PROGRAMME OUTCOMES OF VARIOUS DEPARTMENTS

DEPARTMENT OF GEOGRAPHY

Programme Offered: B. Sc. Geography

Program Outcome: The general outcome that the Department of Geography in the college expects from those who majors in the discipline is to be accomplished in disciplinary theories, methodologies, and content and its practicality in real world situation. The following learning goals and objectives are anticipated from graduation at the end of the programme:

1. Students should be able to acquire an understanding of and appreciation for the relationship between geography and culture. Articulate the theories, philosophies, and concepts in the discipline of geography, including unifying themes of spatial patterns and structures, the interrelationship between people and places, and the interactions between nature and society.

2. A general understanding of geographic processes, the global distribution of landforms and ecosystems, and the role of the physical environment on human populations there by creating an inbuilt environmental awareness progressively.

3. Students are able to read, interpret, and generate maps and other geographic representations as well as extract, analyze, and present such information from a spatial point of view.

4. Students acquire an understanding of and appreciation for the role that geography can play in sustainable life management

5. Students get an understanding of current global population pattern, factors influencing the distribution and mobility of human populations including settlement and economic activities and networks and their impacts on the physical environment.

6. Students are able to correlate past with the present using various geographic so as to plan for the future.

7. Students are capable to estimate the contradictory agenda of society's various stakeholders and the need to reconcile environmental, economic and socio-cultural concerns.

8. Students enhance their personality through learning human geography

9. Students are able to synthesize geographic knowledge and apply innovative research strategies to solve problems in resource conservation, environmental degradation, and sustainable development within the community, region and the world.

10. Students can identify and assess how geographic concepts apply in the place of work and in day to day life to solve real-world problems.

Specific Outcomes: Geography mainly concerns with the changes in spatial characteristic of a phenomenon in a temporal perspective. The B.Sc. programme in geography is adapted to meet specific educational and professional goals in mind of students. It focuses on spatial studies both qualitative as well as quantitative, with much emphasize on human-environment relationship. After completing the course, the students will be adequately prepared to pursue masters in the fields as well as for professional careers in geography and allied disciplines like Spatial technology what the world witness today.

Course	Objectives
Principles of Geomorphology	• Appreciate earth's tectonic and structural evolution • Comprehend the knowledge about earth's interior • Develop an idea about concept of plate tectonics, and resultant landforms • Identify various endogenic & exogenic forces of earth
Fundamentals of GIS & Remote Sensing	Perform basic ways of maps generation through GIS and ways to generate the data collected through satellites
Climatology & Oceanography	• Link atmospheric and climatic elements with other science disciplines • Develop an idea about cyclones • Investigate the mechanism of monsoon
Human Geography	• Correlate various elements of human environment with their real world practices and events • Analyze the problems of physical as well as cultural environments of both rural and urban areas
Maps & Scales: Practical 1	• Learn to draw the projections of many cartography diagram and apply this is in different statistical data • Able to select the appropriate scale & technique for graphical presentation of a maps and data • learn graphically about the enlargement and reduction of maps
Geography of India	• Identify various land formation, climate and natural vegetation • Evaluate the economic resources of India • Examine economic & social distribution of population of the country • Develop an idea about agricultural and industrial regionalisation of India
Geography of Kerala	• Identify various land formation, climate and natural vegetation of the state • Evaluate the economic and human resources of the state • Examine economic & social development of population

Geography of Resources	• Identify spatial distribution of various resources in the world • Recognize various resource depletion causes and potential threats • Find out possible practical solutions for 4R's concept
World Regional Geography	Correlate natural and cultural regions of the world
Cartography	• Develop an idea on the development of maps and chart chronologically • Acquire knowledge on different types of thematic mapping techniques • Identify the stages of development of a raw data to a final map
Environmental Geography	• Develop an idea about human-nature relationships • Build an idea about ecosystem and its various cycles • Observe various environmental issues of the world • Evaluate environmental programmes and policies of the government
An Introduction to Disaster Management	• Gain knowledge about approaches to hazard study • Develop ideas on factors, consequences and management of various natural disasters • Acquire knowledge about human induced disaster and policies to reduce the events
Weather & Climatic Data Analysis: Practical 2	• Develop an idea about different types of thematic mapping techniques • Interpret weather charts and bulletins of IMD and other meteorological departments
Map Interpretation: Practical 3	Gain knowledge about topographical maps and apply this knowledge in ground surface
Surveying: Practical 4	Conduct different types of surveying instruments like Indian clinometers, prismatic compass, dumpy level etc.
Project	• Conduct a social/environmental survey project in relation to their discipline so as to measuring the status of development of a particular section/area in relation to environment Find out the possible measures to solve those problems that arise due to several human interventions as part of such developments

Besides, the department conducts tourism geography as open course for other departments to make them understand the human and environmental characteristics and relations. The course helps the learners to evaluate the natural resources and classes of tourism. Also the learner will be able to explain the significance of strategy and planning in tourism to make it sustainable.

DEPARTMENT OF BIOCHEMISTRY

Programme Offered: B. Sc. Biochemistry

Program Outcome: To impart knowledge of Science as the basic objective of education with following general outcomes

• To develop scientific attitude is the major objective to make the students open minded, critical, curious.
• To develop skill in practical work, experiments and laboratory material and equipments along with the collection and interpretation of scientific data to contribute the science.
• To understand scientific terms, concepts, facts, phenomenon and their relationships.
• To provide practical experience to the students as a part of course to develop scientific ability to work in the field of research and other fields of their own interest and to make them fit for society.
• To create the interest of the society in the subject and scientific hobbies, exhibitions and other similar activities.
• To enrich the students with the latest development in the field of biochemistry, biotechnology and other related field of research and development.
• To keep the scientific temper which the students acquire from school level and to develop
• research culture.
• To encourage students to describe and analyze scientific data.

Course Outcomes:

SEMESTER I: BC 1141: Perspectives, Methodology & Introduction to Biochemistry (Core-I)
Course Outcome: Student will be able to
• Elicit the concepts of science
• Describe the evolution and scope of biochemistry as a science discipline.
• List out the different experimental approaches to study biochemical processes.
• Prepare solutions of different concentration and pH.
• Classify and characterize carbohydrates and lipids.

BC 1141: Practical for BC 1141
• Student will be able toresolve quantitative problems concerning the preparation of solutions, buffers, reagents and analysis of biomolecules etc.

SEMESTER-II: BC 1221: General Informatics and Bioinformatics
Course outcome: Student will be able to
• Elaborate the composition of proteins and their function.
• Detail the importance of genetic information carrier molecules in life.
• Recognize the scope and application of Bioinformatics.
• Perform statistical investigations related to biochemical problems.
• Identify application of information technology in biology.

BC 1221: Practical for BC 1221
• To gain a basic knowledge about bioinformatics and qualitative analysis of biomolecules like amino acids and proteins.

SEMESTER-III: BC1341: Cellular Biochemistry
Course outcome: Student will be able to
• List out cell organelles and describe their structure and function.
• Elaborate the different types of transport systems across cell membrane.
• Explain types of cell division
• Outline the characteristics of cancer cells and mechanisms involved in cancer biology.

• Detail on the mechanism of interaction between cell and its environment.
• Classify enzymes; describe types of enzyme inhibition and regulation.

BC 1341: Practical for BC 1341
• To enable students to qualitatively analyze biomolecules like carbohydrates and lipids and to analyze the progress curve of enzymes.

SEMESTER-IV BC 1441: Techniques in Biochemistry
Course outcome: Student will be able to
• Explain the principle, working and application of different microscopic, photometric chromatographic, electrophoretic, centrifugation and radioactive techniques.
• Select most suitable technique for the isolation and purification of biomolecules based on different criteria.

BC 1442: Core course- IV- Practical
• Course Title: Qualitative Analysis of Biomolecules
Course outcome: Student will be able to
• Qualitatively analyse the type of biomolecule.
• Identify the subclass of each biomolecule by schematic analysis

SEMESTER-V BC 1541: Physiology & Immunology
Course outcome: Student will be able to
• Explain hemopoiesis and biochemical basis of blood group classification.
• Elaborate on the transport of gases, acid base and water balance in the body.
• Remember structure of muscle, neuron and bone.
• Classify hormones and explain the functions of hormones.
• Describe various aspects in basic immunology
• Identify the applications of various techniques involved in immunology.

SEMESTER-V BC 1542 : Bioenergetics and Carbohydrate Metabolism
Course outcome: Student will be able to
• Describe the bioenergetics of metabolic pathways.
• Elaborate the reactions and regulation involved in the metabolism of carbohydrates.
• List out the inborn errors of carbohydrate metabolism.
• Enumerate the link between ETC and energy production in plant and animal cells.
• Elicit the mechanism of energy production in carbohydrate metabolism

SEMESTER-V BC 1543: Food Science
Course outcome: Student will be able to
• Elaborate on the importance of human nutrition.
• Describe the chemical composition of different types of food.
• Explain the various food preservation techniques employed.
• Identify the common adulterants in food.
• Gain knowledge about the role of microorganisms in food and nutrition
• Explain the importance of food safety and management systems.

SEMESTER-V BC 1544: Classical and Molecular Genetics
Course outcome: Student will be able to
• Give an account of Mendelian and non- Mendelian genetics.
• Predict the type of inheritance of a trait/disease using pedigree analysis.
• Explain the organization of chromatin and events during gene expression.
• Illustrate the consequences of different types of mutations and DNA-repair systems

- Depict the concepts of gene regulation in prokaryotic cells
- Describe the methods involved in rDNA technology.

SEMESTER-V BC 1545: Core Course – IX -Practical

Quantitative Analysis of Biomolecules

Course outcome: Student will be able to quantitatively analyze different biomolecules in a given test sample.

SEMESTER-VI BC 1641: Clinical Biochemistry

Course outcome: Student will be able to
- List out the methods of clinical laboratory management and laboratory safety.
- Describe the principle & procedure for studying clinical parameters used for diagnosis.
- Detail the basic concepts of microbiology and pharmacology

SEMESTER VI BC 1642: Metabolism-II

Course outcome: Student will be able to
- Describe the metabolism of lipids, nucleic acids, amino acids and heme.
- Explain the role of enzymes involved under physiological and pathophysiological conditions.
- List out the inborn errors of metabolism of above mentioned biomolecules.
- Detail the processes involved in biological nitrogen fixation.
- Enumerate the important detoxification processes in the body.

SEMESTER-VI BC 1643: Practical
- Course Title: Clinical Biochemistry and Enzymology

SEMESTER-VI BC 1644: Core Course-XIII- Practical
- Course Title: Food Analysis

Course outcome: Student will be able to
- Quantitatively estimate the specific biomolecule in any given food sample.
- Detect the presence of adulterants in different food samples.

DEPARTMENT OF BIOTECHNOLOGY

Programme Offered: BSc Biotechnology Multimajor 2(b)

Programme Outcomes

The Career related first degree programme in Group 2(b) Biotechnology as one of the core subjects is designed to develop a scientific attitude and an interest towards the modern areas of biotechnology in particular and life science in general.

The programme will help the students to become critical and curious in their outlook. The courses are designed to impart the essential basics in chemistry, Botany, Zoology and Biotechnology.

The various courses in the programme is aimed to develop proficiency in the theory as well as practical experiments, common equipments, laboratory, along with the collection and interpretation and presentation of scientific data in proper manner.

The students will be equipped with knowledge in the modern areas of biotechnology and its application in medical science, environment, agriculture, industry, proteomics, genomics, metabolomics, bioinformatics, nanobiotechnology etc.

Apart from understanding biotechnology and its power in developing the nation, it will create awareness about biotechnology and will help in eliminating public fear about the contribution of biotechnology and confusion on GM crops, GM foods and transgenic organisms.

Students, who pursue this programme and pass out successfully, will surely have an urge to continue higher studies in Biotechnology and contribute significantly in its development.

Course Outcome

- Develop basic understanding of the various strems of biotechnology
- Enhance practical skills and competency to conduct experiments in biotechnology
- Group project helps in creating analytical thinking and interpreting the inference
- inculcate skill to organize scientific events and effective communication
- Ascertain their area of interest in research

SEMESTER I

Foundation Course I

BV 1121 Methodology and Perspective of Biotechnology

- The students will be able to understand how science works.
- Students will learn how to apply statistics and IT in Biological science.
- They will receive a general awareness about biotechnology and its application in various fields.

SEMESTER II

Foundation Course II

BV1221 Biophysics & Instrumentation

- The students will be able to understand the fundamentals of biophysics
- the general instrumental techniques used in biotechnology.

Core Course: BV1245 Microbiology

Student will be able to understand the scope of microbiology in various fields such as pharmacy, medicine, clinical research, agriculture , dairy industry, water industry and gain practical knowledge in handling and culturing microbes

SEMESTER III

Core Course: BV1344 Food and Industrial Biotechnology

The students will be introduced to the industrial application of Food Biotechnology and Bioprocess technology.

Students should be trained to understand commercial importance of biotechnology through its industrial aspects

BV1345 Molecular Biology

Molecular biology is basis of modern biology and biotechnology.

This course imparts a very essential foundation for the proper understanding of life at molecular level, which is essential for further studies related to genetic engineering, immunology and other modern applied aspects of biology.

SEMESTER IV

Core Course: BV 1446 Recombinant DNA Technology

The students gain basic understanding on gene manipulation methods and principles

SEMESTER IV

Core Course: BV1447 Immunology

To give a basic training to the students of Biotechnology on immune system, immunology and immunology related techniques.

SEMESTER V

Core Course: BV1544 Environmental Biotechnology

This course is concerned with the application of biotechnology in keeping the environment clean and healthy and application of biotechnology in energy production. Various techniques are described and will be benefited by the students in their higher studies in biotechnology.

Core Course: BV 1545 Plant Biotechnology & Animal Biotechnology

This course is designed to impart basic knowledge in the applied aspects of plant biotechnology and animal biotechnology for the improvement of agriculture and plant based and animal based industries. It gives an introduction about the various techniques of animal cell culture, cloning and tissue culture of plants and animals.

Elective course for Biotechnology students

BV 1648 Bioinformatics and Nanobiotechnology

This course is for biotechnology students, who are interested to know about the methods and application of bioinformatics and modern Nano-biomolecules and their contribution in the various fields of biotechnology and healthcare.

DEPARTMENT OF STATISTICS

Programme Offered: B. Sc. Statistics

Program Outcome:

After completion of the degree apart from his/her specialty in the program of his/her choice the student learns a lot during their three year stay that makes them mature enough to take the right decisions at the right time. Students develop analytical thinking and good communication skills during classroom teaching (through projects/presentation/practical) and also as they participate in various activities both at departmental as well as college level.

As part of various activities in college like seminars and workshops he learns to respect and protect the environment. These programs also help in generating building of ethical values to become a responsible citizen when he/she graduates from the college.

Course Specific Outcome:

Statistics is the language of the uncertainties arised in modern information age. This program is a compact combination of detailed courses of Statistics and adequate amount of courses on Computer Science and Mathematics to complement. The program provide a platform for pursuing higher studies leading to post-graduate or doctorate degrees. Along with this students are equipped with skill enhancement courses like Research methodology, Statistical packages and R language. This enhances theoretical rigor with technical skills which prepare students to become globally competitive to enter into a promising professional life even after graduation. This program offers a range of traditional avenues in academics, Govt. Service, IAS, Indian Statistical/ Economic Services, Industries, Commerce, Investment Banking, Banks and Insurance Sectors, CSO and NSSO, Research Personnel/Investigator in Govt. organizations such as NCAER, IAMR, ICMR, Statistical and Economic Bureau & various PSUs., Market Research, Actuarial Sciences, Biostatistics, Demography etc. It also provides an array of non-traditional employment avenues ranging from Stock Brokers Analyst, Sports Analyst, Poll Analyst, Business Analyst, Financial Analyst, Content Analyst etc.

Courses	Outcomes
ST:1141 Statistical Methods I	Concepts of statistical population and sample, variables and attributes. Tabular and graphical representation of data based on variables. 'Conditions for the consistency' and criteria for the independence of data based on attributes. Measures of central tendency, Dispersion, Skewness and Kurtosis. Moments and their use in studying various characteristics of data
ST:1241 Statistical Methods II	Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial

	correlation coefficient and Multiple correlation coefficient. Concept of Principle of least squares for curve fitting and regression lines.
ST:1341 Probability and Distribution-I	Basic properties of the field of real numbers, the knowledge of the series of real numbers and convergence, Bolzano– Weirstrass theorem, Cauchy criteria Different approaches to the theory of probability. Important theorems on probability and their use in solving problem
ST:1441 Probability and Distribution-II	
ST:1541 Probability and Distribution-III	The knowledge of real functions-limits of functions and their properties, notion of continuous functions and their properties and the differentiability of real functions and related theorems To understand the concept of sampling distributions and their applications in statistical inference theoretical concepts of Bivariate Normal and Multinomial distribution along with their properties
ST:1542 Estimation	Drawing conclusions about the whole population on the basis of a sample Various method of estimation along with order statistics
ST:1543 Testing of Hypothesis	To understand the process of hypothesis testing and its significance To derive the most powerful test
ST:1544 Sample Survey Methods	Basic concepts of survey sampling Principles of survey sampling and main steps involved in selecting a sample Simple random sampling Stratified random sampling Systematic sampling Ratio and Regression method of estimation
ST:1551 Open Course 1	Gives an opportunity to other department students to learn and practice statistics as a part of research methodology
ST:1641Design of Experiments and Vital Statistics	The fundamental concepts of design of experiments. Introduction to planning valid and economical experiments within given resources. Completely randomized design. Randomized block design. Latin square design

ST:1642 Applied Statistics	give exposure to four applied fields of statistics viz. Time Series, Index Numbers
ST:1643 Operation Research and Statistical Quality Control	Formulate and solve LPP, Assignment problems, Transportation problems Different types of control chart
ST:1661.5 Stochastic process	The fundamental concepts of stochastic processes Tools needed to analyze stochastic processes Markov chains and its Stability Poisson process and its variations Branching process Time series
Statistical Data Analysis Using R Practical	Practices of data analysis and graphical interpretation using `R'. .

DEPARTMENT OF CHEMISTRY

Programme Offered: B. Sc. Chemistry and Industrial Chemistry

Program Outcome: The program outcome that the Department of Chemistry expects from the student who pass out is to gain an overall theoretical as well as practical knowledge in three major areas of chemistry ie., Physical, Inorganic and Organic chemistry. The following learning goals and objectives are anticipated fromgraduation at the end of the programme:

1. Students should be able to acquire an understanding of chemical bonding and structure of atoms,solid state, liquid and gaseous state properties of matter, kinetics in order to understand the rates of reactions.

2. In order to familiarize the students with various environmental aspects, different natural resources, biodiversity conservation,understand the need for conservation of ecosystems, various harmful effects of different types of pollution, their syllabus was designed with the intention of addressing all the above topics thereby creating an environmental awareness in their mind and analyze the social issues related to environment.

3. Nanomaterials, Green chemistry and supramolecular chemistry are recentfastly developing areas of wide interest. A flavour in those subjects are also provided.

4. In the organic chemistry topics, they understand the behaviour of different kinds of aliphatic and aromatic compounds, their preparation and properties, their stereochemistry and also they gain an understanding of mechanism of various reactions taking place. They also learn about special bioorganic compounds like proteins, nucleic acids, oils,fats,vitamins, hormones, enzymes etc.

5. In inorganic chemistry they get a detailed understanding of theories of coordination, how metals combine with organic compounds which leads to the exciting field of organometallic chemistry.In this context the important application of metal ions in biological systems also studied.

6. In order to make the students aware of different states of matter, liquid crystals, basics of group theory and quantum mechanics, various thermodynamic principles and properties including statistical thermodynamics, developing field such as spectroscopy are taught which could be considered as the curtainraiser for their future master programmes.

7. The main attraction of this course compared to other BSc chemistry course is that during the second and third year they learn about a large number of industrially important materials such as Glass, cement, soap, refractories, ceramics, paints, fertilizers etc., their manufacture and properties and uses, basic concepts of cosmetics, different techniques in food processing, dyeing etc. Different methods of extraction of metals from their ores and different stages of purification are described in detail. Industrial aspects of organic chemistry is also highlighted such as application in non renewable energy sources such as coal, natural gas, crude oil etc. They also need to study about different local chemical industries in Kerala and they also pay visit for their projects. Basics of polymer industry is also studied. Various separation and purification

techniques, processes in organic chemical manufacture, industrial waste water treatment methods, how to combat different kinds of pollution such as air, water etc., are also studied.

8. After understanding the basic principles of various analytical techniques, they apply in their practicals. Utilizing practical classes they are enabled to make a qualtitative analysis of different cations and anions in a given mixture of solution, determine the weight of elements by using gravimetric analysis, volumetric titration experiments in order to make a quantitative analysis of compounds. Determine the hardness, pH and total dissolved solids in waste water, develop skill in organic compound analysis, gravimetric estimation and determination of physical constants.

Specific Outcomes: Chemistry and Industrial Chemistry course is designed in such a way that they gain an overall knowledge in different areas of chemistry like physical, inorganic and organic and also special emphasis in Industrial Chemistry. Also flavor of recent areas of research are given to them. The programme is adapted to meet specific educational and professional goals in mind of students. Students are sent to chemical industries for their project work during the last semester of the course to make students familiar with the important chemical processing used in the manufacture of chemicals in the industry including the raw materials. It gives the students an idea about the necessary steps required to assist any industrial project. After completing the course, the students will be adequately prepared to pursue masters in the field.

Course	Objectives
Organic chemistry I	• Learns the behaviour of aliphatic and aromatic compounds like aromatic aldehyde,ketones and halides. • The students get an idea of mechanism of reactions of organic compound and hybridization.Comprehend the knowledge about earth's interior
Physical chemistry I	• Aware of different states of matter, liquid crystal • Basics of group theory and thermodynamic property like entropy,enthalpy and free energy
Industrial chemistry I	• Basic knowledge of industrial aspects of Inorganic chemistry and organic chemistry. • Know the procedure of separation and purification techniques. • Gain sound knowledge of inorganic material.
Inorganic Chemistry I	• To give an idea about atom, periodic properties of elements, chemical bonding and theory of

	bonding. • Familiarize the theoretical aspects of atomic structure. • To develop basic knowledge regarding the evaluation of analytical data. • Familiarize the principles of chemical analysis. • Acquire basic laboratory skills required for chemical analysis.
Methodology and Informatics	• Appreciate the role of science in the development of human culture. • Analyse the need of Information technology in human development. • Familiarise chemistry related soft wares. Acquire knowledge on basics of cheminformatics.
Inorganic chemistry II	• Distinguish various theories of chemical bonding. • Predicting the geometry of molecules • Compare various concepts of acid-base • Create basic knowledge on nuclear chemistry. • To develop elementary idea about nanochemistry.
Environmental Studies	• Familiarise structure and functions of environment. • Understand the natural resources, ecosystem and biodiversity. • Analyse the social issues related to environment. • Understand the need for conservation of ecosystems.
Chemistry Lab I and II	• To familiarise the Inorganic qualitative analysis. To acquire skills on systematic analysis of various cations and anions.
Physical Chemistry II	• Introduce the basis of developing fields such as spectroscopy, quantum mechanics and statistical thermodynamics
Inorganic Chemistry III	• Understand how the transition metal co-ordinate the theories of coordination • How metals combine with organic compounds to form organometallic compound • role of metal ions in biological systems
Industrial Chemistry II	• Learn the basic concept of polymers. • Basic knowledge of chemistry of cosmetics,dyes paint , soaps, detergents and food processing

Organic Chemistry – II	• Get an interesting idea about the stereochemistry of organic compounds • Point out the various methods of preparation and properties of organic compounds
Industrial Chemistry- III	• Introduce the chemistry of various polymers and polymerization techniques • Develop an idea about organic spectroscopy.
Industrial Chemistry - IV	• Analyze the structure of organic compounds based on various spectroscopic techniques • Acquire knowledge about various heterocyclic compounds • Develop an interest in rational drug design
Physical Chemistry- III	• Emphasize the principles of electrochemistry including the conductance and emf of cells • Acquire knowledge of phase equillibria to design various chemical processes • Determine the rate of chemical reactions • Understand binary liquid mixtures
Industrial Chemistry-V	• Establish the concept of various organic processes employed in industry • Identify the causes and effects of environmental pollution
Industrial Chemistry-VI	• Get idea about the various control measures of air pollution • Generate an interest to protect the water resources • Acquire knowledge about industrial waste water treatment
Supramolecular, NanoandGreen Chemistry	• Build an idea about the significance of green chemistry • Identify the advantages of microscale experiments • Recognize the various approaches for the synthesis of nanomaterials and their applications • Acquire knowledge about supramolecular chemistry
Practical Chemistry	• Develop skill in organic compound analysis, gravimetric estimation and determination of physical constants
Industrial Chemistry Lab	• Determine the hardness, pH and total dissolved solids in waste water
Project	• To make students familiar with the important chemical processing used in the manufacture of chemicals in the industry including the raw

	materials • Give the students an idea about the necessary steps required to assist any industrial project

DEPARTMENT OF MATHEMATICS

Programme Offered: M. Sc. Mathematics

Program Outcome: Through this programme, we expect to achieve a significant aspect of well-structured Mathematical theory. We would be expecting to get good concepts, clarification of certain aspects in between pure analysis and abstract analysis. We expect a thorough knowledge in definitions and characteristics of concepts in Abstract algebra, Topology, Differential Calculus, Real analysis, Linear algebra, Measure theory, Functional analysis, Complex analysis, Operations research, Number theory, Graph theory and Scientific Programming with Python as main subjects. To evaluate algorithms for solving substantial problems, computer programming using Python have also been included in the syllabus. The following learning goals and objectives are anticipated from graduation at the end of the programme:

1.   Develop mathematical curiosity and use inductive and deductive reasoning when solving problems.

2.   Become confident in using mathematics to analyse and solve problems in real-life situations.

3.   Develop a critical appreciation of the use of information and communication technology in mathematics.

4.   Appreciate the international dimension of mathematics and its multicultural and historical perspectives.

5.   know and demonstrate understanding of the concepts from the twelve branches of mathematics (Abstract algebra, Topology, Differential Calculus, Real analysis & Measure theory, Linear algebra,, Functional analysis, Complex analysis, Operations research, Number theory, Graph theory and Computer programming).

6.   use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts

7.   select and apply general rules correctly to solve problems including those in real-life contexts.

8.   As Bertrand Russel said, realize Mathematics is a world of perfection.

9.   Investigating patterns allows students to experience the excitement and satisfaction of mathematical discovery. Mathematical inquiry encourages students to become risk-takers, inquirers and critical thinkers.

10.   Scientific Programme in Python also included in the course to give an introduction to mathematical computing, with Python as tool for computation.

11.   Through the use of mathematical investigations, students are given the opportunity to apply mathematical knowledge and problem-solving techniques to investigate a problem, generate and/or analyse information, find relationships and patterns, describe these mathematically as general rules, and justify or prove them.

Specific Outcomes: Mathematics is a science as well as art. Through this programme students are able to read and understand higher-level proofs and be able to write the proofs. We are expected to develop and maintain problem-solving skills for each student. This programme gives the student to be able to communicate mathematical ideas with others. Students will get the ability to apply analytical and theoretical skills to model and solve mathematical problems.

Course	Objectives
Linear algebra	● Develop understanding about Linear maps, their null spaces and ranges, Operations on linear maps in the set of all linear maps from one space to another , Rank-Nullity Theorem , Matrix of linear map, its invetibilty. ● Develop understanding in Invariant subspaces, Definition of eigen values and vectors, Polynomials of operators, Upper triangular matrices of linear operators, Equivalent condition for a set of vectors to give an upper triangular operator, Diagonal matrices, Invariant subspaces on real vector spaces ● Develop Concept of generalized eigen vectors, Nilpotent operators, Characteristic polynomial of an operator, Cayley-Hamilton theorem, Condition for an operator to have a basis consisting of generalized eigen vectors, Minimal polynomial. Jordan form of an operator Acquire knowledge in Change of basis, trace of an operator, Showing that trace of an operator is equal to the trace if its matrix, determinant of an operator, invertibilty of an operator and its determinant relation between characteristic polynomial and determinant, determinant of matrices of an operator w.r.t. two base are the same. Determinant of a matrix. ● Able to generalize the vectors in Higher dimensions. ● Learn about the immense applications of Linear Algebra.
Real analysis I	● Develop concept in Functions of Bounded Variation and

	Rectifiable Curves.
	● Develop concept in The Riemann-Stieltjles Integral.
	● Acquire knowlrdge in Sequences of Functions.
	● Comprehend kn owledge in Multivariate Calculus.
	● Learn about the applications of Partial and Total Differentiation
Real analysis II	● Acquire knowledge of concepts of modern analysis, such as convergence, continuity, completeness, compactness and a glimpse into metric spaces and Topological concepts. ● develop a higher level of mathematical maturity combined with the ability to think analytically. ● Acquire ability to operate with Lebesgue Outer Measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesque, Measurability. ● Acquire knowledge in Integration of Non-negative functions, The General Integral, Integration of Series, Riemann and Lebesgue Integrals, The Four Derivatives, Lebesgue's Differentiation Theorem, Differentiations and Integration. ● Appreciate the idea of Abstract Measure Spaces: ● Acquire knowledge in the Lp Spaces, Convex Functions, Convergence in Measure, Signed Measures and the Hahn Decomposition, The Jordan Decomposition, The Radon-Nikodym Theorem. ● Appreciate the idea of Abstract Measure Spaces:

	● Acquire knowledge in the Lp Spaces, Convex Functions, Convergence in Measure, Signed Measures and the Hahn Decomposition, The Jordan Decomposition, The Radon-Nikodym Theorem. ● Be able to apply the Radon-Nikodym Theorem in practical extent.
Differential Equations	● Acquire knowledge in Solving second order Linear Equations. ● Able to find Series solutions of first order equations. ● COmprehend the knowledge in Special functions - Legendre polynomials - Bessel's functions - Gamma functions. ● First Order PDE - Curves and Surfaces, Genesis of first order PDE, Classifications of integrals-Linear equation of first order-Pfaffian Differential Equations- Compatible systems- Charpits equations, Jacobi's method. ● Second order PDE - Classification of second order PDE - One dimensional wave equations-Vibration of finite string - Vibration of semi infinite string - Vibrations of infinite string, Laplace equations - Boundary value problem, Maximum and minimum principles. ● Students should be able to use technology to help solve problems, experiment, interpret results, and verify conclusions.
Topology I	● Develop an intuition to the subject ● Acquire knowledge in Metric Spaces:-Definition, Examples, Open sets, Closed sets, Interior, closure and boundary. Continuous functions, Equivalence of metric spaces, Complete metric spaces-Cantor's Intersection Theorem. ● Acquire knowledge in Topological spaces :-Definition, Examples, Interior, Closure, Boundary, Base, Sub base, Continuity, Topological Equivalence, Subspaces. ● Develop concept in Connectedness and disconnected

	spaces, Theorems on connectedness, Connected subsets of real line, Applications of connectedness, Path connected spaces. ● Develop concept in Compact spaces, compactness and continuity, Properties related to compactness, One point compactification. ● Emphasizes the geometric nature of the subject and the applications of topological ideas to geometry and mathematical analysis. ● To realize that topology is an excellent subject ➢ for learning to prove theorems correctly ➢ for learning the concepts of mathematical rigor ➢ for developing the mathematical maturity and sophistication that are required for higher level courses.
Topology II	Develop the concepts ● In Product and Quotient spaces. ● Separation axioms and Separation by continuous functions. ● Convergence, Tychnoff 's Theorem. ● Algebraic topology:- The fundamental group ● Examples of fundamental groups, The Brouwer Fixed Point Theorem.

Abstract Algebra	● Develop understanding about the role of abstract algebra as the main part of Mathematics. ● Comprehend the knowledge about the importance of applications of Abstract algebra. ● Develop an idea about Groups, different types of groups, rings and Fields. Galois theory in solving the polynomial equations. ● Divisibility in Integral domains-Irreducibles, Primes, Historical Discussion of Fermat's Last Theorem, Unique Factorization domains, Euclidean domains. Extension fields, Fundamental Theorem of Field Theory, Splitting fields, Zeros of irreducible polynomial. ● Algebraic extensions, Characterization of extensions, Finite extensions, Properties of algebraic extensions, Fundamental theorem of Galois Theory, Solvability of polynomials by radicals, Insolvability of Quintic.
Scientific Programming with Python	● Visualizing Data with Graphs - learn a powerful way to present numerical data: by drawing graphs with Python. ● Acquire knowledge in Algebra and Symbolic Math with SymPy and Solving Calculus Problems, Graphical Equation Solver, Summing a Series and Solving Single-Variable Inequalities, Finding the Length of a Curve. ● Ability to programme Interpolation and Curve Fitting - Polynomial Interpolation - Lagrange's Method, Newton's Method and Limitations of Polynomial Interpolation, Roots of Equations - Method of Bisection and Newton-Raphson Method, Numerical Integration - Newton-Cotes Formulas - Trapezoidal rule, Simpson's rule and Simpson's 3/8 rule, Initial Value Problems - Euler's Method and Runge-Kutta methods.

Complex analysis I	● Analyzing the concepts of modern analysis, such as convergence, continuity in complex number system. ● Acquire knowledge in Elementary properties and examples of analytic functions, Power series, Analytic function, Riemann Stieltjess, Power series representation of an analytic function, Zeros of an analytic function, The index of a closed curve. ● Acquire knowledge in Cauchy's Theorem and integral formula, Homotopic version of Cauchy's Theorem, Simple connectivity, Counting zeros: The open Mapping Theorem, Goursat's Theorem. ● Be able to define Singularities: Classification, Residues, The argument principle. ● Acquire knowledge in The extended plane and its spherical representation, Analytic function as mapping, Mobius transformations, The maximum principle, Schwarz's Lemma. ● Ability to explain the concepts, prove theorems and properties involving complex functions.
Complex analysis II	● Develop concept in Compactness and Convergence in the space of Analytic functions, The space $C(G,\Omega)$, Space of Analytic functions, Riemann Mapping Theorem. ● Acquire knowledge in Wierstrass factorization Theorem, Factorization of sin function, The Gamma function. ● Acquire knowledge in Riemann Zeta function, Runge's Theorem, Simple connectedness, Mittag-Leffler's Theorem. ● Develop concept in Analytic continuation and Riemann surfaces, Schwarz Reflexion Principle, Analytic continuation along a path, Monodromy Theorem. ● Acquire knowledge in Basic properties of Harmonic functions, Harmonic function on a disc, Jensen's formula, The genus and order of an entire function, Hadamard factorization Theorem.

Functional analysis I	● Familiarize the student with the basic concepts, principles and methods of functional analysis and its applications. ● Identify abstract concepts concerning vector and function spaces. ● Identify the applicability of functional analysis as a tool for solving a variety of Mathematical problems such as the solution of partial differential equations, engineering fields such as information engineering and Quantum physics. ● Analyzing infinite dimensional spaces Also, develop the concept in ● Normed spaces and continuity of linear maps. ● Hahn-Banach theorems and Banach spaces. ● Uniform boundedness principle, closed graph and open mapping theorems.
	● Bounded inverse theorem, spectrum of a bounded operator. ● Weak convergence, reflexivity and compact linear maps.
Functional analysis II	● Acquire knowledge in Spectrum of a compact operator. ● Acquireknowledge in Inner product spaces, orthonormal sets. ● Develop concept in Approximation and optimization, projection and Riesz representation theorems. ● Acquireknowledge in Bounded operators and adjoints, normal, unitary and self-adjoint operators. ● Develop concept in Spectrum and numerical range, compact self-adjoint operators.

Operations research	● Analyzing the Linear Programming Problems, Transportation problems, Assignment problems, Project management, Dynamic Programming. ● Analyzing the Non- linear Programming Problems through techniques of Kuhn-Tucker optimality conditions. ● construct linear integer programming models and discuss the solution techniques. ● Acquire knowledge in CPM and PERT techniques, to plan, schedule, and control project activities. ● More applications of Operations Research.
Graph theory	● Comprehend about isomorphism, Isomorphism as a relation, Graphs and groups, Cut-vertices, Blocks, Connectivity. ● Appreciate Eulerian graphs, Hamilton graphs, Hamilton walks and numbers ● Develop ideas in Strong diagraphs, Tournaments, matching, Factorization. ● Acquire knowledge about The Four colour problem, Vertex colouring, The Ramsey number of graphs, Turan's Theorem.
	● Acquire concept on The centre of a graph, Distant vertices, Locating numbers, Detour and Directed distance.
Number theory	● Analyzing the Fundamental Theorem of Arithmetic ● Gain knowledge about Arithmetical function and Dirichlet multiplication ● Appreciate the idea of Congruences, Chinese Remainder Theorem ● Appreciate Quadratic residues, Reciprocity law, Jacobi symbol. ● Comprehend the Primitive roots, Existence and number of primitive roots.

Project	Project/Dissertation is aimed to attain an appreciation to the students that mathematics can be used to communicate thinking effectively. This aims to encourage students to become more creative.