's experiment on critical phenomenon of isotherms of CO_2.
- Explain**Liquid State- Properties of liquid:**Surface tension, Viscosity, Refractive index
- Explain**Surface Chemistry and Catalysis**

Semester 1 Practical

Studentswillgainanunderstandingofmethodso f chemicalanalysis suchas detectionof acidic and basic radicals.

To enable the students to understand the various concepts in physical chemistry like heat of solution, heat of ionization of weak acid, viscosity, surface tension etc. by doing

experiments pertaining to these concepts.

Semester II Chemistry Paper-I

After completing the course, the student will be able to:

-Explain Structure and Bonding: Hybridization in alkanes, alkenes and alkynes,

-Explain General mechanism of organic reactions

-Explain Stereochemistry of organic compounds: isomerism, Optical, geometrical and conformation isomerism

-Explain Methods of preparation, structure, nomenclature and reactions of alkanes, alkenes, diens, alkynes and cylcoalkanes

-Explain Structure, molecular orbital structure of benzene and their substitution reactions with mechanisms.

Semester II Chemistry Paper-II

After completing the course, the student will be able to:

Explain**Thermodynamics-** Second law of thermodynamics : Carnot's cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature, concept of entropy, entropy change in reversible and irreversible processes, entropy change of the universe, entropy change for an ideal gas with change in P, V & T, entropy change during physical change, physical significance of entropy, entropy as criteria of spontaneity & equilibrium of a process.Free energy functions: Work function and Gibb's free energy (G), Variation of work function with T and V, variation of Gibb's free energy with T and P. A and G as criteria for spontaneity and equilibrium of a process. Gibb's – Helmholtz equation & its applications.

- Explain**Chemical equilibrium:** Law of mass action, law of chemical equilibrium, relationship between Kp and kc. Van't-Hoffs reaction isotherm, relation between standard free energy change & equilibrium constant, effect of temperature on equilibrium constant (reaction isochor), integrated form of Van't Hoff equation.

- Explain**Phase Equilibria- phase rule and its applications**
- Explain**Liquid-Liquid mixtures**
- Explain**Nuclear chemistry**
- Explain**Molecular structure**
- Explain**Chemical Kinetics**

Semester II Practical

To predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups, melting point.

To enable the students to understand the various concepts in physical chemistry like integral heat of solution, critical solution temperature, rate constant of hydrolysis etc. by doing experiments concerned.

Semester III Chemistry Paper I

After completing the course, the student will be able to:

-Explain VSEPR theory and examples. Preparation, properties and structure of Interhalogen compounds and polyhalides

-Explain MO theory- Molecular Orbital diagrams of homonuclear diatomic molecules, MO of HF, CO and NO diatomic molecules.

-Explain Chemistry of elements of first, second and third transition series.

-Explain Errors in Chemical Analysis: Accuracy and Precision, Absolute and Relative errors, Mean, Median, Average and Standard deviations, and significant figures.

-Explain Non-aqueous solvents: liquids NH_3 and SO_2

-Explain Chemistry of Lanthanides and actinides

Semester III Chemistry Paper II

After completing the course, the student will be able to:

-Explain Orientation ofelectrophilic substitution on monosubstituted benzene with activating and deactivating groups

-Explain Structure method of preparation physical and chemical properties of alkyl halides and polyhalogen compounds.

-Explain Preparation, nomenclature physical and chemical properties of alcohols, dihydric alcohol, trihydric alcohol and phenols.

-Explain Preparation, nomenclature physical and chemical properties of aldehydes and ketones.

-Explain Preparation, nomenclature physical and chemical properties of carboxylic acids and their derivatives such as acid chlorides, anhydrides, esters, amides.

Semester III Practical

Students will gain an understanding of methods of complete analysis of organic compoundswith different functional groups.

To enable the students to understand the methods of quantitative analysis by redox complexometric and acid-base titrations.

Semester IV Chemistry Paper I

After completing the course, the student will be able to:

-Explain Coordination compounds -nomenclature, VBT and MOT of complexes.

-Explain Isomerism in coordination compounds:Structural isomerism and Stereoisomerism in coordination compounds

-Explain Oxidation and reduction:Use of redox potential data: Analysis of Redox cycle, redox stability in water, Latimer diagram of Chlorine and Oxygen, Construction and explanation of Frost diagram. Frost diagram of Nitrogen and Oxygen. Pourbaix diagram of Iron.

-Explain Principles of photometery: Beer-Lamberts Law, derivation and deviation(Numericals). Types of colorimeter and spectrophotometer with simple schematic diagrams. Application of colorimeter and spectrophotometer in quantitative analysis with reference to estimation of Cu(II) as Cu- ammonia complex.

-Explain Separation Techniques: Chromatography, Ion- Exchange and Solvent Extraction

-Explain Inorganic Polymers:Silicones, Silicon oils, Silicone Elastomers and Silicon ResinsPhosphonitrilic halide polymers: Introduction, Preparation, properties and uses. Structure and bonding in $(NPCl_2)_3$ and $(NPCl_2)_4$

Semester IV Chemistry Paper II

After completing the course, the student will be able to:

Explain - Solid State- Laws of crystallography: Law of constancy of interfacial angles, Law of rationality of indices, Law of symmetry, elements of a crystal.Space lattice, Unit cell, Bravais lattices, crystal systems, identification of crystal planes, interplanner distance in cubic systems, X-ray diffraction by crystal, derivation of Braggs′ equation. Determination of crystal structure of NaCl, KCI and CsCl, Laue′s method and powder method.

-Explain**Electrochemistry -**Electrical transport : Conductance in metals (electronic) & in electrolyte solutions (ionic conductance), specific, equivalent and molar conductance, measurement of electrolytic conductance, variation of equivalent, specific & molar conductance with dilution, Kohlrausch′s law, Arrhenius theory of electrolyte dissociation &

its limitation, Ostwald′s dilution law, validity and importance of Ostwald′s dilution law.Debye-Huckel theory (elementary treatment).Relaxation effect, Electrophoretic effect, Onsagar equation.

- Explain **Spectroscopy- Rotational and Vibrational Spectroscopy.**
- Explain **Quantum Chemistry**

Semester IV Practical

To enable the students to understand the methods of quantitative analysis by gravimetric analysis and qualitative by paper chromatography.

Students will gain an understanding of instrumental methods of analysis by conductometry and potentiometry.

Semester V Paper I

After completing the course, the student will be able to:

-Explain Preparation, nomenclature, structure,physical and chemical properties of aliphatic and aromatic nitro and amino compounds.

-Explain Aromaticity in heterocyclic compounds of five membered six membered and fused ring compounds containing nitrogen, sulphur and oxygen as heteroatom, preparation and reactions of pyridine indole quinoline and isoquionoline.

-Explain Quantitative analysis of carbon, hydrogen. Nitrogen,Sulphur and halogens in organic compounds and empirical and molecular formula.

-Explain Organometallic compounds with magnesium, lithium and zinc their preparations and reactions.

-Explain Spectroscopic analysis -UV and IR.

Semester V Paper II

After completing the course, the student will be able to:

-Explain Electrochemistry

ExplainGalvanic cells, irreversible & reversible cells, emf of cell & its measurement, relation between electrical energy and chemical energy, calculation of thermodynamic quantities of a cell reactions (ΔG, ΔH & ΔS & equilibrium constant)

ExplainTypes of reversible electrodes : metal-metal ion electrode, gas electrode, metal insoluble salt-anion electrode, redox electrodes, amalgam electrode, Nernst equation, calculation of cell emf from single electrode potential, reference electrodes, standard electrode potential, concentration cells with & without transference, liquid-junction potential, salt bridge & its functions.

ExplainApplications of emf measurements in : (i) pH- determination using hydrogen electrode, quinhydrone electrode & glass electrode (ii) Potentiometric titration(Acid –Base and Redox titrations).

- Explain**Quantum Chemistry and Molecular Orbital Theory**
- Explain**Photochemistry and Raman Spectroscopy**
- Explain**Colligative properties and Macromolecules**

Semester V Practical

To enable the students to understand the Quantitative analysis of glucose, amide and carboxylic group and saponification value of oil.

Molecular mass by Rast method and Viscometric method

Verification of Beer-Lambert law, Zero order reaction, Quantitative analysis using Abbes' refractometer

Semester VI Paper I

After completing the course, the student will be able to:

-Explain Metal ligand bonding in Transition Metal Complexes:Crystal field theory: Splitting of d-orbital in octahedral, tetrahedral and square planar complexes. High spin and low spin complexes

-Explain Electronic spectra of Transition Metal Complexes:

Jahn-Teller Effect, selection Rules Hole Formalism Principle Electronic spectrum of $[Ti(H_2O)_6]^{3+}$ and $[Cu(H_2O)_6]^{2+}$ complex ions with respect to position of the band, intensity of the band, symmetry of the band and bandwidth.

-Explain Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT.

-Explain Thermodynamic and Kinetic stability of metal complexes

-Explain Organometallic Chemistry: Nomenclature and Classification of Organometallic compounds. Structure of metal ethylenic complexes. Mechanism of homogeneous Hydrogenation using Wilkinson's Catalyst

-Explain Metal carbonyls: Definition, preparation, properties. Structure and bonding in mononuclear carbonyls

-Explain Bioinorganic Chemistry:structure and biological role of Hemoglobin and Myoglobin, role of Ca, Na and K, Na-K pump and Ca pump

-Explain Hard and Soft Acids and Bases: Classification of Acids and Bases as Hard and Soft. Pearson's HSAB Concept and its applications. Symbiosis, Antagonism.

Semester VI Paper II

After completing the course, the student will be able to:

-ExplainNMR spectra of organic molecules,

-ExplainMalonic ester and acetoacetic ester -preparation and reaction

-ExplainCarbohydrate chemistry, structure and reactions of glucose

-ExplainStructure of disaccharide and polysaccharide without involving structure determination.

-Explainstructure and reactions of amino acids, proteins and nucleic acids.

Fats oils and detergents

-ExplainSynthetic dyes,drugs and polymers with suitable examples

Semester VI Practical

To enable the students to understand separation and analysis of the two component organic mixture using $NaHCO_3$ and NaOH.

Preparation of complexes of copper, nickel and iron.

PROGRAM SPECIFIC OUTCOMES

(With Subject Combination from Life Science subjects)

The institution offers a Bachelor of Science (B.Sc.) Program with any of three Life Science Subjects: Biochemistry, Biotechnology, Botany, Chemistry and Zoology.

An undergraduate course in Life Science subjects gives detailed information about life, the environment, interactions among life forms such as plants, animals, bacteria and viruses. It also delves deep into the structure and functioning of cells, the biochemical interactions taking place in them and the reasoning for them. The subjects have has employment opportunities in the field of chemical industry, agriculture, forestry, biofertilizer and biopesticide industry, wildlife conservation and management, and gives opportunity for work and entrepreneurship in applied fields such as floriculture, horticulture, mushroom cultivation, apiculture, sericulture, fishery, prawn culture, pearl culture, lac culture, etc. It provides opportunity for higher learning, research and teaching in all the subjects studied.

Teaching Learning and evaluation Methods:

Students are taught as per the prescribed syllabus which is well supplemented by practical work, where students acquire skill and confidence in handling laboratory glassware, chemicals and equipments. Teaching is in the form of conventional chalk and black board method, power point presentations, animations, demonstration of laboratory techniques, etc. Additional inputs are given to the students in the form of guest lectures and field visits. Students are encouraged to prepare and show power point presentations as their assignments. Students are evaluated internally on the basis of their performance in periodic tests, assignments, projects, attendance, etc., and through the regular University theory and Practical Examinations conducted by the University. Students also learn soft skills such as Leadership, Management, Public speaking, team work through various platforms and subject associations.

Curricular Structure: The student is expected to appear for two theory papers and a Practical examination in all science subjects, except Mathematics, in each of the six semesters. In addition they appear for additional two language papers in the first two semesters.

The Program specific outcomes are:

PSO1. Understand the nature and basic concepts of the life science with the study of various aspects of life and its processes.

PSO2. Analyse the relationship among life forms with respect to various biochemical processes underlying living systems.

PSO3. To identify the role played by various chemical substances and phenomena in living systems and in the environment by analysis of their chemical interactions.

PSO4. To identify organisms on the basis of their characteristics and classify them. To perform procedures as per laboratory standards in the subject by use of different tools and techniques.

PSO5. Understand the applications of the subject in the field.

PSO6. To identify and analyse the role played by organisms in sustaining the environment.

PSO7. To apply the basic knowledge of Science in general to Life Sciences to identify problem areas, and to find solutions for their remediation through analytical thinking.C

COURSE OUTCOMES

Biochemistry

B. Sc. With Biochemistry as one of the Major subject – Course Outcomes	
Course	Outcomes
Biomolecules and Human Physiology	The students will gain an insight into various physiological activities in human beings and the coordination between different systems of human body. Through understanding of Carbohydrate Chemistry, Digestion, Excretion, Hematology, Muscle Physiology and Biochemistry, Reproduction, Endocrinology, NeuroBiology, Lipids, Membranes and transport mechanisms. Understand energetic and structural roles of carbohydrates and Lipids in living organisms. Understand the structure and functions of membrane proteins. Laboratory experiments are designed to strengthen theoretical knowledge of the subject. The students will be conversant with blood components and their examination, staining, digestive enzymes, quantitative clinical Biochemistry techniques and qualitative analysis of various physiologically important molecules.
Microbiology, Virology & Immunology	This course presents a basic study of Micro-organisms (Bacteria and Viruses) and Immunology. The student gains basic knowledge of History, classification, laboratory techniques, structure and methods of studying growth, nutritional requirements, control of microorganisms. Study of Immunology makes the students understand the basic defense mechanisms and human immune responses towards microorganisms. The student gains basic knowledge about Immunity, Antigen, Antibody, Cells of immune system and their function and regulation. The students would understand basic concepts in the working of human immunological system, at the molecular level. Laboratory experiments are designed to strengthen theoretical knowledge of the subject. The students learn Microscopy and aseptic handling, isolation, pure culture preparation, staining characteristics, external morphology of microbes. Understanding the effect of antibiotics and UV radiations. Handing of equipment required and study of various immunochemical techniques.
Macromolecules	By the end of this course, student will have in depth knowledge about the four major types of biological molecules like DNA, RNA, Proteins and their role in life related processes. Able to explain the impact of slight changes the structure of Macromolecules. Understand the structures and properties of the amino acids found in proteins. Able to describe the primary, secondary, tertiary and quaternary structures of proteins including explanation of the forces involved in forming and maintaining such structures. Students are given hands-on training about estimations of these molecules by various methods, interpretation of results and handling of sophisticated instruments.
Biophysical & Biochemical techniques / Bioinstrumentation	Enable the student to get sufficient knowledge in principles and applications various instruments and techniques of Biological Importance. The students study spectroscopy, chromatographic and electrophoresis techniques, centrifugation methods, Isotopic tracer techniques. Understand the instruments, analytical techniques and application of Biophysical methods used in the laboratory. Demonstrate practical skills required to deal with the detection, identification, separation, and estimation of various biomolecules.
Enzymology	Understand biological mechanisms of enzyme catalysis. In-depth knowledge of History, chemical nature, isolation, purification, structure, active site, regulatory mechanisms, kinetic studies, factors affecting rates of enzyme reactions, role of modulators, vitamins and coenzymes, etc. Explain structural mechanisms for how important biological processes take place and are regulated. Explain the Michaelis-Menten model of enzyme kinetics, including the effects of inhibitors, substrate concentration, temperature, pH. Explain allosteric, covalently modulated, immobilized enzymes and multienzyme complexes. Laboratory experiments focus on isolation and study of their activities, data analysis and interpretation. The student will be able to perform immobilization of enzymes.
Metabolism	Understanding the importance of thermodynamic principles governing Metabolism,

	concepts of high energy bonds and their role in Metabolism, techniques involved in metabolic studies, Substrate level and oxidative phosphorylation.. Students will explain / describe the catabolic and anabolic pathways of Carbohydrates, Lipids, Proteins and Nucleic acids along with their regulation. Understanding the importance of reactive oxygen species and and their role in aging.
Molecular Biology & Basic rDNA technology	By the end of this course, student will have detailed knowledge of molecular processes of DNA Replication, Transcription, Translation in prokaryotes and Regulation of these processes. Explain the Recombinant DNA Techniques used in microbiological research, gene manipulation and gene transfer technologies, expression systems, methods of selection, use of plasmids and restriction enzymes in creating recombinant DNA. Students will be able to analyze structural-functional relationships of genes and proteins in prokaryotes and factors responsible for ageing and cancer. Understand the instruments, analytical techniques and application of Biophysical methods used to study molecular processes.
General outcomes of the Laboratory Courses.	At the end of laboratory courses, students will be able to implement the theoretical concepts studied, interpretation of experimental data, expertise in fundamental laboratory skills, laboratory safety protocols, classical laboratory techniques and modern instrumentation. Viva voce promotes analytical thinking and Research aptitude.

Biotechnology

B. Sc. With Biotechnology as one of the Major subject – Course Outcomes	
Course	Outcomes
Microbiology & Virology	This course presents a basic study of Micro-organisms (Bacteria and Viruses). The student gains basic knowledge of history, classification, laboratory techniques, structure and methods of studying growth, nutritional requirements and control of microorganisms. Laboratory experiments are designed to strengthen theoretical knowledge of the subject. The students learn microscopy, aseptic handling, isolation, pure culture preparation, staining characteristics and external morphology of microbes. Understanding the effect of antibiotics and UV radiations.
Macromolecules	By the end of this course, student will have in depth knowledge about the major types of biological molecules i.e. DNA, RNA, Proteins and their role in life related processes. Able to explain the impact of slight changes the structure of macromolecules. Understand the structures and properties of the amino acids found in proteins. Able to describe the primary, secondary, tertiary and quaternary structures of proteins including explanation of the forces involved in forming and maintaining such structures. Understand Chemistry of Carbohydrate and Lipids and their energetic and structural roles. Laboratory experiments are designed to strengthen theoretical knowledge of the subject. The students become acquainted with quantitative and qualitative analysis of various biological molecules. Students are given hands-on training about estimation of these molecules by various methods, interpretation of results and handling of sophisticated instruments.
Cell Biology	At the end of the course, student will gain knowledge about Structure and function of the cell and its organelles. Cell division, cell cycle, structure of muscle and nerve cell, synaptic transmission and neuromuscular junctions.
Enzymology	Understand the biological mechanisms of enzyme catalysis. In-depth knowledge of history, chemical nature, isolation, purification, structure, active site, regulatory mechanisms, kinetic studies, factors affecting rates of enzyme reactions, role of modulators, vitamins and coenzymes, etc. Explain the mechanism by which biochemical reactions take place and are regulated. Understand enzyme kinetics with respect to Michaelis-Menten equation, effects of inhibitors, substrate concentration, temperature and pH. Students will have knowledge of allosteric, covalently modulated, immobilized enzymes and multienzyme complexes. Laboratory experiments focus on isolation and study of enzyme activity, data analysis and interpretation. The student will be able immobilize enzymes and test their activity.
Metabolism	Understanding the importance of thermodynamic principles governing metabolism, concepts of high energy bonds and their role in metabolism, techniques involved in metabolic studies, substrate-level and oxidative phosphorylation. Students will be able to explain the catabolic and anabolic pathways of Carbohydrates, Lipids, Proteins and Nucleic acids along with their regulation. Understand the importance of reactive oxygen species and their role in aging.
Biophysical techniques / Bioinstrumentation	Enable the student to get sufficient knowledge in principles and applications various instruments and techniques of Biological Importance. The students study spectroscopy, chromatographic and electrophoresis techniques, centrifugation methods, Isotopic tracer techniques. Understand the instruments, analytical techniques and application of Biophysical methods used in the laboratory. Demonstrate practical skills required to deal with the detection, identification, separation, and estimation of various biomolecules.
Immunology	Study of Immunology makes the students understand the basic defense mechanisms and human immune responses towards pathogens. The student gains basic knowledge about Immunity, Antigen, Antibody, Cells of immune system and their function and regulation. The students will understand basic concepts in the working of human immune system at a molecular level. Students gain theoretical and practical knowledge of different diagnostic tests based on antigen-antibody reactions like RID,

	ODD, etc.
Biostatistics	Understand basic concepts of Mean, Median, Mode, Standard Deviation and Standard Error and practice problems associated with these concepts.
Molecular Biology & Basic rDNA technology	By the end of this course, student will have detailed knowledge of molecular processes of DNA Replication, Transcription, Genetic Code, Translation in Prokaryotes and Regulation of these processes. Explain the Recombinant DNA Techniques, gene manipulation, gene transfer, expression systems, methods of selection, use of plasmids / other vectors and restriction enzymes in creating recombinant DNA. Students will be able to analyze structural-functional relationships of genes and proteins in prokaryotes and factors responsible for ageing and cancer. Understand the instruments, analytical techniques and application of biophysical methods used to study molecular processes.
Environmental, Industrial and Food Biotechnology	At the end of the course, students learn about water and waste water treatment processes, concept of biodegradation, biodeterioration and biotransformation, xenobiotics, bioaccumulation and biomagnification. Understand the basic principles of Industrial Biotechnology like commercial products obtained from microorganisms, GMOs and various types of fermentors. Gain knowledge about various processes in food biotechnology like types of cheeses and their production, microorganisms as food (mushroom and spirulina) and assessment of microbiological quality of various foods. Awareness of importance of quality control, quality assurance in food and pharamaceutical industry.
Plant and Animal Biotechnology	At the end of the course, student will have theoretical and practical knowledge of Animal and Plant Tissue Culture Techniques. Understand the preparation and composition of tissue culture media, callus and suspension cultures, their initiation and maintenance, Ti & Ri plasmids, transgenic plants and their applications. In-depth knowledge of various techniques of animal cell and tissue culture, culture media, growth factors, laboratory facilities and design, characteristics of cells in culture, primary culture, cell lines and their maintenance in the laboratory, Awareness of the use of recombinant DNA products in medicine, recombinant vaccines and concept of transgenic animals.
General outcomes of the Laboratory Courses.	At the end of laboratory courses, students will be able to implement the theoretical concepts studied, interpretation of experimental data, expertise in fundamental laboratory skills, laboratory safety protocols, classical laboratory techniques and modern instrumentation. Viva voce promotes analytical thinking and Research aptitude.

Botany

Sem I
Botany Paper I- Viruses, Prokaryotes and Algae

1. Students are able to explain general characteristics of Viruses, Ultra structure of TMV, Structure and Multiplication of T4 – Bacteriophage
2. Students are acquainted with economic importance of viruses
3. Students gained knowledge about Mycoplasma
4. Students learned difference inArchaebacteria and Eubacteria.
5. Students are equipped with knowledge on cell structure and Reproduction and economic importance of Bacteria in and Cyanobacteria
6. Students are able to differentiate algal species from otherorganisms.
7. Students gained knowledge about habitat of algae and various forms of algae.
8. Students learned about economic importance of algae

Sem I
Botany Paper II
Fungi, Lichen, Plant Pathology and Bryophyta

1. Describe General charachteristics, Classification and Economic importance of Fungi
2. Explain Life history of *Albugo, Mucor, Puccinia, Cercospora*
3. Elucidate types of Lichens and their Reproduction and Economic importance
4. Students are ableto identify diseased plants
5. Students are aware of symptoms of plant diseases and their control measures
6. Students gained knowledge regarding various forms of Bryophytes
7. Students learnt importance of bryophytes in ecology as well as their applications for human use.

Practical

1. Students are able to prepare temporary mount of algae and its microscopic observation.
2. Students are able to demonstrate Gram staining of bacteria
3. Students can prepare temporary mount ofbryophytes by taking hand sections and examine internal structure microscopically.
4. Students can prepare temporary mount by taking hand section through affected portion of diseased plant

Semester – II
Botany Paper – I
(Pteridophyta& Gymnosperms)

Students are able to

1. Elucidate classification, alternation of generation and economic importance of Pteridophytes and general characters of Psilopsida, Lycopsida, Sphenopsida and Pteropsida,
2. Elucidate classification, general characters, economic importance, and alternation of generation of Gymnosperms.

3. Elucidate life cycle ofPteridophtes (*Rhynia, Selaginella,Equisetum*)and Gymnosperms*(Cycas* and *Pinus)*
4. Elucidatedetails of fossil*Cycadeoidea*
5. Explain concept of Apogamy, Apospory, Stelar system in pteridophytes, heterospory and seed habit.

Semester – II
Botany Paper – II

Palaeobotany& Morphology Of Angiosperms

Students can

1. Elucidate Geological time scale, process of fossilization and Types of fossils.
2. Describe *Glossopteris, a* fossil Gymnosperm
3. Describe types of Root ,Stem ,Leaf
4. Describe types of inflorescence
5. Explain details of flower and fruit

Practicals

1. Students can study internal structure by taking hand section and making temporary Mountof *Selaginella* and *Equisetum***,** *Cycas and Pinus*
2. Students are able to describe morphological characters of leaf
3. Students can describe various parts of flower

Semester III

Botany Paper I
Angiosperm Taxonomy

1. Students have gained knowledge about Benettitalean theory Origin of Angiosperms and Phylogeny of Angiosperm and Fossil Angiosperm *Sahanianthus*
2. Students learned about Floras, Herbarium, keys and Principles of Botanical Nomenclature
3. Students can explain Bentham and Hooker's &Englerand Prantl's System of classification.
4. Students gained insight into various aspects that can be used to classify the plants.
5. Students are aware about characterstics and economic importance of Malvaceae, Brassicaceae, Fabaceae,Asteraceae, Asclepiadaceae, Euphorbiaceae and Poaceae

Semester III

Botany Paper II

Cell Biology, Plant Breeding and Genetics

1. Students can explain structure of plant cell wall , plasma membrane, Endoplasmic reticulum, Golgi complex Vacuoles, Ribosomes (70S and 80S), Mitochondria, Chloroplasts and Nucleus

2. Students can explain morphology of chromosome, karyotype, Nucleosome model of chromosome organization and sex Chromosomes in *Melandrium*
3. Students can elucidate stages of Cell division i.e Mitosis and Meiosis in plants and importance of cell division.
4. Students gained knowledge about basic terms and methods used in descriptive statistics
5. Students are able to explain measures of Central tendency and measures of variability in descriptive statistics.
6. Students learned about use of descriptive statistics in student's t test
7. Students are equipped with knowledge regarding various plant breeding methods that can be employed for production of new plant varieties.

Practicals-

1. Students are able to do plant description and are able to draw diagrams required for plant identification
2. Students are able to solve problems based on descriptive statistics and student's t test
3. Students are able to prepare slides for examination of various stages of cell division.

Semester – IV
Botany Paper – I
Anatomy & Embryology of Angiosperms

1. Students can explain basic body plan &modular type of growth in plants
2. Students gained knowledge about meristems and permanent tissue, apical meristem, cambium, periderm, growth ring, sap wood, heart wood and senescence and abscission of leaves and types of vascular bundles
3. Students learned about anatomy of dicot and monocot root, stem and leaf.
4. Students are aware about types, adaptation, and significance of pollination
5. Students can explain structure of anther and development of male gametophyte, structure and types of ovules, development of female gametophyte, Fertilization and formation of endosperms and structure of embryo.

Semester- IV
Botany Paper-II
Genetics & Molecular Biology

1. Students can explain concepts of Mendelism and non-mendelian interaction of genes
2. Students are equipped with knowledge of linkage and crossing over and their significance
3. Students are aware about polyploidy and aneuploidy
4. Students are equipped with knowledge pertaining to structural changes in chromosome:.
5. Students can elucidate Watson and Crick model of DNA Structure and semi conservative method of DNA replication in eukaryotes
6. Students are aware about Benzor's concept of gene
7. Students can explain details of mutations and its application in crop improvement
8. Students have knowledge on DNA damage and repair
9. Students know aboutsatellite and repetitive DNA
10. Students can explain Genetic code, t-RNA (Clover leaf model) and are aware about transcription and translation in prokaryotes

11. Students can explain Lac operon model for regulation of gene expressionin prokaryotes

Practicals

Students are able to

1. Do anatomical study by preparing temporary mount of the root, stem and leaf by taking hand sections
2. Calculate percent germination in the given pollen grains
3. Prove Mendel's Laws of Inheritance through coloured beads
4. Solve problems based on gene interaction

Semester V

Botany Paper I
Biochemistry and Plant Physiology-I

1. Students learned about various biomolecules and their structural and functional role in plants.
2. Students can explain various plant water relations and their significance
3. Students are able to explain process of upward movement of water through xylem and mechanism of transpiration and phloem transport.
4. Students are aware about role and deficiency symptoms of macro- and micro-nutrients, passive and active modes of Solute transport
5. Students can elucidate types and processes of respiration and photosynthesis
6. Students are able to explain Glyoxylate cycle of lipid metabolism .
7. Students are aware about mechanism of biological nitrogen fixation

Semester V
Botany Paper II
Plant Ecology-I

1. Students gained knowledge regarding Ecology, its branches and significance
2. Students learned about Gaseous composition of Atmosphere, effect of Light & Temperature on vegetation.
3. Students learned about soil formation,its profile andphysical and chemical properties
4. Students learned about interactions between living organisms
5. Students can elucidate Nitrogen and phosphorous cycles
6. Students are able to explain ecosystem, food chain, food web, ecological pyramids.
7. Students are able to understand difference between qualitative and quantitative study of plant and plant forms at community level and distribution of plants.
8. Students are equipped with knowledge of Phytogeography, especially pertaining to India

Practical

1. Students are able to demonstrate presence of particular biomolecule in given sample.
2. Students can demonstrate process pertaining to PlantPhysiology and Plant Biochemistry

3. Students are able to demonstrate practical field work techniques (Density, Abundance, Frequency and Homogeneity)

Semester – VI
Botany Paper – I
Plant Physiology-II & Biotechnology

1. Students are aware about concept of growth in plants, phytochromes and their role
2. Students can explain circadian rhythms and biological clock, tropic and nastic movements in Plants
3. Students have gained knowledge about plant growth regulators
4. Students can explain concept of photoperiodism and vernalization, senescence and abscission
5. Students can elucidate causes and role of seed dormancy and methods to break it
6. Students are aware of hypersensitive response and Systemic acquired resistance in plant defence mechanism and role of terpenes and phenolic compounds
7. Students are equipped with knowledge and basic procedures involved in Plant tissue culture,
8. Students are also equipped with basic knowledge of Genetic engineering and A*garobacteriumtumefaciens*mediated gene transfer in plants
9. Students are aware of advantages and disadvantages of transgenic plants

Semester – VI
Botany Paper – II
Plant Ecology, Techniques & Utilization of Plants

1. Students gained knowledge about plant succession and its causes.
2. Students can explain morphological, anatomical & physiological adaptationsin plants
3. Students are aware about environmental management, environmental pollution & its control
4. Students gained acquaintance with renewable and non-renewable natural resources
5. Students learned about Principle and application of microscopy, centrifugation, electrophoresis, spectroscopy, chromatography
6. Students are equipped with knowledge about morphology, utilization and chemical constituents of Wheat, Groundnut, Cotton, Clove, Coffee, Neem and Rubber.
7. Students are aware about ethnobotany

Practicals

Students are able

1. To determine seed viability
2. To study the ecological adaptations of plants by morphological and anatomical observations
3. To perform practical pertaining to basic physiochemical properties of water
4. To study the dust holding capacity of leaves and determine the percent leaf-area injury of different leaf samples

5. Students are equipped with skill to demonstrate separation of biomolecules

Chemistry

Semester I
ChemistryPaper-I
After completing the course, the student will be able to:
- Explain the **atomic structure** based on quantum mechanics and explain **periodic properties** of the elements.
- Explain the structure and **bonding in covalent molecules**and **ionicsolids**and predict the structure of molecules.
- Explain selected crystal structures, and perform calculations of the lattice energy of ionic compounds.
- Explain the properties of **s block elements** and hydrogen bonding in compounds.
- Explain the properties of **Noble gases** and structure, bonding and applications of Xenon fluorides (XeF_2, XeF_4, XeF_6). Structure and bonding in $XeOF_2$ and $XeOF_4$.
- Explain the properties of**p-block elements** like Atomic and ionic radii, Ionization potential, electron affinity, electronegativity, redox properties and oxidation state.
- Explain about Hydrides:Comparative study with respect to structure of NH_3, PH_3, AsH_3 and SbH_3, Structure of P_2O_3,P_2O_5, Structure of H_3PO_3 and H_3PO_4, Preparation and structure of Caro's and Marshall's acids.
Structure and bonding of diborane, structure of borazine.

Semester 1
ChemistryPaper-II
After completing the course, the student will be able to understand Explain**Thermodynamics: fundamental concepts**
-ExplainStatements of first law of thermodynamics, definition of internal energy & enthalpy. Heat capacity, heat capacity at constant volume and at constant pressure & their relationship. Joule-Thomson experiment, Joule-Thomson coefficient & inversion temperature, calculations of w, q, ΔE & ΔH in isothermal & adiabatic expansion of ideal gases for reversible process.
- ExplainThermo chemistry: Standard states, Standard enthalpy of formation. Hess's law of constant heat of summation & its applications. Heat of reaction, relation between heat of reaction at constant volume and constant pressure. Average bond energy, bond dissociation energy and its calculations from thermo chemical data.
- Explain**Gaseous State** - Postulates of kinetic theory of gases, derivation of kinetic gas equation, deduction of various gas laws from kinetic gas. Effect of temperature on molecular velocities. Different types of molecular velocities (most probable, R.M.S. and average and expressions for them), their inter relationships. Definitions of collision diameter, collision number and Mean free path.
- Explain**Ideal gas and real gases**-Difference between an ideal and real gases. Deviations from ideal behavior. Explanation of the terms – Compressibility factors and Boyle temperature. Causes of deviation from ideal behaviors. Vander Wall's equation of state, explanation of behavior of real gases by Van der Waal's equation. Andrew's experiment on critical phenomenon of isotherms of CO_2.
- Explain**Liquid State- Properties of liquid:**Surface tension, Viscosity, Refractive index
- Explain**Surface Chemistry and Catalysis**

Semester 1
Practical
Studentswillgainanunderstandingofmethodso f chemicalanalysis suchas detectionof acidic

and basic radicals.
To enable the students to understand the various concepts in physical chemistry like heat of solution, heat of ionization of weak acid, viscosity, surface tension etc. by doing experiments pertaining to these concepts.

Semester II
Chemistry Paper-I
After completing the course, the student will be able to:
-Explain Structure and Bonding: Hybridization in alkanes, alkenes and alkynes,
-Explain General mechanism of organic reactions
-Explain Stereochemistry of organic compounds: isomerism, Optical, geometrical and conformation isomerism
-Explain Methods of preparation, structure, nomenclature and reactions of alkanes, alkenes, diens, alkynes and cylcoalkanes
-Explain Structure, molecular orbital structure of benzene and their substitution reactions with mechanisms.

Semester II
Chemistry Paper-II
After completing the course, the student will be able to:
Explain**Thermodynamics-** Second law of thermodynamics : Carnot's cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature, concept of entropy, entropy change in reversible and irreversible processes, entropy change of the universe, entropy change for an ideal gas with change in P, V & T, entropy change during physical change, physical significance of entropy, entropy as criteria of spontaneity & equilibrium of a process.Free energy functions: Work function and Gibb's free energy (G), Variation of work function with T and V, variation of Gibb's free energy with T and P. A and G as criteria for spontaneity and equilibrium of a process. Gibb's – Helmholtz equation & its applications.
- Explain**Chemical equilibrium:** Law of mass action, law of chemical equilibrium, relationship between Kp and kc. Van't-Hoffs reaction isotherm, relation between standard free energy change & equilibrium constant, effect of temperature on equilibrium constant (reaction isochor), integrated form of Van't Hoff equation.
- Explain**Phase Equilibria- phase rule and its applications**
- Explain**Liquid-Liquid mixtures**
- Explain**Nuclear chemistry**
- Explain**Molecular structure**
- Explain**Chemical Kinetics**

Semester II
Practical
To predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups, melting point.
To enable the students to understand the various concepts in physical chemistry like integral heat of solution, critical solution temperature, rate constant of hydrolysis etc. by doing experiments concerned.

Semester III
Chemistry Paper I
After completing the course, the student will be able to:

-Explain VSEPR theory and examples. Preparation, properties and structure of Interhalogen compounds and polyhalides
-Explain MO theory- Molecular Orbital diagrams of homonuclear diatomic molecules, MO of HF, CO and NO diatomic molecules.
-Explain Chemistry of elements of first, second and third transition series.
-Explain Errors in Chemical Analysis: Accuracy and Precision, Absolute and Relative errors, Mean, Median, Average and Standard deviations, and significant figures.
-Explain Non-aqueous solvents: liquids NH_3 and SO_2
-Explain Chemistry of Lanthanides and actinides

Semester III
Chemistry Paper II
After completing the course, the student will be able to:
-Explain Orientation ofelectrophilic substitution on monosubstituted benzene with activating and deactivating groups
-Explain Structure method of preparation physical and chemical properties of alkyl halides and polyhalogen compounds.
-Explain Preparation, nomenclature physical and chemical properties of alcohols, dihydric alcohol, trihydric alcohol and phenols.
-Explain Preparation, nomenclature physical and chemical properties of aldehydes and ketones.
-Explain Preparation, nomenclature physical and chemical properties of carboxylic acids and their derivatives such as acid chlorides, anhydrides, esters, amides.

Semester III
Practical
Students will gain an understanding of methods of complete analysis of organic compoundswith different functional groups.
To enable the students to understand the methods of quantitative analysis by redox complexometric and acid-base titrations.

Semester IV
Chemistry Paper I
After completing the course, the student will be able to:
-Explain Coordination compounds -nomenclature, VBT and MOT of complexes.
-Explain Isomerism in coordination compounds:Structural isomerism and Stereoisomerism in coordination compounds
-Explain Oxidation and reduction:Use of redox potential data: Analysis of Redox cycle, redox stability in water, Latimer diagram of Chlorine and Oxygen, Construction and explanation of Frost diagram. Frost diagram of Nitrogen and Oxygen. Pourbaix diagram of Iron.
-Explain Principles of photometery: Beer-Lamberts Law, derivation and deviation(Numericals). Types of colorimeter and spectrophotometer with simple schematic diagrams. Application of colorimeter and spectrophotometer in quantitative analysis with reference to estimation of Cu(II) as Cu- ammonia complex.
-Explain Separation Techniques: Chromatography, Ion- Exchange and Solvent Extraction
-Explain Inorganic Polymers:Silicones, Silicon oils, Silicone Elastomers and Silicon ResinsPhosphonitrilic halide polymers: Introduction, Preparation, properties and uses. Structure and bonding in $(NPCl_2)_3$ and $(NPCl_2)_4$

Semester IV
Chemistry Paper II
After completing the course, the student will be able to:
Explain - Solid State- Laws of crystallography: Law of constancy of interfacial angles, Law of rationality of indices, Law of symmetry, elements of a crystal.Space lattice, Unit cell, Bravais lattices, crystal systems, identification of crystal planes, interplanner distance in cubic systems, X-ray diffraction by crystal, derivation of Braggs′ equation. Determination of crystal structure of NaCl, KCI and CsCl, Laue′s method and powder method.
-Explain**Electrochemistry -**Electrical transport : Conductance in metals (electronic) & in electrolyte solutions (ionic conductance), specific, equivalent and molar conductance, measurement of electrolytic conductance, variation of equivalent, specific & molar conductance with dilution, Kohlrausch′s law, Arrhenius theory of electrolyte dissociation & its limitation, Ostwald′s dilution law, validity and importance of Ostwald′s dilution law.Debye-Huckel theory (elementary treatment).Relaxation effect, Electrophoretic effect, Onsagar equation.
- Explain **Spectroscopy- Rotational and Vibrational Spectroscopy.**
- Explain **Quantum Chemistry**

Semester IV
Practical
To enable the students to understand the methods of quantitative analysis by gravimetric analysis and qualitative by paper chromatography.
Students will gain an understanding of instrumental methods of analysis by conductometry and potentiometry.

Semester V
Chemistry Paper I
After completing the course, the student will be able to:
-Explain Preparation, nomenclature, structure,physical and chemical properties of aliphatic and aromatic nitro and amino compounds.
-Explain Aromaticity in heterocyclic compounds of five membered six membered and fused ring compounds containing nitrogen, sulphur and oxygen as heteroatom, preparation and reactions of pyridine indole quinoline and isoquionoline.
-Explain Quantitative analysis of carbon, hydrogen. Nitrogen,Sulphur and halogens in organic compounds and empirical and molecular formula.
-Explain Organometallic compounds with magnesium, lithium and zinc their preparations and reactions.
-Explain Spectroscopic analysis -UV and IR.

Semester V
Chemistry Paper II
After completing the course, the student will be able to:
-Explain Electrochemistry
ExplainGalvanic cells, irreversible & reversible cells, emf of cell & its measurement, relation between electrical energy and chemical energy, calculation of thermodynamic quantities of a cell reactions (ΔG, ΔH & ΔS & equilibrium constant)
ExplainTypes of reversible electrodes : metal-metal ion electrode, gas electrode, metal insoluble salt-anion electrode, redox electrodes, amalgam electrode, Nernst equation, calculation of cell emf from single electrode potential, reference electrodes, standard electrode potential, concentration cells with & without transference, liquid-junction

potential, salt bridge & its functions.
ExplainApplications of emf measurements in : (i) pH- determination using hydrogen electrode, quinhydrone electrode & glass electrode (ii) Potentiometric titration(Acid –Base and Redox titrations).

- Explain**Quantum Chemistry and Molecular Orbital Theory**
- Explain**Photochemistry and Raman Spectroscopy**
- Explain**Colligative properties and Macromolecules**

Semester V
Practical
To enable the students to understand the Quantitative analysis of glucose, amide and carboxylic group and saponification value of oil.
Molecular mass by Rast method and Viscometric method
Verification of Beer-Lambert law, Zero order reaction, Quantitative analysis using Abbes' refractometer

Semester VI
Chemistry Paper I
After completing the course, the student will be able to:
-Explain Metal ligand bonding in Transition Metal Complexes:Crystal field theory: Splitting of d-orbital in octahedral, tetrahedral and square planar complexes. High spin and low spin complexes
-Explain Electronic spectra of Transition Metal Complexes:
Jahn-Teller Effect, selection Rules Hole Formalism Principle Electronic spectrum of $[Ti(H_2O)_6]^{3+}$ and $[Cu(H_2O)_6]^{2+}$ complex ions with respect to position of the band, intensity of the band, symmetry of the band and bandwidth.
-Explain Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT.
-Explain Thermodynamic and Kinetic stability of metal complexes
-Explain Organometallic Chemistry: Nomenclature and Classification of Organometallic compounds. Structure of metal ethylenic complexes. Mechanism of homogeneous Hydrogenation using Wilkinson's Catalyst
-Explain Metal carbonyls: Definition, preparation, properties. Structure and bonding in mononuclear carbonyls
-Explain Bioinorganic Chemistry:structure and biological role of Hemoglobin and Myoglobin, role of Ca, Na and K, Na-K pump and Ca pump
-Explain Hard and Soft Acids and Bases: Classification of Acids and Bases as Hard and Soft. Pearson's HSAB Concept and its applications. Symbiosis, Antagonism.

Semester VI
Chemistry Paper II
After completing the course, the student will be able to:
-ExplainNMR spectra of organic molecules,
-ExplainMalonic ester and acetoacetic ester -preparation and reaction
-ExplainCarbohydrate chemistry, structure and reactions of glucose
-ExplainStructure of disaccharide and polysaccharide without involving structure determination.
-Explainstructure and reactions of amino acids, proteins and nucleic acids.
Fats oils and detergents

-ExplainSynthetic dyes,drugs and polymers with suitable examples

Semester VI
Practical
To enable the students to understand separation and analysis of the two component organic mixture using $NaHCO_3$ and NaOH.
Preparation of complexes of copper, nickel and iron.

Zoology

Zoology as a subject at the Program level includes a variety of topics, both of generalized and specialised nature, such as Taxonomy of Invertebrates and Chordates, Environmental Biology, Biodiversity, Cell Biology and genetics, Embryology, Physiology, Applied Zoology including Recombinant DNA technology, Animal Tissue Techniques, Biostatistics and Bioinformatics.

Students passing B.Sc. Zoology have the following attributes:

Course Outcome	**Semester & Paper**	**Topic**	**Outcome**
CO1.	Sem I & II Paper I	Life and diversity of Animals: Invertebrates	• To understand the concepts of taxonomy of animals, to relate taxonomy with evolution of animals. • To describe the general characteristics and classification of the invertebrate phyla- Protozoa, Porifera, Coelenterata, Platyhelminthes. Aschelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. • To describe the characteristics, structure and life cycle of one animal as a representative type study from each phylum. • To identify parasites with their adaptations, pathogens with diseases, symptoms, treatment and prophylaxis, important animals with their economic importance, from among the invertebrates so studied. • To identify various animals and classify them as laboratory work. • To understand organ systems through understanding techniques of dissection. • To prepare permanent stained micro preparations as part of laboratory work.
CO2.	Sem I paper II	Environment	• To understand the environment through study of various zones of atmosphere, lithosphere and hydrosphere, and identify the place of animals in various food chains and ecological pyramids. • To understand the causes, effects and control measures of different types of pollution. • To understand and analyze specific problems related to the environment, and to come up with solutions to the problems

			through creative thinking. • To analyse the different parameters of water quality- pH, Dissolved Oxygen, Dissolved carbon dioxide and total hardness as laboratory work. • To identify producers and consumers of the ecosystem in a food chain, by observation as laboratory work.
CO3.	Sem I Paper II	Biodiversity	• To understand the concept of biodiversity, and relate the same to plant-animal interactions. • To understand the reasons for reduction and the present methods being used for conservation of biodiversity. • To understand the locations and biodiversity of various National parks and Wildlife Sanctuaries in India. • To understand and analyze specific problems related to the conservation of biodiversity, and to come up with innovative solutions to the problems through creative thinking.
CO4.	Sem II paper II	Cell Biology	• To understand the cell as the unit of life. To study various cell organelles and their role in the functioning of the cell. To study the various biochemical processes adopted by cells in maintenance of life. • To understand the process and types of cell division. • To relate cell biology to immunology and the biology of cancer. • To study cell division under microscope and observe and identify various stages of division.
CO5.	Sem III & IV, Paper I	Life and diversity of Animals: Chordates	• To understand the taxonomy of various chordates, with characteristics, classification and type study of the different Classes- Protochordata, Urochordata, Cephalochordata, Cyclostomata, Pisces, Amphibia, reptilian, Aves and Mammalia. • To understand the structure and gradual development of different organ systems such as heart, aortic arches, urinogenital system over the different classes and relate the same to evolution. • To understand in detail the development of Fishes, Amphibia, Aves and Mammalia through developmental

			biology. • To identify and classify various Protochordates, Cyclostomes, Fishes, amphibians, Reptiles and Mammals, based on observation, as laboratory work. • To identify stages of embryo development as laboratory work.
CO6.	Sem III & IV Paper II	Genetics	• To understand the basic concept of genes. • To study Mendelian genetics with respect to inheritance of characters and relate the same to eugenics. • To relate genetics with abnormalities occurring in the physical and sexual make up of individuals, their causes and pathways of inheritance. • To understand population genetics, inbreeding and cross breeding. • To study the structure and processes of DNA replication. • To understand the meaning of the genetic code and its role in protein synthesis. • To study and understand the process of protein synthesis. • To study the difference between structure and function of prokaryote and eukaryote genes. • To study Operon systems of prokaryotes. • To experimentally verify laws of inheritance as laboratory work. • To identify genetic defects as laboratory work.
CO7.	Sem V and VI	Mammalian Physiology	• To understand mammalian histology and physiology with respect to digestive, respiratory, excretory, reproductive, muscle and nervous systems. • To relate Physiology with the endocrine system and its control over the other systems. • To acquire the skills of identifying presence of proteins, lipids and carbohydrates from given samples in the laboratory by performing various tests. • To microscopically study histology of various mammalian organs in the laboratory. • To acquire the skills of enumerating the different types of blood corpuscles under

			the microscope.
CO8.	Sem V Paper II	Aquaculture	• To understand requirements and process of fish farming. • To study different types of polyculture systems and composite fish culture systems. • To understand the process of induced breeding of freshwater fish. • To understand breeding and maintenance of aquarium fishes. • To understand the requirements of the prawn fishery and to be able to differentiate it from those of fresh water fishery. • To visit fish farm as part of practical work. • To identify different edible and economically important fishes as laboratory work. • To identify different types of fish scales by microscopy. • To understand the digestive and reproductive systems of fish by studying dissection techniques. • To calculate the Gonosomatic Index of fish. • To gain insights into fishery as a possibility of entrepreneurship.
CO9.	Sem VI Paper II	Microtechnique	• To gain in-depth knowledge of the theory and process of tissue processing, microtomy, histological and histochemical staining. • To collect, preserve and process tissue for study in the laboratory through processes of fixation, dehydration, block making, section cutting and staining. • To acquire the skill of operating the microtome. • To acquire the skill of preparation of permanent slides using double staining technique.
CO10.	Sem V Paper II	Economic Zoology	• To understand economic entomology, with classification and characters of the insects involved. • To study processes of bee-keeping, sericulture and lac culture as possible sources of income. • To identify and characterise various animals of economic importance in the laboratory.

CO11.	Sem VI Paper II	Genetic Engineering, Biostatistics and Bioinformatics	• To understand the fundamentals of the processes of recombinant DNA technology and bioinformatics. • To study and understand concepts of bioinformatics and relate them to life, especially to genetic processes. To form a knowledge platform on which to base higher studies. • To understand the concepts in biostatistics, and their use in analysis of complex problems in science. • To identify problems related to Zoology, and conduct a survey of literature on the work done with respect to the problem, by use of ICT tools in the laboratory. • To study proteins and their genetic makeup from various gene and protein databases available online as part of laboratory work.

PROGRAM OUTCOMES

Bachelor of Computer Applications (B.C.A)

1) To identify, design, and analyze complex computer systems and implement and interpret the results from those systems.

2) To analyze the local and global impact of computing on individuals, organizations, and society.

3) To make the students employment ready with the knowledge and skills imparted to them.

4) To inculcate in the students the soft skills essential for jobs as well as to communicate effectively.

5) to imbibe in them the moral values leading to their becoming good persons and good citizens.

PROGRAM SPECIFIC OUTCOMES

Program: B.C.A.

1) Provide to work in an IT or computing environment with the opportunity to enhance their career prospects by gaining additional knowledge and skills in selected areas of IT.

2) Appreciate and integrate new software and hardware technologies and extend their knowledge in specific areas of interest in academia and the industry.

3) Be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.

COURSE OUTCOMES

Course: B.C.A.	
Operating System (BCA I SEM I)	• Appreciate the role of operating system as System software. • Compare the various algorithms and comment about performance of various algorithms used for management of memory, CPU scheduling, File handling and I/O operations. • Apply various concept related with Deadlock to solve problems related with Resources allocation, after checking system in Safe state or not. • To appreciate role of Process synchronization towards increasing throughput of system.
Linux Operating System (BCA I SEM 2)	• Understanding the basic set of commands and utilities in Linux/UNIX systems. • To learn the important Linux/UNIX library functions and system calls. • 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. • Effectively use the UNIX/Linux system to accomplish typical personal, office, technical, and software development tasks.
Software Engineering –I (BCA II SEM IV, BCA III SEM I)	• Students shall have strong foundation in science, mathematics, and engineering, and can apply this fundamental knowledge to software engineering tasks. • Students can effectively apply software engineering practice over the entire system lifecycle. This includes requirements engineering, analysis, prototyping, design, implementation, testing, maintenance activities and management of risks involved in software and embedded systems. • Students know classical and evolving software engineering methods, can select and tailor appropriate methods for projects, and can apply them as both team members and managers to achieve project goals.
Web Technology-I (BCA II SEM III)	• Should be able to apply a structured approach to identifying needs, interests, and functionality of a website. • Should be able to design dynamic websites that meet specified needs and interests. • Should be able to write well-structured, easily maintained, standards-compliant, accessible HTML code. • Should be able to write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different ways. • Should be able to use JavaScript to add dynamic content to pages. • Should be able to select appropriate HTML and CSS code from public repositories of open-source and free scripts that enhances the experience of site visitors. • Should be able to modify existing HTML and CSS code to extend and alter its functionality, and to correct errors and cases of poor practice. • Should be able to write code that works in all major browsers (including IE, Mozilla-based browsers such as Firefox, Opera, Safari and Chrome). • Should be able to effectively debug code, making use of good practice and debugging tools. •
Web Technology-II(BCA II SEM IV)	• In WT-II students should be able to develop dynamic web site using java script, vb script and jsp • Students will be able to write server side java application called serverlet to catch form data sent from client, process it and store it on database • Students will be able to write a server side java application called jsp to catch form data sent from client and store it on database
Software Engineering - II(BCA II SEM IV, BCA III SEM I)	• Students shall be knowledgeable of the ethics, professionalism, and cultural diversity in the work environment. • Students can apply basic software quality assurance practices to ensure that software designs, development, and maintenance meet or exceed applicable standards. • Students should be able to impart effective written and oral communication skills. • Students can prepare and publish the necessary documents required throughout the project lifecycle. • Students can effectively contribute to project discussions, presentations, and

	reviews. • Students shall understand the need for life-long learning and can readily adapt to new software engineering environments.
Software Testing (BCA III SEM II)	• Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs. • Implement various test processes for quality improvement • Design test planning. • Manage the test process • Apply the software testing techniques in commercial environment • Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques
Theory of Computation (BCA II SEM IV)	• To provide a basic knowledge of various mathematical models required in compiler construction(lexical analysis, syntax analysis, parsing etc)
Operation Research (BCA II SEM III, IV)	• Enables the students to handles different categories of problems like Transportation Problem, Assignment Problem, Inventory Control, Queueing Model etc
Office Automation(BCA 1, SEM I)	• Develop familiarity with Microsoft word, excel, PowerPoint. • Use ms-office programs to create personal, academic and business documents • Study components of computer and windows operation system
System Analysis and Design(BCA I, SEM II)	• To introduce software project management and to describe its distinctive characteristics and to discuss project planning and the planning process and show how graphical schedule representations are used by project management and the risk management
Discrete mathematics (BCA I SEM I,II)	• To introduce most of the basic logic used in advanced courses in computer sciencelike Graph , Tree etc. • Gives a knowledge of prerequisites to basic mathematical logic
Java Programming (BCA-III SEM-VI)	• Gives the students an opportunity to work with a language which supports internet. • Enables them to develop applications and applets. • Helps them to develop GUI, handle events, draw graphs etc. • This language is very important as it is used in the industry for the different applications like Mobile applications , Robotics etc
Data Structure using C++	Makes the students aware about the manner in which the data can be stored in the memory of the computer so that different operations like traversing, insertion , deletion, searching sorting, merging copying can be performed on the stored data efficiently.
SQL AND PL/SQL(BCA-II SEM-III)	• Practically they learn to work in a relational database management system. • They learn to create, manipulate and control the data kept inside the database tables. • They also learn the ways of normalizing tables.

Visual Basic Programming	To introduce the concepts of visual programming. To introduce GUI programming using Microsoft foundation classes. To enable the students to develop programs and simple application using Visual Basic 6.0.
Database Management System	• Makes them aware of different data models. • Gives them an idea of storing the data in a centralized database. • They also learn its advantages over traditional file system. • They also learn the role played by database administrator.
Compiler Construction	• To introduce how the high level programming languages are handled by the system.
Statistical Methods (BCA-I SEM-I)	• Statistics are the numerical quantities calculated from sample observation, a single quantity that has been calculated. • Statistics assists in sound and effective planning in any field.
VB.Net (BCA-III SEM-V)	• Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic. • Describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE) • Create applications using Microsoft Windows® Forms. • Create applications that use ADO. NET. • Working with XML Documents . • Using Crystal Reports
DE-I & II (BCA-II SEM III,IV)	• It helps to understand the fundamental concepts and techniques used in digital electronics. • To understand the number systems and its application in digital design. • The ability to understand and design various combinational and sequential circuits. • It helps to understand the internal structure or process of computer system (hardware).
C Programming (BCA-I ,sem-I)	Students build the basic skills of programming through C. Develop their logic through this language. After studying this language the students learn to do programming in C independently. Creates a strong base for other advanced languages
C++ using OOPs Concept (BCA-I SEM-II)	Makes the students realize the importance of data and teaches them a way to protect the data. Teaches them object oriented concepts and brings them closer to the real world. Through C++ the students learn object oriented programming.
Computer Graphics –I,II (BCA-III SEM-V,VI)	• Helps to understand how the graphics system works . • Teaches how images are constructed in computer hardware display devices.
System Analysis and Design **(BCA I SEM I)**	• This course deals with the concepts, skills, methodologies, techniques, tools, and perspectives essential for systems analysts. • After successfully completing this course, students will have gained comprehensive theoretical knowledge as well as practical skills related to the system development process of information systems.

	• Students who successfully complete the course should be able to:- ✓ Gather data to analyse and specify the requirements of a system. ✓ Design system components and environments. ✓ Build general and detailed models that assist programmers in implementing a system. ✓ Design a database for storing data and a user interface for data input and output, as well as controls to protect the system and its data.
Computer Fundamental **(BCA I SEM I)**	• Give students an in-depth understanding of why computers are essential components in business, education and society. • Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing. • Student will be able to identify the components of a personal computer system as well as Internetworking components. • Student will be able to demonstrate mouse and keyboard functions as well as some networking tools. • Student will be able to demonstrate window and menu commands and how they are used. • Student will be able to demonstrate how to organize files and documents on a USB/hard drive. • Upon completion of this course, the student will be able apply technical knowledge and perform specific technical skills, including: 1) Describe the usage of computers and why computers are essential components in business and society. 2) Utilize the Internet Web resources and evaluate on-line e-business system. 3) Solve common business problems using appropriate Information Technology applications and systems. 4) Identify categories of programs, system software and applications. Organize and work with files and folders. 5) Describe various types of networks network standards and communication software.
PHP **(BCA III SEM V/ SEM VI)**	• developed web applications using PHP with MySQL • The actual implementation of Programming concepts as well as designing tools. • PHP offers a plenty of benefits that will surely deliver limits of developing something outstanding.

	• PHP does not need one to spend a lot of time studying a manual. A complete web page will develop just a single PHP file. • To get a good head-start in their career.
Data Communication & Networking **(BCA III SEM V/ SEM VI)**	By the end of this course, students should be able to: • understand the fundamental concepts of data communications and networking • identify different components and their respective roles in a computer communication system. • apply the knowledge, concepts and terms related to data communication and networking. • solve problems in networking by referring to problems solving steps through relevant information by choosing suitable techniques. • acquaint themselves with networking software simulation tools, configuring of networking devices and understand their functionality. • know the strategies for securing network applications • appreciate usefulness and importance of computer communication in today life and society.
E-commerce (BCA I SEM II)	• Demonstrate an understanding of the foundation and importance of E-commerce. • Analyze the impact of E-Commerce on business models and Strategy. • Describe internet trading relationships including Business-to-Consumer,Business-to-Business,Intra-organizational. • Presents concepts and skills for the strategic use of e-commerce.
ASP.NET (BCA-III SEM VI)	• XML helps in data-modeling techniques and managing metadata services. • ASP.NET helps the students to understand and develop dynamic web applications. • Use Microsoft ADO.NET to access data in wed applications.
NUMERICAL METHOD (BCA-I SEM-II)	• It helps the student to obtain approximate solutions to mathematical operations. • Derive numerical methods for various mathematical operations and task such as interpolation, differentiation, integration, the solution of liner and non-linear equations

PROGRAM OUTCOMES

Program: Bachelor of Commerce in Computer Applications (B.C.C.A.)

1) To identify, design, and analyze complex computer systems and implement and interpret the results from those systems.
2) To analyze the local and global impact of computing on individuals, organizations, and society.

PROGRAM SPECIFIC OUTCOMES

Program Bachelor of Commerce (Computer Applications)

1) To provide to work in an IT or computing environment with the opportunity to enhance their career prospects by gaining additional knowledge and skills in selected areas of IT.
2) To appreciate and integrate new software and hardware technologies and extend their knowledge in specific areas of interest in academia and the industry.
3) To be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.

COURSE OUTCOMES

Course: Bachelor of Commerce (Computer Applications)	
C Programming (BCCA-I, Sem-I)	• Understanding a functional hierarchical code organization. • Ability to define and manage data structures based on problem subject domain. • Ability to work with textual information, characters and strings. • Ability to work with arrays of complex objects. • Understanding a concept of object thinking within the framework of functional model. • Understanding a concept of functional hierarchical code organization. • Understanding a defensive programming concept. Ability to handle possible errors during program execution
Fundaments Of Computer (BCCA-I, Sem-I)	Enables the students to understand the basics of computers including hardware, software and networking. • Identify and analyze computer hardware, software, networking components. • Install, configure, and remove software and hardware. • Use system development, word-processing, spreadsheet and presentation software to solve basic information systems problem. • Retrieve information and create reports from relational databases.
Financial Accounting (BCCA-I, Sem-I)	• Develop and understand the nature and purpose of financial statements in relationship to decision making. • Develop the ability to use accounting information.

	• develop the knowledge of accounting.
English & Business Communication (BCCA-I, Sem-I)	• Develop the student's ability to communicate effectively in English both orally and writing, on Business related topics. • Practically students learn to write standard business related letters and application for employment as well as Job Offer Letters. • Students learn the basic English grammar and English vocabulary. Students also learn the essentials of English communication and barriers to effective communication (and how to overcome them.)
English & Business Communication (BCCA-I, Sem-II)	• Develop the student's ability to communicate effectively in English both orally and writing, on Business related topics. • Practically students learn to write standard business related letters and application for employment as well as Job Offer Letters. • Students learn the basic English grammar and English vocabulary. Students also learn the essentials of English communication and barriers to effective communication (and how to overcome them.)
C++ (BCCA-I, Sem-II)	• Be able to understand the difference between object oriented programming and procedural oriented language and data types in C++. • Be able to program using C++ features such as composition of objects, Operator overloading, inheritance, Polymorphism etc. • Students will able to simulate the problem in the subjects like Operating system, Computer networks and real world problems.
Principal Of Business Management (BCCA-I, Sem-II)	• Discuss and communicate the management evolution and how it will affect the future manager • Identify and evaluate social responsibility. • Practice the process of management
E_Commerce and Web Designing (BCCA-I, Sem-II)	• Students learn the concepts and skills for the strategic use of e commerce from three perspectives: business to consumers, business to business and intra-organizational. • Students should be able to apply a structured approach to identifying needs, interests, and functionality of a website. • Students should be able to design dynamic websites that meet specified needs and interests. • Students should be able to write well-structured, easily maintained, standards-compliant, accessible HTML code. • Studentshould be able to write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different ways. • Students should be able to write code that works in all major browsers (including IE, Mozilla-based browsers such as Firefox, Opera, Safari and Chrome). Students should be able to effectively debug code, making use of good practice.
Business Economics (BCCA-I, Sem-III)	• Develop the ability to explain economic terms , concepts and theory • Demonstrate the ability to employ the economic way of thinking • Recognize the role of ethical values in economic decision.
Environmental Studies (BCCA-II, Sem-	• Acquire awareness about immediate surrounding through lived experiences on various themes related to daily life • Develop sensitivity for the natural, physical and human resources in the

III)	immediate environment.
Visual Basic Programming (BCCA-II, Sem-III)	• To introduce the concepts of visual programming. • To introduce GUI programming using Microsoft foundation classes. • To enable the students to develop programs and simple application using Visual Basic 6.0.
Database Management System (BCCA-II, Sem-III)	• Students learn the fundamental knowledge of Database management system and various types of Data models. • Students learn the practical implementation of Relational database management system (using Oracle software) • Students learn the normalization of database tables. Students learn the role of a database administrator
Mathematics (BCCA-II, Sem-IV)	• Basics theory and concept of probability theory. • Basic statistical concept data collection and presentation. • Analyze and correlation • Forecasting nonlinear one factor regression
Business Law (BCCA-II, Sem-IV)	• To understand the business law to individuals and businesses and role of law in an economic political. • It helps to understand the students to the legal and ethical framework of business
Core Java Business Law (BCCA-II, Sem-IV)	• Java enables students to work professionally and make desktop application and web applications with java development kit. • To understand the importance of classes and objects along with the constructors, arrays and vectors. • To understand the importance of multithreading and different exception handling mechanism. • It enables to understand java swings for designing GUI applications based on architecture.
PHP & MYSQL Business Law (BCCA-II, Sem-IV)	• Enable Students to write PHP code to produce outcome and solve problems. • Basic Debugging develop the ability to understand PHP error messages and used them to debug. • Export and import a database and tables with PHP myadmin. • Writing and executing SQL statements with PHP.
System Analysis and Design Business Law (BCCA-II, Sem-V)	To introduce software project management and to describe its distinctive characteristics and to discuss project planning and the planning process and show how graphical schedule representations are used by project management and the risk management process.
Computerized Accounting (Tally) Business Law (BCCA-III, Sem-V)	• Demonstrate basic knowledge of computers and computerized accounting software. • Demonstrate ability to write a business memo using correct formatting, grammar and spellings. • Demonstrate an understanding of accounting reports and records.
Cost & Management Accounting	• It provides students with an understanding of management accounting concepts related to the management functions of planning,control and design making.

(BCCA-III, Sem-V)	• The course covers management accounting fundamentsls and introduces a range of management accounting tools.
VB.Net (BCCA-III, Sem-V)	• Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic. • Describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE) • Create applications using Microsoft Windows® Forms. • Create applications that use ADO. NET. • Working with XML Documents . • Using Crystal Reports
Company Law and Secretarial Practice (BCCA-III, Sem-VI)	• It provides the knowledge of company law. • It helps to understand the role of secretory in company. • It helps to understand the companies Act 2013 and also the history of companies law.
Python (BCCA-III, Sem-VI)	• Python enables students to use English keyword while other languages may use punctuations. • The structure of python is simple which provides easy readability and understanding. • Understand the concepts of file input output. • Python provides visualization libraries.
C#.NET (BCCA-III, Sem-VI)	• Learn about MS.NET framework developed by Microsoft. • You will be able to using XML in C#.NET specifically ADO.NET and SQL server • Be able to understand use of C# basics, Objects and Types, Inheritance • To develop, implement and creating Applications with C#. • To develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web. • To understand and be able to explain Security in the .NET framework and Deployment in the .NET. • To develop Assemblies and Deployment in .NET, Mobile Application Development.

PROGRAM OUTCOMES
Bachelor of Arts (B.A.) Six Semester Program

The students are expected to

PO1. To acquire basic and fundamental knowledge in the field of language, humanities, social sciences which make them sensitive and responsible citizens of the country.

PO2. To develop critical temper and to think and act wisely dealing with various issues prevailing in the human society with responsibility and courage.

PO3. To develop creative ability.

PO4. To develop problem-solving ability.

PO5. To update knowledge of students.

PO6. To equip students to appear for All India Competitive examinations.

PO7. To develop within them and spread among others those human values that will result in a sense of social service and good citizenship qualities.

PROGRAM SPECIFIC OUTCOMES

Program: Bachelor of Arts (B.A.)

The program admits students who have passed the +2 level examination. The subjects offered by the institution are English, Supplementary English, English Literature, Hindi, Hindi Literature, Marathi, Marathi Literature, Philosophy, History, Economics, Political Science and Sociology. A student generally opts, as per rules of the affiliating Rashtrasant Tukadoji Maharaj Nagpur University, any five of the available subjects, although she/ he may opt for another subject not offered by the institution.

Program Specific Outcomes of B.A. are:

PSO1. To develop Learning, Reading, Speaking and Writing competencies.

PSO2. Ability to interpret and analyze available texts, to have an understanding of the literary, socio economic and political progress of the world over centuries, and the principles on which human kind has developed to its modern form.

PSO3. Application of principles and theories to the present scenario, with an ability to correlate and communicate the same.

PSO4. Assimilate soft skills forprofessional and business communication through proper use of language.

PSO5. To develop an ability to form and express one's own ideas through knowledge of the different Arts subjects studied.

PSO6. To interact with society and understand various issues affecting society.

PSO7. To understand and recognize responsibility towards nation and society.

COURSE OUTCOMES

English

After studying the course in English Literature, the students will have the following competencies:

1. Understanding different genres of writing (prose, poetry, short stories, plays)
2. Knowledge of historical contexts and backgrounds to literary movements
3. Emerging trends in new writings including media communication
4. Ability to critically respond to the aesthetic qualities of literature.
5. Write creatively essays and projects as well as make innovative presentations

Economics

1) Micro Economics

Sem I

– Gets an overall knowledge about the scope of the subject and tools of economic analysis.

- Gain knowledge about consumer demand in the economy and factors affecting demand and supply of commodities in the market.
- Study about the decision making of consumer under various choices through utility analysis and indifference curve analysis.
- Study about the concepts of consumer surplus
- To study about the meaning of production and laws related to returns to production.

Sem II

- Understanding the production techniques and calculation of cost and revenue in enterprises.
- Understanding the different market structure in the economy and compare it with the real market sectors in the economy.
- Understanding the determination of prices of different factors of production such as land, labour and capital.
- To learn the basic statistics those are necessary for calculations in average.

2) Macro Economics

Sem III

- To learn about macro economic aspects of an economy
- An understanding about the Gross National Output (GDP) of an economy and it's measurement.
- To learn about the concept of money and the functions performed by it in an economy.
- To learn about the monetary and fiscal policy in a country are framed and their role in stabilisation of the economy.
- To study about the consumption, investment and expenditure functional relationship and their measurement.

Sem IV

- To learn about the history and functions of commercial banks and how the credit is created in the country.
- To understand about the functioning of Reserve Bank of India as well as how the monetary policy is framed in the country.
- To gather knowledge about the modern banking system as well as money market and capital market instruments in India.
- Introduction to the new subject of health economics and understand the health problems in India.

- To study about the concept of dispersion in social science data analysis with practical questions.

3) Indian Economy

Sem V

- To evaluate the characteristics of Indian economy as well as different types of economies.
- To study about the trend of national income in India
- To study about the features of Maharashtra Economy
- To gather knowledge about the problems related to agriculture and agricultural labour in India.
- To understand the role of industry in Indian economy and importance of cottage and small industries.
- To study the different concepts of employment and poverty in India.

Sem VI

- To familiarise the terms and measurement of economic development.
- To understand the concepts of inclusive growth, sustainable development and human development index and its measurement.
- To understand the importance and objectives of planning in India.
- To know about the taxation issues and role of finance commission
- To understand the role of foreign trade in Indian economy.

Hindi

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ch-,- lsesLVj - 5

1- fuca/k fy[kus dh dyk ls voxr djk;kA

2- fofHkUu jpukdkjksa ls ifjfpr gq,A

3- ,dkadh n~okjk bfrgkl ds iUuksa dks ik=ksa n~okjk le>k;kA

ch-,- lsesLVj - 6

1- **^**/keZohj Hkkjrh* n~okjk jfpr miU;kl ^lwjt dk lkrokWa ?kksMk* esa fpf=r lkekftd]/kkfeZd o dqfjfr;ksa ls gksusokys izHkko dks le>k;kA

2- vuqokn ds vFkZ]ifjHkk"kk ,oa izdkj]vuqokn dk egRo o vuqoknd dh ;ksX;rk,aW dh tkudkjh izkIr gqbZA

3- daI;wVj dk ifjp;]izeq[k vo;o]mi;ksfxrk rFkk baVjusV dk lkekU; ifjp; ,oa mi;ksfxrk dh tkudkjh izkIr gqbZA

4- vk/kqfud xn~;dkjksa ,oa dfo;ksa dk ifjp; izkIr gqvkA

fo"k;- fgUnh lkfgR;

ch-,- lsesLVj - 1

1- fgUnh lkfgR; dh fofo/k fo/kkvksa ls ifjfpr gq, blds varxZr lkekftd dgkfu;kWa]fuca/k o flusek fo/kk dh tkudkjh izkIr gqbZA

2- fgUnh lkfgR; ds bfrgkl ds rgr vkfndky dh jktfufrd]lkekftd o /kkfeZd ifjfLFkfr dk Kku izkIr gqvkA blds vykok dky fu/kkZj.k] i`"BHkwfe ,oa ukedj.k]izeq[k izo`fRr;kWa o fo'ks"krkvksa o vkfndkfyu dfo;ksa ls ifjfpr gq,A

3- fgUnh lkfgR; ds izeq[k lkfgR;dkjksa ls ifjfpr gq,A

ch-,- lsesLVj - 2

1- ^eksgu jkds'k* ds ukVd ^vk/ks v/kwjs* ls lkekftdrk dk cks/k gqvkA e/;eoxhZ; ifjokj esa vkfFkZd fLFkfr dh leL;k o vius vki dks loZxq.k laiUu le>uk Bhd ugha gS D;ksafd dksbZ Hkh euq"; loZxq.k laiUu ugha gksrk ;g crk;k x;k gSA

2- fgUnh lkfgR; dh fo/kkvksa ds varxZr egkdkO;][kaMdkO;]miU;kl]dgkuh]ukVd],dkadh]laLej.k]lk{kkRdkj o vkRedFkk ls ifjfpr gq,A

3- fgUnh lkfgR; ds izfrfuf/k lkfgR;dkjksa ls ifjfpr gq,A

ch-,- lsesLVj - 3

1- lkekftd dqfjfr;ksa]va/kfo'okl laca/kh feF;kpkj dk fojks/k djus okys HkfDrdky ds fuxqZ.k /kkjk ds dfo dchjnkl tks vkt Hkh izklafxd gS muds O;fDrRo vkSj d`frRo dk ifjp; izkIr gqvkA

2- HkfDrdky ds lxq.k /kkjk ds dfo lwjnklth ftUgksaus d`".k dh cky yhykvksa rFkk okRlY; Hkko dk ltho  fp=.k viuh eu dh vkWa[kksa ls fpf=r fd;k A muds inksa ]O;fDrRo o d`frRo ls ifjfpr gq,A

3- jkedkO; ds izorZd rqylhnklth ds dkO;xr 'kfDr vkSj lhekvksa ls ifjfpr gq,A

4- HkfDrdkyhu dfo;=h ehjkckbZ ds in ls ifjfpr gq,A

5- jghe ds nksgksa ls ifjfpr gq,A

6- xkxj esa lkxj mfDr okys J`xkafjd dfo fcgkjh ds dkO; ls ifjfpr gq,A

7- HkfDrdkyhu izfrfuf/k dfo;ksa ls ifjfpr gq,A

ch-,- lsesLVj - 4

1- ^oa`nkouyky oekZ* jfpr ,sfrgkfld miU;kl ^e`xu;uh* bl dFkk esa fL=;ksa dks Lokoyach o n`<fu'p;h crk;k gS tks dh vkt Hkh izklafxd gSA

2- jl rFkk vyadkj ds varxZr vFkZ]ifjHkk"kk]izdkj o vo;o ls ifjfpr gq,A

3- 'kCn'kfDr]dkO; xq.k rFkk dkO; nks"k dk Kku izkIr gqvkA

4- fgUnh lkfgR; ds bfrgkl ds varxZr HkfDrdky ds ukedj.k ,oa

oxhZdj.k]mn; vkSj fodkl]lar lkfgR; dh izo`fRr;kWa ,oa izeq[k dfo]lwQh lkfgR; dk mn~Hko]fodkl ,oa lkekU; izo`fRr;kWa]jkeHkfDr 'kk[kk dk mn~Hko]fodkl]fo'ks"krk,Wa ,oa izeq[k dfo]d`".kHkfDr 'kk[kk dk mn~Hko]fodkl]fo'ks"krk,Wa ,oa izeq[k dfo ds ckjs esa tkudkjh izkIr gqbZA

5- jhfrdky dh i`"BHkwfe]ukedj.k]lkekU; izo`fRr;kWa ,oa izeq[k dfo dh tkudkjh izkIr gqbZA

ch-,- lsesLVj - 5

1- Nk;koknh dfo;ksa t;'kadj izlkn ds ^dkek;uh*egkdkO; ds ^bMk lxZ* ls ifjfpr gq,A rFkk lw;Zdkar f=ikBh ^fujkyk*th dh dforkvksa dks vkRelkr fd;kA
2- fgUnh lkfgR; ds ys[kdksa rFkk dfo;ksa ls ifjfpr gq,A
3- vk/kqfud dky ds varxZr Hkkjrsanq ;qx] n~foosnh ;qx] Nk;kokn] izxfrokn] iz;ksxokn] ubZ dfork] lkBksRrjh dfork ls ifjfpr gq,A
4- fgUnh lkfgR; ds izfrfuf/k dfo;ksa dh dforkvksa dks vkRelkr fd;kA

ch-,- lsesLVj - 6

1- fofHkUu fuca/kdkjksa ds fuca/k dh 'kSfy;ksa ls ifjfpr gq,A
2- vk/kqfud dky esa fgUnh dh lkfgfR;d fo/kkvksa dk dzfed fodkl ds varxZr miU;kl] dgkuh] fuca/k] ukVd] ,dkadh] vkykspuk bu fo/kkvksa dh tkudkjh izkIr gqbZA
3- xn~; ds izfrfuf/k dgkuhdkjksa ls ifjfpr gq,A

History

The main focus in the history course in UG level of the RTM Nagpur University, to which the College is affiliated to is the stages and growth of civilization in India right from Indus Valley period to contemporary India. It contains political, social, cultural, religious and economic development of India. It also focuses on the landmark events of world history with special reference to Europe and Asia. The main aims of history teaching are:

1. Understanding of the process of change and development over the centuries through which the civilization has passed through to reach the present stage of development.

2. To promote an understanding of current national and international occurrences.

Course Specific Outcome of History:

The university offer undergraduate general course of history. Students who pass B.A. with history as an optional subject might come up with the following knowledge and skill.

1. Learn a basic narrative of historical events in a specific time frame of any part of the world.

2. Understand and evaluate different historical ideas, various arguments and points of view.

3. Present clear and compelling argument based on critical analysis of diverse historical sources.

4. Students will understand the use of past for present purposes.

5. Students will understand the value of diversity, develop a secular outlook towards society and believe in the equality of man irrespective of caste, creed, religion and colour, learn religious toleration.

Philosophy

After successfully completing Philosophy:

1. Students will be able to understand and discuss major philosophical problems in the Indian and Western Traditions.

2. Students will be able to express complex thoughts logically and coherently.

3. Students will be able to apply their philosophical learning to important public issues and articulate their thoughts well in such debates.

4. Students will develop their own philosophical areas of interest and investigate them from various perspectives.

5. Students will learn and articulate fundamental metaphysical questions about what exists; epistemological inquiries such as what we can know; and ethical aspects such as how we should live our lives, etc.

6. Students will be able to describe the ways in which the formal techniques of logic are important to philosophical research.

7. Students will acquire reading skills necessary to understand and critically engage with historical and contemporary philosophical texts.

8. Students will be aware of the existence of multiple philosophical traditions, particularly our own Indian tradition, and will be able to reflect on the similarities and differences of such traditions.

Political Science

B. A. program in S F S College has multiple optional subjects and Political Science is one of them. The semester pattern for B. A. program is now divided into six semesters from the year 2016. Syllabus has been designed for all six semesters by the RTM Nagpur University. The syllabuses for Semester I to VI are given below:-

B. A. Semester I- Political Theory
II- Political Thinkers (Western Thinkers)
III-Indian Government and Politics
IV- State Politics
V- Comparative Government and Politics
VI-Foreign Policy

Pattern of Marks- Internal Marks 20 and University Examination 80 Marks

The Outcome of this program and pattern

Students have developed interest in the subject Political Science as it has included THINKERS and FOREIGN POLICY in B. A. Program. Many students have opted Political Science compared to the previous batches. The Seriousness of study is seen among students as this syllabus is going to help them in preparation for Civil Studies examination. Most of the students have decided to take political science as an optional subject in their examination.

Previous syllabus did help students to compete Civil Service, Bank, Railway examinations. Some of the students have joined Railway, Banks and other Private Companies.

Students are taken to Maharashtra Assembly Bhawan to witness the functioning of Indian Parliamentary system. Students are also sent to World Parliament, Students' Parliament held in Pune. The Ministry of Parliamentary Affairs conducted Inter-college Mock Parliament in the RTM Nagpur University. Students have been benefited out these programs and have developed interest in the subject.

This new syllabus has developed writing-skill and students do consult number of books. Competitive spirit has been developed among students

In brief one can see following outcome of B. A. Program:

a) Competitive sprit has been seen among students
b) Likeness towards syllabus has been developed by students (Thinkers, Foreign Policy)
c) Reading-culture has developed among students
   Focus has been shifted from clerical job to Class I services like IAS, IPS, etc.

Sociology

1. To make students understand the nature of sociology and its nexus with other disciplines.

2. To make students understand the recent concept surfacing in the studies of sociologist and social scientists.

3. To equip young minds to understand the sociological perspective so as to enhance sociological understanding of the problem in hand.

4. To understand social stratification and social structure, changing nature of social institutions and related social dynamics and social problems of Indian society.

5. To build the knowledge base and apply it to the different facets of society.

6. To examine different sociological concepts and social institutions like gender, religion, caste, class, education and family.
7. To make use of sociological concepts in understanding social problems and role of human being in society.
8. To sustain the interest of the students in term of making them capable of fitting into the job market.
9. To develop a multi-disciplinary interest and a broad perspective among the students.

Therefore, the Course Outcome would be as follows:

1. The learner will be able to understand the importance of Sociology and its relation with other social sciences.
2. The learner will be able to understand the recent concept surfacing in the studies of sociologist and social scientist.
3. The learner will be able to understand the sociological perspective so as to enhance sociological understanding of the problem in hand.
4. The learner will be able to understand the social stratification, social structure, changing nature of social institutions, related social dynamics and social problems of Indian society.
5. The learner will be able to understand the various sociological thoughts of founding fathers of Sociology and its relevance to the current scenario.
6. The learner will be able to understand the meaning, needs and importance of social control.
7. The learner will be able to understand effect and importance of various sources of social change.
8. The learner will be able to understand the various component of Indian society.
9. The learner will be able to understand the various important element and functions of social structure.
10. The learner will be able to understand the role of religion, family and education in the society.
11. The learner will be able to understand the pattern of social deviance in different societies and measures to control them.
12. The learner will be able to understand various concepts such as Law, Society, Community, Association, Institution, Organization and other basic concept of Sociology.

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