



Gandhinagar Institute of Science (03)

Academic Regulation & Curriculum

for

Bachelor of Science (06)

in

Forensic Chemistry (176)

Gandhinagar University

Khatraj-Kalol Road, Moti Bhoyan

Ta. Kalol, Dist. Gandhinagar – 382721

Gujarat

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(Applicable from 2025 admitted Batch)

Preamble

The Department of Chemistry at Gandhinagar Institute of Science is dedicated to promoting academic excellence, scientific research, innovation, and ethical values in the field of forensic and Chemical Sciences. The department aims to develop skilled and responsible graduates who can contribute effectively to scientific advancement, industrial growth, environmental sustainability, and societal development. The Bachelor of Science in Chemistry programme is designed in accordance with the National Education Policy (NEP) and Choice Based Credit System (CBCS), ensuring a multidisciplinary, skill-oriented, and outcome-based approach to learning. The curriculum emphasises both theoretical understanding and hands-on training in modern instrumental techniques such as chromatography, spectroscopy, and toxicological analysis. Students are introduced to the examination of various types of evidence, including drugs, poisons, explosives, trace materials, and environmental contaminants. Through laboratory work and case-based learning, the program fosters critical thinking, precision, and ethical responsibility—qualities that are essential for forensic professionals.

In addition to scientific expertise, the program highlights the importance of legal procedures, evidence handling, and documentation to ensure the integrity and admissibility of forensic findings in courts of law. Interdisciplinary exposure enables students to understand the broader context of criminal investigations and the role of forensic chemists within investigative teams. Special emphasis is given to laboratory experiments, project work, internships, industrial exposure, and training on modern analytical instruments to strengthen technical expertise, scientific thinking, problem-solving ability, and professional competence among students. The department also encourages experiential learning through seminars, workshops, industrial visits, research activities, MOOCs, and collaborative programmes to enhance innovation, communication skills, and lifelong learning abilities.

The curriculum has been developed after considering valuable feedback from academicians, industry experts, alumni, researchers, and other stakeholders to maintain relevance with modern scientific developments and employment opportunities. Equal importance is given to laboratory safety, ethical practices, environmental awareness, and sustainable scientific approaches. Through a dynamic academic environment and student-centered learning, the Forensic Chemistry Program is committed to nurturing skilled professionals who can contribute effectively to crime laboratories, law enforcement agencies, research institutions, and regulatory bodies. By integrating scientific rigour with real-world applications, the program prepares graduates to meet the evolving challenges of

forensic investigations and to uphold the principles of justice through accurate and reliable chemical analysis.

Table of Contents

1. Institutional Vision & Mission	05
2. Departmental Vision & Mission.....	06
3. Program Objective.....	07
4. Program Educational Objectives (PEOs).....	08
5. Program Details.....	09
6. Curriculum Structure.....	10
7. Teaching Learning and Evaluation.....	12
8. Rules and Regulation.....	14
9. Student Support.....	16
10. Program Credibility.....	17
11. Collaborative field work / Experimental work.....	21
12. Market Survey Review.....	25
13. Review and Revision of Regulation.....	26
Annexure 1. Details Syllabus.....	27
Annexure 2. AEC, VAC, SEC.....	69

1. Institutional Vision & Mission

Gandhinagar Institute of Science

1.1 VISION:

Gandhinagar Institute of Science aims to strengthen quality science education and research by fostering innovation, ethical values, and scientific temperament for societal and sustainable development.

1.2 MISSION:

- To provide quality education supported by modern infrastructure and an industry- oriented curriculum, while emphasizing ethics and critical thinking.
- To promote an innovative and research-oriented environment that fosters effective problem-solving skills and entrepreneurial development.
- To encourage innovation, entrepreneurship, and scientific ethics for developing responsible and skilled graduates.
- To foster interdisciplinary learning, sustainability, and community engagement for national development.

2. Departmental Vision & Mission

Department of Chemistry

2.1 VISION:

To be a premier department in Chemistry education by fostering scientific knowledge, research excellence, innovation, practical skills, and ethical values among students, thereby contributing to societal development and advancements in chemical sciences.

2.2 MISSION:

- To provide quality education in Chemistry through effective teaching-learning practices.
- To develop practical, analytical, and research skills among students through laboratory training, projects, and scientific exposure.
- To promote innovation, interdisciplinary learning, and application-oriented chemical knowledge for academic and industrial needs.
- To inculcate ethical values, environmental awareness, leadership qualities, and social responsibility among students.

3. Program Objectives

The program aims to:

PO-1: Develop a strong understanding of fundamental chemical principles relevant to forensic science.

PO-2: Apply modern analytical techniques and instruments for examining forensic samples.

PO-3: Gain skills in proper collection, preservation, and handling of crime scene evidence.

PO-4: Analyze drugs, poisons, and toxic substances in biological and environmental samples.

PO-5: Interpret experimental data and prepare accurate forensic reports.

PO-6: Understand legal procedures and ethical responsibilities in forensic practice.

PO-7: Enhance critical thinking and problem-solving abilities for forensic investigations.

PO-8: Develop effective communication skills for presenting scientific findings clearly to law enforcement agencies, legal professionals, and in court testimony.

4. Program Educational Objectives (PEOs)

PEO-1: To develop strong foundational knowledge in chemical sciences and apply analytical techniques for the examination and interpretation of forensic evidence.

PEO-2: To equip graduates with practical skills in modern forensic instrumentation and laboratory methodologies for accurate and reliable analysis.

PEO-3: To prepare students to address real-world forensic challenges by integrating scientific principles with investigative and legal procedures.

PEO-4: To inculcate ethical values, professional integrity, and adherence to legal standards in the handling and reporting of forensic evidence.

PEO-5: To promote lifelong learning, research aptitude, and adaptability to emerging technologies and advancements in forensic chemistry.

5. Program Details

5.1 Program Structure & Duration

- Duration & Intake: 4 Years & 60 Seats
- Semesters: 8
- Mode: Full Time
- Credit Structure: As per NEP/University norms
- Medium of Instruction: English

5.2 Eligibility criteria for admission

Candidates who have obtained a bachelor's degree in any discipline from a recognized University/Institution approved by UGC, with minimum 50% aggregate marks (45% for reserved category candidates as per applicable norms), shall be eligible for admission to the program

5.3 Admission procedure

Admission to the B.Sc. Chemistry program may be granted on the basis of merit obtained in the qualifying examination and/or performance in the Entrance Test and/or Personal Interview, as prescribed by the University from time to time. Candidates who have successfully completed Higher Secondary Education (10+2) with Chemistry as one of the core subjects from a recognized board are eligible for admission. The University reserves the right to revise admission procedures.

6. Curriculum Structure

GANDHINAGAR UNIVERSITY Gandhinagar Institute of Science											
Program Name: Bachelor of Science (Forensic Chemistry)						Program Code: 176					
Semester / Year : First Year Bachelor of Science - Semester I						Effective From Academic Year: 2025-26 (As per NEP 2020)					
Subject Code	Course Type	Subject Name	Credit	Hours per week			Theory (Marks)		Practical (Marks)		Total Mark
				L	T	P	University	Continuous	University	Continuous	
10760101	Major	Introduction of Forensic Science-I	4	3	-	2	5	50	50	25	150
10760102	Major	Forensic Toxicology-II	4	3	-	2	5	50	50	25	150
10770103	Minor	Introductory Microbiology	4	3	-	2	5	50	50	25	150
	Multi / Interdisciplinary	Astrology-I	4	4	-	-	4	50	50	-	100
AEC016	Ability Enhancement Course	Practical English	2	2	-	-	2	25	25	-	50
SEC001	Skill Enhancement Course	Data analysis using spreadsheet	2	-	-	4	4	-	-	25	50
VAC004	Value Added Course	Basic Life Support	2	2	-	-	2	25	25	-	50
			22	17	0	10	27	-	-	-	700
More (If any):											

GANDHINAGAR UNIVERSITY Gandhinagar Institute of Science												
Program Name: Bachelor of Science (Forensic Chemistry)												
Semester / Year : First Year Bachelor of Science - Semester II												
Program Code: 176												
Effective From Academic Year: 2023-26 (As per NEP 2020)												
Subject Code	Course Type	Subject Name	Credit	Hours per week			Theory (Marks)		Practical (Marks)		Total (Mark)	
				L	T	P	University	Continuous	University	Continuous		
101760201	Major	Introduction of Forensic Science-II	4	3	-	2	5	50	50	25	25	150
101760202	Major	Forensic Toxicology-II	4	3	-	2	5	50	50	25	25	150
10170203	Minor	Nutritional Pattern in Microorganism	4	3	-	2	5	50	50	25	25	150
10170205	Multi / Interdisciplinary	Agriculture Business Management	4	4	-	-	4	50	50	-	-	100
AEC015	Ability Enhancement Course	Personality Development for Effective Leadership	2	2	-	-	2	25	25	-	-	50
SEC019	Skill Enhancement Course	Social Media Management	2	2	-	-	2	25	25	-	-	50
IKS0201	IKS	Indian Ancient History and Cultural Heritage	2	1	-	2	3	25	25	25	-	50
			22	18	0	8	26	-	-	-	-	700
Note (If any):												

7. Teaching Learning and Evaluation

7.1 Teaching Methodology

The program shall adopt:

- Classroom Teaching
- Case Studies
- Industry Interaction
- Site Visits
- Workshops
- GIS/Software Training
- Field Surveys
- Research Projects
- Internships
- AI-based Learning Tools
- Blended and Digital Learning

7.2 Attendance rules

- Minimum 75% attendance shall be mandatory in each course.
- Students below prescribed attendance may not be permitted to appear in examination.
- Additional attendance requirements may apply for practicals, internships, and field work.

7.3 Examination and Evaluation

7.3.1 Evaluation Components

- The evaluation may consist of Continuous Internal Evaluation (CIE) and End Semester Examination (ESE)
- Continuous Internal Evaluation (CIE) may include:
 - Mid-Semester Examination
 - Assignments
 - Presentations
 - Field work
 - Class Test
 - AI Quiz & Viva Voce
 - Dissertation
 - Project work

7.4 Suggested weightage:

- Continuous Internal Evaluation: 40%
- End Semester Examination: 50%

7.5 Passing Standard

- Minimum 50% marks in each component where applicable.
- Minimum 50% aggregate for passing the course/program.
- Separate passing may be required in theory and practical examinations.

7.6 Grading System

The program shall follow Gandhinagar University grading norms.

7.6.1 Grad Table:

Grade	Grade Points	From Marks	To Marks
AA	10	80	100
AB	9	75	79
BB	8	70	76
BC	7	65	69
CC	6	60	64
CD	5	55	59
DD	4	50	54
DF	0	0	49

7.7 Dissertation / project work

Students shall undertake Research Project OR Industry-Based

Dissertation. Requirements may include:

- Proposal Presentation
- Periodic Review
- Viva and Final Report Submission

The dissertation shall be evaluated by internal and external examiners.

8. Rules and Regulations

8.1 Rule for Promotion

A student shall be promoted to the next semester as per Gandhinagar University rules subject to fulfilment of academic requirements, minimum attendance and Completion of required credits.

8.2 Maximum Duration for Completion

The maximum duration for completing the program shall be 4 years from the date of admission (or as prescribed by the University).

8.3 Internship Guidelines

8.3.1. Students shall undergo mandatory internship/field training in:

- Accredited Forensic Science Laboratories
- Forensic Science Institutions
- Toxicology Laboratories
- Pharmaceutical Testing Facilities
- Environmental Analysis Laboratories
- Research Organizations

8.3.2 Students must submit:

- Internship Report
- Work Diary/Logbook
- Completion Certificate
- Presentation

8.4 Discipline Rules

Students shall maintain discipline, professional ethics, and proper conduct within the institution, during field visits, internships, industry interactions, examinations, and all academic activities. Students are expected to attend classes regularly, follow institutional rules and regulations, respect faculty members, staff, fellow students, and institutional property, and maintain academic integrity in assignments, projects, and examinations. Any form of misconduct, ragging, indiscipline, use of unfair means in examinations, damage to institutional property, harassment, or behaviour affecting the academic

environment shall be treated seriously and may result in disciplinary action including warning, suspension, cancellation of examination, withholding of results, or expulsion.

8.5 Anti-Ragging Policy

The program shall strictly follow:

- UGC Anti-Ragging Regulations
- Anti-Ragging Affidavit requirements
- Institutional disciplinary

procedures

- Ragging in any form is strictly prohibited.

8.6 Ethical use of Technology and AI Tools

Students are encouraged to use:

- Various Software and AI Tools
- Data Analytics Tools
- AI-based Learning Platforms
- Valuation Software
- Digital Survey Tools

Use of AI tools shall be ethical and academic integrity must be maintained

9. Student Support

9.1 Industry Collaboration

The Department shall promote collaboration with forensic laboratories, law enforcement agencies, pharmaceutical industries, chemical industries, analytical testing centers, environmental agencies, and research institutions. Activities may include internships, crime lab training, laboratory visits, expert lectures, workshops, seminars, and placement support. MoUs may be established to enhance practical exposure, research, skill development, and employability in forensic chemistry.

9.2 Research and Consultancy

The department shall encourage research and consultancy in forensic chemistry areas such as toxicology, drug analysis, environmental forensics, trace evidence analysis, and forensic instrumentation. Students may undertake case studies, forensic investigations, and research projects. Consultancy services may be provided to government agencies, forensic labs, and industries for chemical analysis and forensic investigations.

9.3 Library and Laboratory Facilities

Adequate library and laboratory facilities shall be provided, including access to forensic science books, journals, e-resources, and chemical databases. Laboratories shall be equipped with essential forensic and analytical instruments (e.g., chromatography, spectroscopy) to support practical training and research in forensic chemistry.

9.4 Student Support and Mentoring

A structured mentoring system shall support students through academic guidance, career counselling, and skill development. Opportunities for interaction with forensic experts, scientists, and legal professionals shall be provided through workshops, seminars, and training programs to enhance professional competency.

9.5 Placement and Career Development

The department shall facilitate placement and career development through collaborations with forensic laboratories, police departments, legal agencies, pharmaceutical companies, and analytical industries. Activities such as internships, skill training, resume building, and placement-oriented workshops shall be conducted to improve employability.

10. Program Credibility

10.1 Executive Summary

The B.Sc. Forensic Chemistry Programme is designed to develop scientifically competent graduates with strong theoretical knowledge, practical laboratory skills, analytical abilities, and research aptitude in various branches of chemistry. The programme provides a comprehensive foundation in Organic, Inorganic, Physical, Analytical, and Environmental Chemistry while integrating contemporary scientific developments and industrial applications.

All courses are delivered by qualified faculty members with expertise in their respective fields, ensuring that students receive high-quality education supported by practical training, laboratory experiments, and research-oriented learning. The curriculum emphasizes the development of critical thinking, problem-solving skills, scientific ethics, and hands-on experience through well-equipped laboratories and project-based activities. Specialized practical training is provided in modern analytical techniques, instrumental methods, chemical synthesis, spectroscopy, chromatography, and quality control practices. Students are encouraged to participate in seminars, workshops, industrial visits, research projects, and scientific events to enhance their academic and professional competencies.

The programme promotes collaboration with chemical industries, pharmaceutical companies, research laboratories, environmental agencies, and academic institutions to provide exposure to real-world applications of chemistry. Industry interactions, internships, expert lectures, and skill development programmes help bridge the gap between academic learning and professional practice. The curriculum is designed in accordance with contemporary educational frameworks and industry requirements, preparing students for higher studies, research careers, competitive examinations, and employment opportunities in chemical, pharmaceutical, petrochemical, environmental, food, agricultural, and allied industries.

Graduates of the programme are equipped with the knowledge, laboratory proficiency, analytical skills, and professional competence required for successful careers in scientific research, quality assurance, manufacturing, education, environmental monitoring, and emerging interdisciplinary fields of chemical sciences.

10.2 Scope and Career Opportunities

Graduates of the program may work in:

- Forensic Chemist in government forensic science laboratories (FSLs).
- Scientific Officer in crime investigation agencies (CBI, NIA, state police).
- Drug Analyst in narcotics, pharmaceutical, and regulatory agencies.
- Toxicologist in hospitals, poison control centers, and research laboratories.
- Quality Control/Quality Assurance Chemist in chemical and pharmaceutical industries.
- Environmental Forensic Analyst in pollution control and environmental agencies.
- Crime Scene Investigator (support role in evidence collection and analysis).
- Research Scientist in forensic science, chemistry, and allied research institutes.
- Academic Professional (lecturer or assistant professor in universities/colleges).
- Forensic Consultant or Expert Witness in legal and court-related cases.
- Customs, Excise, and Excise Intelligence Officer dealing with chemical evidence.
- Laboratory Analyst in private forensic and analytical testing laboratories.

10.3 Potential Job Roles

- Forensic Chemist
- Scientific Officer
- Drug Analyst
- Toxicologist
- Crime Lab Analyst
- Environmental Forensic Expert
- Quality Control Chemist
- Research Scientist
- Crime Scene Analyst
- Customs Officer
- Academic Faculty
- Forensic Consultant
- Lab Manager
- Investigation Officer
- Evidence Analyst
- Chemist
- Analytical Chemist
- Quality Control (QC) Analyst
- Quality Assurance (QA) Officer

- Research Associate
- Laboratory Technician
- Chemical Analyst
- Pharmaceutical Chemist
- Production Chemist
- Environmental Chemist
- Forensic Science Analyst
- Food Quality Analyst
- Water Quality Analyst
- Industrial Chemist
- Research Scientist (after higher studies)
- Chemical Safety Officer
- Technical Executive
- Scientific Officer
- Regulatory Affairs Associate
- Academic Researcher
- Chemistry Teacher/Lecturer (after required qualifications)
- Sales and Marketing Executive (Chemical/Pharmaceutical Products)
- Patent Analyst (with additional training)
- Laboratory Manager (with experience)

10.4 Higher Study & Professional Opportunities

Students may pursue:

- M.Sc. Forensic Chemistry
- M.Sc. Forensic Science
- M.Sc. Analytical Chemistry
- M.Sc. Toxicology
- M.Sc. Environmental Science
- M.Sc. Pharmaceutical Chemistry
- M.Sc. Criminology & Criminal Justice
- M.Phil. / Ph.D. Forensic Science/Chemistry
- PG Diploma in Forensic Science / Toxicology / Cyber Forensics
- MBA (Forensic Management / Hospital Administration optional path)
- M.Sc. in Chemistry (Organic, Inorganic, Physical, Analytical, Industrial, Environmental, etc.)
- Competitive Examinations such as CSIR-NET, GATE, SET, UPSC, and State PSCs

- Research Fellowships through CSIR, UGC, DST, and other funding agencies
- Ph.D. in Chemistry and related disciplines
- Integrated Ph.D. Programs in Chemical Sciences
- M.Tech. in Chemical Engineering, Materials Science, Nanotechnology, or related fields
- MBA in Pharmaceutical Management, Healthcare Management, or Industrial Management
- Postgraduate Diplomas in Analytical Instrumentation, Quality Control, and Industrial Chemistry
- Professional Certifications in Laboratory Management, Quality Assurance, and Regulatory Affairs
- Environmental Science and Pollution Control Programs
- Patent Analysis and Intellectual Property Rights (IPR) Certifications

11. Collaborative Field Work / Experimental Work (B.Sc. Forensic Chemistry)

11.1 Forensic Laboratory Visits

Field visits to Forensic Science Laboratories (FSLs) for exposure to real case analysis and forensic workflows.

11.2 Police Department Interaction

Engagement with police units to understand crime scene investigation procedures and evidence handling methods.

11.3 Crime Scene Training

Practical training in crime scene investigation including collection, preservation, labeling, and documentation of evidence.

11.4 Narcotics Agency Exposure

Visits to drug control and narcotics agencies for understanding identification and analysis of controlled substances.

11.5 Industrial Laboratory Visits

Exposure to pharmaceutical and chemical industries for learning quality control and analytical testing methods.

11.6 Instrumental Analysis Training

Hands-on experience with advanced instruments such as GC-MS, HPLC, FTIR, and UV-Visible spectroscopy.

11.7 Mock Crime Scene Practice

Participation in simulated crime scene setups to develop analytical and investigative problem-solving skills.

11.8 Collaborative Research Work

Joint research activities with universities, forensic institutes, and scientific experts.

11.9 Toxicology & Trace Analysis

Experimental work on toxic substances, drugs, and trace evidence using forensic laboratory techniques.

11.20 Professional Workshops

Participation in workshops, seminars, and training sessions conducted by forensic scientists and industry experts.

11.21 Chain of Custody Training

Practical understanding of legal procedures, evidence integrity, and documentation in forensic casework.

11.22 Project-Based Learning

Real-world forensic projects involving experimental analysis, case studies, and scientific reporting.

11.23 Water Quality Analysis

Students will collect water samples from different sources and analyze pH, hardness, alkalinity, chloride, and dissolved oxygen using standard analytical methods. A laboratory report with observations, calculations, and conclusions will be submitted.

11.24 Soil Analysis and Fertility Assessment

Students will collect soil samples and determine pH, moisture content, organic carbon, and nutrient levels. The study will include interpretation of soil fertility and recommendations for agricultural applications.

11.25 Industrial Visit – Chemical/Pharmaceutical Industry

Students will visit a chemical or pharmaceutical industry to observe manufacturing processes, quality control procedures, safety practices, and waste management systems. A visit report will be submitted.

11.26 Identification and Characterization of Chemical Compounds

Students will perform qualitative analysis of inorganic salts and organic compounds using standard laboratory techniques and submit an analytical report.

11.27 Environmental Monitoring Study

Students will assess environmental samples (water, soil, or air) for pollutants and compare results with prescribed standards. Findings will be presented in a structured report.

11.28 Instrumental Analysis Exercise

Students will use instruments such as UV-Visible Spectrophotometer, Flame Photometer, Conductometer, or pH Meter for quantitative analysis and interpretation of results.

11.29 Food Adulteration Testing

Students will test common food products for adulterants using standard chemical methods and prepare an illustrated report on food quality and safety.

11.30 Chromatographic Separation Study

Students will separate and identify components of mixtures using Paper Chromatography or Thin Layer Chromatography (TLC) and prepare a laboratory report.

11.31 Advanced Instrumentation Training

Students will receive exposure to advanced analytical instruments such as HPLC, GC, FTIR, or AAS through laboratory demonstrations or industrial visits.

10.32 Research Methodology and Scientific Writing

Students will learn literature review, data analysis, referencing styles, and scientific report writing through a guided mini-research project.

11.33 Mandatory Internship (6–8 Weeks)

Students will complete an internship in a chemical, pharmaceutical, environmental, food, or research laboratory and submit a detailed internship report.

11.34 Mini Research Project

Students will conduct a small-scale research project under faculty supervision involving experimentation, data analysis, and presentation of findings.

11.35 Scientific Seminar and Literature Review

Students will critically review recent research papers in chemistry and present their findings through seminars and written reports.

11.36 Live Industry Problem-Solving Project

Students will work on a real-world problem provided by an industry or laboratory and propose scientifically justified solutions.

11.37 Research Dissertation

Students will prepare a dissertation (5,000–10,000 words) based on experimental work, literature review, and data analysis, followed by a viva voce examination.

11.38 Portfolio Presentation and Exit Viva

Students will compile laboratory records, project reports, internship work, and research outputs into a portfolio and defend their work before a faculty panel.

Recommended Organizations/Agencies: Council of Scientific and Industrial Research, Indian Council of Agricultural Research, Department of Science and Technology, Indian Institute of Chemical Technology, Bureau of Indian Standards, Central Pollution Control Board.

12.0 Market Survey Review

A market survey of the Forensic Chemistry program offered under the Department of Chemistry indicates a strong and continuously growing demand for trained forensic professionals in India and globally. With the increasing reliance on scientific evidence in criminal investigations, judicial systems are progressively integrating forensic science as a mandatory component in serious crime analysis. This shift has significantly expanded career opportunities for graduates specializing in forensic chemistry. Government forensic science laboratories (FSLs), central forensic institutions, state police departments, and crime investigation agencies are actively recruiting candidates with a strong background in analytical chemistry and forensic techniques. Reports indicate a consistent rise in vacancies due to workforce shortages and increasing case loads, particularly in toxicology, drug analysis, trace evidence examination, and chemical residue identification.

The private sector also shows promising growth, with demand emerging from pharmaceutical companies, environmental monitoring agencies, insurance investigation firms, cybersecurity organizations, and quality control laboratories. Additionally, advancements in analytical instrumentation such as GC-MS, FTIR, HPLC, and DNA profiling technologies have further enhanced the employability of forensic chemistry graduates, as industries seek professionals skilled in both theoretical chemistry and applied investigative science. Academic institutions are also expanding forensic-related programs, reflecting the rising student interest and institutional recognition of this field as a specialized career pathway.

Market trends further reveal that forensic chemistry professionals are increasingly required not only in criminal justice systems but also in civil litigation cases involving fraud detection, environmental contamination, food adulteration, and industrial compliance testing. In India, policy developments and legal reforms emphasizing mandatory forensic investigation in serious offences have further strengthened job prospects. Salaries in this field are competitive and improve with experience, specialization, and higher qualifications such as M.Sc. or research degrees.

Overall, the market survey clearly demonstrates that the Forensic Chemistry program is highly relevant, future-oriented, and aligned with national and global workforce needs. It offers strong employability, interdisciplinary exposure, and sustainable career growth, making it a valuable academic offering under the Department of Chemistry.

13. Review and Revision of Regulation

The University reserves the right to interpret, modify, revise, amend, or update any provision, rule, regulation, curriculum structure, evaluation pattern, academic requirement, or operational guideline related to the program from time to time in accordance with University regulations, statutory requirements, industry developments, and academic needs.

In case of any ambiguity or dispute regarding interpretation of any provision of this manual, the decision of the University/Competent Authority shall be final and binding on all stakeholders. Any amendments, additions, or revisions approved by the appropriate academic or statutory bodies of the University shall automatically become applicable to the program.

Annexure 1: Detailed Syllabus

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-1

Subject Code: 101760101	Subject Title: Introduction of Forensic Science
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) To develop a strong foundation in chemical principles and analytical techniques used in forensic investigations, including spectroscopy, chromatography, and toxicology.
- (2) To apply forensic chemistry concepts to real-world criminal cases, such as drug analysis, arson investigations, and trace evidence examination

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Forensic Science: Definition, Introduction , Basic Principles & Significance, History & Development of Forensic Science in India and World, signification and scope of Forensic Science, multi professional and multi personal aspects of forensic science.	10	23%
2	Crime: Definition of crime, history and development, victimology, criminological perspective, characteristics of crime, classification of crimes: atrocity, seriousness, motive, situational & systematic. Professional crime, organized crime, present scenario of crime in India.	11	27%
3	Forensic Ethics: Introduction, Definition, Scope, Ethics in Forensic Science, Professionalism and ethics: Importance of professional ethics, the importance of professional ethics to science practitioners, development of code of conduct and code of ethics for Forensic Science; Application of codes and ethics.	11	27%

4	History and development of Forensic Science: Specific contribution of scientists in the field of Forensic Science. Development of Forensic Science in India. National and international scenario of teaching and research institution in Forensic Science.	10	23%
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Course Outcomes:

- Demonstrate proficiency in using advanced chemical instrumentation (e.g., GC-MS, HPLC, FTIR, AAS) to analyse forensic evidence such as drugs, explosives, and toxic substances.
- Evaluate and interpret chemical data from crime scenes, including trace evidence, arson residues, and biological samples, to support criminal investigations.
- Follow proper chain-of-custody procedures, quality control protocols, and ethical guidelines to ensure the integrity of forensic evidence in legal proceedings.
- Present forensic analysis results effectively through written reports and expert testimony, ensuring clarity and accuracy for law enforcement and courtroom proceedings.

Reference Books:

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed. : Stuart H. James
3. Handbook of Forensic Psychology: Dr. Veerraghavan

List of Suggested Practical

1. Study of animal cell.
2. Study of blood cell.
3. Identification and morphological examination of Toxic plants
4. To determine specific gravity of petroleum products
5. Collection, preservation, handling, physical evidence method of different Crime

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-1

Subject Code: 101760102	Subject Title: Forensic Toxicology
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) Explain the mechanisms of drug and poison action, including absorption, distribution, metabolism, and excretion (ADME), and their effects on the human body.
- (2) Analyze lab results in the context of forensic cases and assess their legal and medical implications.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Forensic Chemistry: Introduction, Colour & Spot test, microcrystal tests, inorganic and organic analysis. Analysis of Beverages: alcoholic and nonalcoholic beverages, country made liquor, illicit liquors, detection and estimation of ethanol.	10	23%
2	Drug of Abuse: Classification of drugs, drugs of abuse in sports. Narcotic drugs and psychotropic substances such as cocaine, cannabis, barbiturates, benzodiazepines, amphetamine, opium, designers drugs. NDPS act.	11	27%
3	Poison: Poison and Types of Poisoning, Action of Poison, Factors Modifying the Action of Poison, Extraction, Isolation and Clean-Up Procedures- For Non-Volatile Organic Poison, Volatile Poisons, Botanical Evidence, Biological Evidence etc.	11	27%
4	Forensic Toxicology: Introduction and scope of Forensic Toxicology, classification of poisons, legal aspects of poisoning, types of poisoning. Antidotes, factors modifying action of poisons, LD-50, ED50, sign and symptoms of common poisons. Collection, preservation of postmortem material for poison analysis;	10	23%

Course Outcomes:

- Perform qualitative and quantitative analysis of drugs, alcohol, poisons, and metabolites in biological specimens (blood, urine, hair) using laboratory techniques.
- Interpret laboratory findings in the context of overdoses, poisoning, DUI, and postmortem investigations, correlating results with pharmacological effects and legal thresholds
- Apply chain-of-custody procedures, quality control measures, and ethical guidelines to maintain the integrity and admissibility of toxicological evidence in legal proceedings.
- Prepare scientifically sound toxicology reports and demonstrate the ability to present and defend analytical results in a courtroom or legal setting as an expert witness.

Reference Books:

1. Essentials of Forensic Medicine and Toxicology" by K.S. Narayan Reddy and O.P. Murty.
2. Forensic Toxicology: Principles and Concepts by Nicholas T. Lappas
3. Casarett & Doull's Toxicology: The Basic Science of Poisons by Curtis D. Klaassen.
4. Principles and Practice of Critical Care Toxicology

List of Suggested Practical

1. To analyze the cement samples.
2. To prepare a case report on arson case.
3. To carry out analysis of explosive substances.
4. To separate explosive substances using thin layer chromatography.
5. To perform adulteration testing of various food samples.
6. To prepare a case report on bomb blast case.
7. To examine petroleum products.
8. To examine ink sample using paper chromatography.

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-1

Subject Code: 10170103	Subject Title: Introductory Microbiology
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidates must have studied core subjects like Physics, Chemistry and Biology at their Higher Secondary level.	

- Course Objective:**
- (1) To explain the History, Scopes, Branches and Basics of microbiology.
 - (2) To explain the habitats and impart the knowledge regarding the pure culture techniques.
 - (3) Clear the concepts of cultivating various microorganisms on different types of media.
 - (4) To explore the preservation techniques for maintaining routine cultures.
 - (5) To impart information regarding various national and international culture collection centers.
 - (6) To train the students in staining techniques and clear the concepts of Microscopy.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuou s Assessment	University Assessment	Continuou s Assessment	
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr . N o	Topic	Tota l Hour s	Weight (%)
1	History and Scope of Microbiology: Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Role of microorganisms in fermentation, Germ theory of disease. Development of various microbiological techniques and golden era of microbiology. Development in the field of soil microbiology: Contributions of Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A. Waksman. Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Elie Metchnikoff, Edward Jenner.	15	33%

	Branches and Scopes in Microbiology		
2	Habitats of Microorganisms: Soil, Water, Air and others. Pure culture Techniques and Cultivation: Pure culture Techniques: Definition of Pure culture and Axenic culture, Mix culture, Methods for Pure culture techniques: Striking, Spreading, Serial Dilutions, Pour Plate methods. Cultivation of Anaerobic Bacteria. Culture Media: Principles of Media Formulation, Media Ingredients, Types of Media: Natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media, Sterilization. Culture Collection Centers. Preservation Techniques: Preservation of industrially important organism: Principle, methods and quality control.	15	34%
3	Techniques used to study microorganisms: Microscopy: Principles of Microscopy, magnification and resolving power, Light microscopy: Simple and compound microscope, bright field and dark field microscopy, Principles and applications of phase contrast, fluorescent and Electron microscopy. Staining: Dyes and stains: Definition, acidic, basic dyes and leuco compounds. Smear: Fixation, use of mordents, intensifiers and decolorizers Mechanism of staining. Types of staining: Simple and differential staining.	15	33%

Course Outcome: After completion of this course, student will be able to

1. Comprehend historical developments/branches and scopes in the field of Microbiology.
2. Comprehend various habitats of microorganisms.
3. Prepare Media in Laboratory and learn the basic skills of isolation and cultivation of microorganisms in laboratory.
4. Preserve Microbial cultures on various media.
5. Explain principles and working pattern of Microscopes.
6. Learn aspects of staining techniques, various dyes and smear preparation.

List of Text Books:

1. Dr. C. B. Powar and Dr. H. F. Dagainawala, (2010), General Microbiology Volume-I. 2nd edn. Himalaya Publishing House.
2. Dr. C. B. Powar and Dr. H. F. Dagainawala, (2010), General Microbiology Volume-II. 2nd edn. Himalaya Publishing House.
3. Pelczar Jr, M J, Chan E C S, Krieg N R, (2023), Microbiology: An Application-Based Approach, 5th edn. McGraw-Hill Book Company, NY.

List of Reference Books:

1. Atlas R M, (2015), Principles of Microbiology, 2nd Edition, McGraw Hill education, Mumbai.
2. Ingraham J. L. and Ingraham C. A. Introduction to Microbiology: Thomson Brooks/Cole.
3. Microbiology: an introduction- Tortora, G.J., Funke, B.R. and Case, C.L.
4. Stanier, R.Y., Ingraham J. L., Wheelis, M. L. (1999). General Microbiology, 5th Edition, Palgrave Macmillan.

Open e-Resource:

- Swayam Portal: General Microbiology - Course (swayam2.ac.in)
- OpenStax: Microbiology – OpenStax
- <https://microbenotes.com/>

<https://www.microbiologybook.org>

List of Suggested Experiments

1. Awareness and knowledge of Lab apparatus. Dos and Don'ts-Criteria to be followed – Lab Discipline – Biosafety, Washing, Cleaning and preparation of glassware for sterilization. Disposal of laboratory waste and cultures. Preparation of standard solutions. Good Laboratory Practices. Good Documentation Practices.
2. Study of principles and working of laboratory instruments: Light microscope, Autoclave, Hot air oven, Incubator, Water-bath, Laminar Air Flow chamber, Rotary shaker, pH meter, Spectrophotometer/Colorimeter, Centrifuge, Refrigerator, Colony counter.
3. Basic Microbe handling techniques:
 - a. How to inoculate Needles and wire loops
 - b. Preparing suspensions
 - c. Inoculating/transferring cultures
 - d. Handling petri plates
 - e. Incubating petri dishes, slants and broths
 - f. Preparing smear
 - g. Preparing serial dilutions
4. Study of Hay infusion.
5. Staining of Bacteria: Simple staining: Positive staining, Negative staining. Differential staining: Gram staining.
6. Preparation of Nutrient media: Nutrient agar and Nutrient broth.
7. pH adjustment of media by use of pH strip and pH meter.
8. Isolation and cultivation methods for bacteria from water, soil, curd and surface of table.
Cultivation methods for bacteria:
 - a. Broth culture
 - b. Agar slope/slant culture

- c. Agar plate method
 - i. Streak plate method
 - ii. Pour plate method
 - iii. Spread plate method
 - iv. Serial Dilution method
 - d. Cultivation of Anaerobic Bacteria.
9. Preservation Techniques:
- a. Periodic sub culturing and storage at refrigeration temperature
 - b. Preservation in soil (fungi/Azotobacter)
10. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-1

Subject Code: 10170105	Subject Title: Astrology-1
Pre-requisite:	

Course Objective:

1. To introduce the basic principles, origin, development, and key texts of astrology.
2. To understand the astrological view of the universe and its applications in various fields.

Teaching Scheme (Hours per week)			Credit	Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical		Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	-	-	04	50	50	-	-	100

Subject Contents			
Sr. No	Topics	Total Hours	Weight (%)
1	Astrology Introduction Origin Development of Astrology	10	23%
2	Elements of Astrology Siddantha Samhitha Hora	11	27%
3	Concept of Universe Word Solar family Earth	11	27%
4	Applications of Astrology Social Environmental Health and Education	10	23%

Course Outcome: After completion of this course, students will be able to

1. Understand the origin, development, and core elements of astrology, including key texts like Siddantha, Samhitha, and Hora.
2. Describe the astrological universe and the roles of the solar family and Earth.
3. Identify and analyze essential astrology components and terminology.
4. Evaluate astrology's applications in social, environmental, health, and education fields.

Textbooks

1. "Brihat Samhita" by Varahamihira
2. "Surya Siddhanta" (Translation by Ebenezer Burgess or modern Indian authors)
3. "Brihat Parashara Hora Shastra" by Maharishi Parashara
4. "Essentials of Astrology" by Komilla Sutton

Reference Books

1. "Light on Life: An Introduction to the Astrology of India" by Hart de Fouw & Robert Svoboda
2. "Astrology and Science" by B.V. Raman
3. "Phaladeepika" by Mantreswara
4. "Indian Astrology" by B.V. Raman

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-2

Subject Code: 101760201	Subject Title: Introduction of Forensic Science-II
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) To develop a strong foundation in chemical principles and analytical techniques used in forensic investigations, including spectroscopy, chromatography, and toxicology.
- (2) To apply forensic chemistry concepts to real-world criminal cases, such as drug analysis, arson investigations, and trace evidence examination

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Introduction to Crime Scene Crime scene: Definition; Types of crime scenes: Primary, Secondary, Indoor, Outdoor, based on manner of crime: homicide, suicide, accidental; Actions of first responding officer: emergency care, secure and control, Statements of victim, witness, suspects, databases and records, officer safety, release scene to appropriate authorities.	10	23%
2	Crime Scene Investigation Securing the crime scene; Evaluating the crime scene; Preliminary walk-through and documentation of the crime scene; Search and seizure of the crime scene; Crime scene search patterns: strip method, grid method, zone/quadrant method, spiral method (inward and outward), wheel, and random	11	27%
3	Documenting the Crime Scene Photography of the crime scene: Wide range, mid-range and close up photography; Sketching: Rough and final sketch (Triangulation, Baseline, and polar coordinate methods), Videography, notes. Identifying and listing evidence along with their evidentiary value.	11	27%
4	Crime Scene Evidence	10	23%

	Evidence- Definition; Types of evidence found in the crime scene: according to the Indian Evidence Act; based on the nature of evidence- physical evidence, biological evidence, digital evidence, individual evidence, and class evidence. The evaluation of 5Ws (who?, what?, when?, where?, why?) and 1H (how), Frye case and Daubert standard.		
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Course Outcomes:

- Explain the concept, types, and classification of crime scenes and describe the duties and responsibilities of the first responding officer in scene management and preservation.
- Apply systematic crime scene investigation procedures including securing, preliminary walk-through, search and seizure, and selection of appropriate search patterns.
- Demonstrate effective documentation of crime scenes through photography (wide, mid-range, close-up with scale), sketching (triangulation, baseline, polar coordinate methods), videography, and proper note-taking.
- Classify and evaluate different types of evidence in accordance with the Indian Evidence Act, and assess admissibility using principles of 5Ws & 1H, and standards laid down in Frye and Daubert

Reference Books:

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed. : Stuart H. James
3. Handbook of Forensic Psychology: Dr. Veerraghavan

List of Suggested Practical

1. To identify and classify the provided crime scene case
2. To demonstrate the crime scene search pattern- Mock Drill
3. Learn to document evidence properly- Crime scene photography
4. Learn crime scene sketching
5. Identification and classification of evidence.
6. Application of 5Ws and 1H in Crime Scene Investigation

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-2

Subject Code: 101760202	Subject Title: Forensic Toxicology-II
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) Explain the mechanisms of drug and poison action, including absorption, distribution, metabolism, and excretion (ADME), and their effects on the human body.
- (2) Analyze lab results in the context of forensic cases and assess their legal and medical implications.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit					Total
Lecture	Tutorial	Practical		Theory		Practical		
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01	04	50	50	25	25	150

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Animal Poisons Snake- Poisonous snakes and non-poisonous snakes, Russell's viper, Rattle snakes, Pit viper, Cobras, kraits, Sea snakes, common poisonous snakes, poison gland and fangs, components of snake venom, Colubrine bite and viperine bite, diagnosis, first aid, treatment, absorption, excretion, post-mortem appearances; Cantharides; Scorpions, Spiders, Bees and Wasps; Centipedes, Ants	10	23%
2	Plant Poisons Plant Poisons- <i>Ricinus communis</i> (Castor); <i>Croton Tiglium</i> (Jamalgota); <i>Abrus precatorius</i> ; <i>Semecarpus anacardium</i> ; Ergot; Calotropis; Dhatura/Datura; Opium; Cannabis; Cocaine; <i>Strychnos nux-vomica</i> ; <i>Digitalis purpurea</i> ; <i>Nerium Odorum</i> ; <i>Cerbera Thevetia</i> ; <i>Nicotiana Tabacum</i> ; Distribution; Toxic Parts; Identification of Seeds; Active Principle; Medico-legal Aspects	11	27%
3	Inorganic Metal Poisons Inorganic Metal Poisons- Arsenic, Mercury, Cyanides, Lead, Copper, Thallium: Nature; forms and uses; administration; mode of action; signs and symptoms; post mortem findings; fatal dose; fatal period; detection; toxicological materials.	11	27%
4	Corrosive Poisons	10	23%

	Corrosive Poisons- Sulphuric acid, Vitriolage, Hydrochloric acid; Nitric acid; Oxalic acid and Carbolic acid; Nature; Fatal dose; fatal period; signs and symptoms; Treatment; Cause of death; Post-mortem appearance, Circumstances of poisoning.		
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Course Outcomes:

- Classify and describe major animal poisons, including venomous and non-venomous snakes (e.g., Russell's viper, cobras, kraits, sea snakes), arthropods and insects, explaining their toxic components, mode of action, clinical features, first aid, treatment, and post-mortem findings.
- Identify and explain important plant poisons such as Ricinus communis, Abrus precatorius, Datura, Opium, Cannabis, Digitalis purpurea, Nerium, and others, with reference to toxic parts, active principles, identification, symptoms, and medico-legal importance.
- Analyze the toxicological aspects of major inorganic metal poisons (arsenic, mercury, cyanides, lead, copper, thallium) including nature, forms, mode of action, fatal dose and period, signs and symptoms, post-mortem findings, and laboratory detection methods.
- Evaluate the toxic effects and medico-legal significance of corrosive poisons, including fatal dose, fatal period, clinical features, treatment, cause of death, post-mortem appearances, and circumstances of poisoning.

Reference Books:

1. Essentials of Forensic Medicine and Toxicology by K.S. Narayan Reddy and O.P. Murty.
2. Review of Forensic Medicine and Toxicology by Gautam Biswas
3. Forensic Toxicology: Principles and Concepts by Nicholas T. Lappas
4. Casarett & Doull's Toxicology: The Basic Science of Poisons by Curtis D. Klaassen.
5. Principles and Practice of Critical Care Toxicology

List of Suggested Practical

1. Introduction to laboratory glassware
2. Introduction to laboratory instruments
3. Detection of heavy metals by titration
4. Blood group detection
5. Identification of Poisonous and Non-Poisonous Snakes
6. Visit the herbarium to identify poisonous plants

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-2

Subject Code: 10170203	Subject Title: Nutritional Pattern in Microorganisms
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Chemistry and Biology at their Higher Secondary level and he/she may have complete Certificate Course (First Year, B.Sc.) with Basic Microbiology and Chemistry subjects.	

Course Objective:

- (1) To make the students to understand the physiology of microbes in detail.
- (2) To make students aware about the nutritional pattern of microbes and their mode of nutrition uptake.
- (3) To make students learn about basics of enzymes and other biomolecules.
- (4) To teach student Microbial Growth pattern.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuou s Assessment	University Assessment	Continuou s Assessment	
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Microbial Nutrition and Growth supporting conditions: Culture media: Types of culture media: Routine and specialized media; Selective media, differential media, enriched media, enrichment media, enumeration media, assay media and maintenance media. Modes of nutritional uptake: a. Entry of nutrition in the cell, passive diffusion, facilitated diffusion and active transport b. Utilization of nutrients that cannot enter the cell. Classification of bacteria on the basis of growth supporting environmental factors such as oxygen, temperature, pH, osmotic pressure, salt and hydro static pressure.	15	33%

2	Microbial growth: Methods of reproduction in bacteria and new cell formation: Microbial Growth: a. Introduction to growth rate, generation time b. 15 Criteria for growth measurement: Cell mass and cell number, methods of c. their measurement d. Normal growth curve of bacteria e. Continuous growth and synchronous growth.		33%
3	Enzymes: General introduction: a. Physical and chemical properties b. Structure of enzymes: Prosthetic group, apoenzyme, coenzymes, cofactors c. Localization of enzymes: Extra cellular and intra-cellular d. Nomenclature and classification of enzymes, IUB system of enzyme classification. Enzyme action: a. Active sites of enzymes b. Mechanism of enzyme action c. Factors affecting enzyme activity d. Inhibition of enzyme activity: Competitive and non-competitive.	15	34%

Course Outcome: After completion of this course, student will be able to

1. Understand the concept of Nutrition of the Bacteria and develop an understanding of growth and various parameters affecting to the growth also get the information about how bacterial cell uptake nutrition from the media, Students will understand Classification of bacteria on the basis of different parameters.
2. Students will Gain knowledge about the properties of enzymes and how it works& what is the structure of enzyme, Role of enzymes in Microbial cell also students can learn about what factors will affect the optimum activity of enzymes and how enzymes can inhibit their over acting activity
3. Also, by this paper learning students will aware profoundly about how bacteria and other Microbial cell can reproduce, how new cell formation process will occur, what is growth, how growth can be measured, how was the life cycle of bacteria, what are different types of growth.
4. Basic understanding of bio-molecules and their role in metabolism.

List of Text Books:

- Microbial physiology (4th ed.) Moat, A.G., Foster, J, W., and Spector, M. P. Wiley, Liss. New York; 2002.
- Pelczar Jr, M J, Chan E C S, Krieg N R, (2023), Microbiology: An Application Based Approach, 5th edn. McGraw-Hill Book Company, NY.

List of Reference Books:

- Bacterial Metabolism. (2nd ed.) Gerhardt, G. Springer, 1986.
- Bacterial Physiology and Metabolism. Sokatch, J. R. (2014). Academic Press, New York.
- Biochemistry and Physiology of microorganisms (3rd ed.) David White. Oxford University Press; 2007.

- Black J G, (2015) Microbiology: Principles and Explorations, 9th edn, John Wiley and Sons, Inc. NY.
- Brock's Biology Microorganisms (14th ed.) Madigan, M.T., Martinko, J. M., Bender, K.S., Buckley, D.H., Stahl, D. A., Benjamin Cummings.
- Ingraham J L, and Ingraham, C L, (2000) Introduction to Microbiology, 2nd edn, Brooks/Cole, Singapore.
- Lehninger's Principles of Biochemistry. (8th ed.) Nelson, D.L. & Cox, M. W. H. Freeman & Co. NY; 2021.

Open e-Resource:

- <https://www.onlinebiologynotes.com/>
- <https://microbiologynotes.org/>
- <https://www.easybiologyclass.com/>
- <https://microbiologyinfo.com/>
- <https://thebiologynotes.com/>

List of Suggested Experiments

- 1. Study of different types of media:**
 - A. Selective media: Rose Bengal agar medium
 - B. Differential medium: MacConkey's agar medium, EMB agar medium, Triple sugar iron agar medium
 - C. Enrichment media: Selenite broth
 - D. Enriched media: Blood agar medium, Glucose yeast extract agar medium
 - E. Natural media: Soil extract agar medium.
- 2. Qualitative analysis of biomolecules:**
 - A. Carbohydrates: Iodine test, Molisch's test, Benedict's test, Barfoed's test, Bial's test
 - B. Protein: Biuret test, Ehrlich's test, Glyoxilic acid test and Xanthoproteic test.
- 3. Study of effect of Environmental factors on growth of bacteria:**
 - A. Study the effect of heavy metal on the growth of bacteria.
 - B. Study the effect of temperature on the growth of the bacteria.
 - C. Study the effect of pH on the growth of the bacteria.
 - D. Study the effect of osmotic pressure on the growth of the bacteria.
 - E. Study the effect of UV light on the growth of the bacteria.
- 4. Study of Biochemical reactions:**
 - A. Based on Carbon source
 - i. Oxidative and fermentative breakdown of glucose
 - ii. Fermentation of Sugars: Glucose, Xylose, Mannitol, Lactose, Maltose and Sucrose
 - iii. Glucose breaks down products: Methyl red test and Voges Proskauer's test
 - iv. Citrate utilization test
 - v. Starch utilization test
 - vi. Lipid utilization test.
 - B. Based on Nitrogen source
 - i. Indole production test
 - ii. H₂S production test
 - iii. Urea utilization test
 - iv. Casein hydrolysis test
 - v. Gelatin Hydrolysis test
 - vi. Deamination test
 - vii. Ammonia production test
 - viii. Nitrate reduction test.
 - C. Other tests
 - i. Catalase test
 - ii. Dehydrogenase test
 - iii. Oxidase test.
- 5. Methylene Blue Reduction Test of milk samples (MBRT).**
- 6. Isolation and characterization of spoilage microorganisms from vegetable/fruit/milk-milk products.**
- 7. Preparation of Yoghurt/curd/probiotic curd/probiotic lassi using pure culture.**

8. Standard plate count from vegetables and fruit juices, milk-milk products, soft drink (Any available in Market).

GANDHINAGAR INSTITUTE OF SCIENCE
B.Sc. Forensic Chemistry
Semester-2

Subject Code: 10170205	Subject Title: Agriculture Business Management
Pre-requisite: Candidate must have achieved regular 10+2 degree from any recognized Board.	

Course Objective: (1) To expose learners to the environment in which the agri-business is conducted.

(2) Focus will be on understanding micro and macro environmental forces and their impact on agri-business.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	-	-	04	50	50	-	-	100

Subject Contents			
Sr. No	Topics	Total Hours	Weight (%)
1	Agri-business: Meaning, definition, history and scope of agri-business (Input, Farm Product Sectors). Importance of agri-business in the Indian economy. Changing dimension of agricultural business. Agri-business Management-distinctive features, nature and components.	15	25%
2	Structure of Agriculture - Linkages among sub-sectors of the Agribusiness sector; economic reforms and Indian agriculture; impact of liberalization, privatization and Globalization on Agri business sector. Emerging trends in production, processing, marketing and exports; policy controls and Regulations relating to the industrial sector with specific reference to agro-industries.	15	25%

3	Role of agriculture in Indian economy; problems and policy changes relating to farm Supplies, farm production, agro processing, agricultural marketing, agricultural finance etc. in the country. Demand and Supply: Definition, Meaning, Laws, Factor affecting, Types, Determinants. Elasticity: Definition, Types Natural Resource Economics.	15	25%
4	Agricultural Economics: Meaning, Definition, Scope and Importance of Agricultural Economics Basic Concepts: Goods, Services, Utility, Value, Price, Wealth, and Welfare, Consumption Wants: Meaning, Characteristics, Classification of Wants, Importance.	15	25%

Course Outcome: After completion of this course, student will be able to

1. Understand the fundamentals of management with reference to agribusiness.
2. Acquaint with various functional areas of agribusiness.
3. Study the managerial functions and its applications with reference to agribusiness.
4. Learn the concepts and process of Planning and Organizing.
5. Provides knowledge about the Staffing, Directing and Control.

List of Reference Books:

1. Freddie L. Barnard, Jay T. Akridge, Frank J. Dooley, Agribusiness Management (Environmental and Agricultural Economics), 2010.
2. John B. Penson, Oral Capps, C. Parr Rosson, Richard T. Woodward, Introduction to Agricultural Economics, Pearson, 2019.
3. W.J. Obst, R. Graham & G. Christie, Financial Management in Agribusiness, Scientific Publishers, 2010.

Gandhinagar Institute of Science
B.Sc. Forensic Chemistry
Semester-2

Subject Code: IKS0201	Subject Title: Indian Ancient History and Cultural Heritage
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Course Objective:

- Foster an appreciation for the composite nature of Indian history, culture and heritage.
- Instill a sense of love and belonging among learners, contributing to nation-building efforts.
- Provide an overview of various components of cultural heritage, including fairs, festivals, dances, art, architecture, and historical landmarks, which are crucial for a deeper understanding of history.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
01	0	2	02	0	25/ Project	25/ Project		50

Subject Contents			
Sr. No	Topics	Total Hours	Credit
1	Indian Ancient History: Introduction of Ancient India. Harappan Civilization. Rigvedic & Later Vedic Period. India in the 6th Century B.C. Persian and Greek invasions and its impact. Mauryan and Gupta Periods. Post – Mauryan. Brief History of the Sanskrit literature: The Vedas, The Brahmanas and Upanishads & Sutras, Epics: Ramayana and Mahabharata & Puranas.	15	1
2	Indian Cultural Heritage: Ethnic Indian Cultural Construct – Fairs & Festivals and their historical background. Indian dances as Cultural Heritage. Indian Architecture: Temples, Stupas, Caves, Chaityas. Medieval Architecture and Colonial Architecture. Social culture in India- Vedic culture. Ancient period- varna and jati, family and marriage in India, position of women in ancient India, Contemporary period; caste system and communalism.	15	1

Course Outcome: After completion of this course, students will be able to

- Demonstrate knowledge of the key events, periods, and figures that have shaped Indian history from ancient to modern times, including their impact on the socio-political and economic landscape.
- Analyze the rich cultural heritage of India, including art, architecture, literature, and philosophy, while recognizing the contributions of various communities to India's pluralistic society.

List of Text Books:

1. An advanced history of India – causes and decline of Guptas by B.C. Majumdar and others, 1967, Macmillan.
2. Ancient India by R.C. Majumdar, 1977, Motilal Banarasi Das.
3. History of Ancient India by Rama sankar Tripathi, 1942, Motilal Banarasi Das.
4. History and culture of India to 1000 A.D. by H.V. Srinivasa Murthy, 1980, S. Chand and Co.
5. History of South India by K.A. Nilakanta Sastry 1976, Oxford University Press.
6. History of Ancient India by Krishnaswamy Aiyangar, 1980, Seema Publishers.
7. Ancient India by V.D. Mahajan, 1985, S.Chand and Company.
8. Advance History of India by K.A. Nilakantasastry and C.S.Srinivasachari, 1980, Allied Publishers.
9. Ancient Indian History and Civilization by Silendranath Sen, 1988, Wiley Eastern.
10. Lothal and Indus Civilizations by S.R.Rao, 1972, Asia Publishers, Madras

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-3

Subject Code: 101760301	Subject Title: General Biology
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

(1) To provide fundamental knowledge of cell biology, human body systems, genetics, endocrinology, and biochemistry, enabling students to understand the structure, function, and biological significance of biomolecules, cells, and human physiological systems.

(2) To develop an understanding of the application of biological and biochemical principles in forensic science, including genetic identification, blood group analysis, hormonal investigations, and other biological evidence used in forensic investigations.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	-	-		50	50			

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Basic Cell Structure Prokaryotic and eukaryotic cells; Animal and plant cells; Basic cell structure and Cell organelles: Structure and function of Mitochondria, Ribosomes, Chloroplasts, Endoplasmic Reticulum, Golgi apparatus, Nucleus, Lysosome, Plasma membrane, Cell wall, An overview of cell cycle and cell division- mitosis and meiosis, Programmed cell death, Necrosis; Importance of cells and tissues in forensic identification.	10	23%
2	Human Body Systems Structure and functions of major human systems: Digestive system- alimentary canal and accessory digestive organs like liver, gall bladder, pancreas; Circulatory system- Structure of heart, Double circulation, Composition of blood, Blood vessels- Arteries, Veins and Capillaries; Nervous system- Central nervous system and peripheral nervous system, Structure of neurons, types of neurons- sensory, motor and relay neurons, Structure of brain; Importance of human body system in forensic science.	11	27%
3	Genetics and Human Biology	11	27%

	Basic Genetics; Mendel's laws of inheritance; Monohybrid and dihybrid crosses; Chromosomal theory of inheritance; Human Genetics-Blood group systems (ABO and Rh factor); Sex determination in humans; Genetic disorders- single gene disorder (Sickle Cell Anemia, Cystic Fibrosis, Hemophilia, Huntington's Disease), Chromosomal anomalies (Down Syndrome-Trisomy 21, Turner Syndrome-XO, Klinefelter Syndrome-XXY, Cri du Chat Syndrome); Forensic Relevance- Blood group identification in forensic science, Paternity testing, Identification of missing person, Genetic markers in identification		
4	Endocrine Glands, Hormones and their Forensic Implications Endocrine and exocrine glands, Hormones, Major endocrine glands- Structure, location and hormones secreted by the pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and gonads; Hormonal Regulation and Feedback Mechanisms- positive and negative feedback mechanisms; role of hormones in forensic investigations- sex determination, pregnancy test, detection of hormonal drug abuse, steroid abuse, investigation of sexual assault cases.	10	23%

Course Outcomes:

- Explain the structure and functions of prokaryotic and eukaryotic cells, major cell organelles, cell cycle and cell division, and evaluate the role of cells and tissues in forensic identification.
- Describe the structure and functioning of major human body systems including digestive, circulatory and nervous systems, and interpret their significance in forensic investigations.
- Understand the basic principles of genetics and human inheritance, analyze blood group systems and genetic disorders, and apply genetic concepts in forensic identification, paternity testing, and missing person identification.
- Explain the structure and functions of endocrine glands and hormonal regulation, and evaluate the forensic implications of hormones in cases such as sex determination, pregnancy testing, steroid abuse, and sexual assault investigations.

Reference Books:

1. An Introduction to Forensic Science – by Richard Saferstein
2. Textbook of Forensic Medicine and Toxicology – by K. S. Narayan Reddy and O. P. Murty

3. Principles of Anatomy and Physiology – by Gerard J. Tortora & Bryan H. Derrickson, Wiley.
4. Genetics: A Conceptual Approach - by Benjamin A. Pierce
5. Forensic Biology – by Richard Li
6. Forensic Science in Criminal Investigation and Trials- by B. R. Sharma
7. Forensic Science: An Introduction to Scientific and Investigative Techniques- by Stuart H. James
8. Review of Forensic Medicine and Toxicology by Gautam Biswas

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-3

Subject Code: 101760302	Subject Title: Biochemistry
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

(1) To develop a fundamental understanding of the structure, properties, and functions of major biomolecules—carbohydrates, proteins, nucleic acids, and lipids—and their significance in biological evidence encountered in forensic investigations.

(2) To enable students to apply biochemical principles in forensic science, particularly in the identification, analysis, and interpretation of biological materials such as DNA, body fluids, and cellular components used in forensic examination and criminal investigations.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	-	-		50	50			

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Carbohydrates Occurrence; Biological importance; Classification of carbohydrates- monosaccharides, oligosaccharides, and polysaccharides; Structure of glucose, fructose and galactose; Disaccharides- structure of maltose, sucrose, lactose; D and L isomers, Optical activity of carbohydrates, Racemic mixture; epimers and enantiomers.	10	23%
2	Proteins Basic Structure of amino acids, Classification of amino acids, dipeptide formation, Protein organizational Hierarchy- Primary, Secondary, Tertiary and Quaternary Structure; Physical and Chemical Properties of amino acids; Zwitterion and Isoelectric pH; Functions of Proteins.	11	27%
3	Nucleic acids Basic Structure of DNA and RNA- Nucleosides, Structure of Nucleotide, Deoxyribose Sugar, Ribose Sugar, Nitrogenous bases- Purines and Pyrimidines, Double Helical Structure of DNA, Structure of RNA, Types of DNA and RNA and their functions, Contribution of Rosalind Franklin and Watson and Crick, Functions of DNA and RNA.	11	27%

4	Lipids Basic Structure of Lipids, Classification and Biological Functions; Saturated and Unsaturated Fatty Acids; Role of lipid in Membrane Structure; Fluid Mosaic Model; Transport of Small Molecules- Passive and Active Transport, Transport of Macromolecules- exocytosis, endocytosis, phagocytosis, and pinocytosis.	10	23%
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Course Outcomes:

- Explain the structure, classification and biochemical properties of carbohydrates and proteins and interpret their importance in biological evidence such as blood, saliva and other body fluids in forensic investigations.
- Describe the structure and functions of nucleic acids (DNA and RNA) and evaluate their role in forensic DNA analysis, individual identification, paternity testing and criminal investigations.
- Analyze the structure and biological functions of lipids and biomembranes, and relate their role in cell membrane integrity and transport mechanisms relevant to forensic toxicology and cellular evidence analysis.
- Apply the fundamental concepts of biomolecules (carbohydrates, proteins, nucleic acids and lipids) to understand the biochemical basis of biological samples encountered at crime scenes and their relevance in forensic laboratory analysis.

Reference Books:

6. Biochemistry – U. Satyanarayana & U. Chakrapani
7. Criminalistics: An Introduction to Forensic Science – Richard Saferstein
8. Principles of Biochemistry – David L. Nelson & Michael M. Cox
9. Biochemistry – Debajyoti Das

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-3

Subject Code: 101760303	Subject Title: Forensic Practical-I
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) To develop basic laboratory skills in biochemical and biological techniques, including estimation and qualitative analysis of biomolecules, chromatography, spectrophotometry, and microscopic examination of plant and animal cells.
- (2) To enable students to understand and apply experimental methods for analyzing biological samples, and to interpret results relevant to physiological studies and the examination of biological evidence in forensic science.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
-	-	8		-	-	50	50	

Subject Contents

Sr. No	Topics		Weight (%)
1.	Estimation of amino acid by titration Determination of pH of different solutions Slide preparation of animal cells using human cheek cells Slide preparation of plant cell Estimation of protein by Lowry method using UV-Visible spectrophotometer or colorimeter. Qualitative tests for carbohydrate, proteins and fats Amino acid separation by using TLC or Paper Chromatography and calculation of R _f value. Urea detection by TLC Determination of viscosity of sugar solutions. Observation of pollen grains under microscope Demonstration of a pregnancy test by using kit. Measurement of pulse rate and blood pressure before and after physical activity Preparation and observation of Pollen grain germination Slide. Study of mitosis in onion root tips	15	100%

Course Outcomes:

- Demonstrate basic laboratory skills in the qualitative and quantitative analysis of biomolecules such as carbohydrates, proteins, amino acids, and urea using biochemical techniques like titration, chromatography, and spectrophotometry.
- Perform microscopic examination of plant and animal cells, including human cheek cells, blood cells, pollen grains, and mitotic stages, to understand cellular structure and biological processes relevant to biological evidence analysis.
- Apply fundamental biochemical and physiological techniques such as pH determination, viscosity measurement, and pregnancy testing, and interpret their significance in biological and forensic investigations.
- Develop skills in observation, data recording, and interpretation of experimental results, enabling the identification and analysis of biological materials that may serve as evidence in forensic science.

Reference Books:

1. Biochemical Methods – S. Sadasivam & A. Manickam
2. Practical Biochemistry – David T. Plummer
3. Introductory Practical Biochemistry – S. K. Sawhney & Randhir Singh
4. Practical Biochemistry – Keith Wilson & John Walker
5. Experiments in Microbiology, Plant Pathology and Biotechnology – K. R. Aneja
6. Practical Human Physiology – C. L. Ghai
7. Practical Zoology – P. S. Verma & V. K. Agarwal
8. Practical Botany – B. P. Pandey
9. Forensic Biology – Richard Li
10. Criminalistics: An Introduction to Forensic Science – Richard Saferstein

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-3

Subject Code: 10170308	Subject Title: Astrology-II
Pre-requisite:	

Course Objective:

1. To study the traits and scientific aspects of planets, signs, houses, and aspects with critical thinking.
2. To build skills in natal chart reading using concepts from prediction, psychology, and neuroscience.

Teaching Scheme (Hours per week)			Credit	Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical		Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	-	-	04	50	50	-	-	100

Subject Contents				
Sr. No	Topics	Total Hours	Weight (%)	
1	Planets Introduction Characteristics Scientific aspects	10	23%	
2	The Zodiac: Understanding the 12 Signs Introduction Characteristics Relative analysis with Science	11	27%	
3	Houses and Aspects Introduction Characteristics Critical Thinking & Skepticism	11	27%	
4	Reading a Natal Chart Introduction Characteristics Prediction, Psychology and Neuroscience	10	23%	

Course Outcome: After completion of this course, students will be able to

- Understand the traits and scientific aspects of planets, signs, houses, and aspects.
- Analyze zodiac signs from both traditional and scientific viewpoints.
- Use critical thinking to evaluate houses and other astrological concepts.
- Interpret natal charts using astrology, psychology, and neuroscience.

Textbooks

1. "Planets in Transit" by Robert Hand
2. "The Only Astrology Book You'll Ever Need" by Joanna Martine Woolfolk
3. "Astrology for the Soul" by Jan Spiller

Reference Books

1. "Cosmos and Psyche" by Richard Tarnas
2. "Aspects in Astrology" by Sue Tompkins
3. "The Inner Sky" by Steven Forrest
4. "Psychological Astrology: A Synthesis of Jungian Psychology and Astrology" by Karen Hamaker-Zondag
5. "Houses: Temples of the Sky" by Deborah Houlding

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-4

Subject Code: 101760401	Subject Title: Molecular Biology
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

(1) To develop understanding of molecular biology concepts such as DNA structure, replication, transcription, and translation, and their significance in forensic DNA analysis and identification techniques.

(2) To relate genome organization and gene expression mechanisms with modern forensic applications such as DNA profiling, genetic identification, and molecular evidence analysis in criminal investigations.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Genome and its organization Nucleic acid as the genetic material- Griffith's experiment, Avery MacLeod and McCarty's experiment, Hershey-Chase experiment; Importance of molecular biology; central dogma of molecular biology; Introduction to genetic material (DNA and RNA), DNA as genetic material; Watson and Crick model of DNA Structure; A, B and Z forms of DNA; gene, coding sequence, regulatory sequence, intron, exon, Nucleosome structure and packaging of DNA into higher order structures, chromatids, chromosomes.	10	23%
2	DNA Replication in Prokaryotes Features of DNA Replication, Proof of the semiconservative nature of DNA replication, features of bidirectional DNA replication. Mechanism of bidirectional DNA replication- initiation, elongation and termination; role of different enzymes used in DNA replication- helicases, polymerases, Primase, gyrase, topoisomerase, SSB proteins, DNA clamps, Ligases, and telomerase.	11	27%

3	Transcription in Prokaryotes Transcription in prokaryotes- Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains; Genetic code, properties of genetic code, Wobble hypothesis, triplet codon	11	27%
4	Translation in Prokaryotes Components of Protein Synthesis Machinery- messenger RNA, tRNA structure and function, Charging of tRNA, aminoacyl tRNA synthetase, Ribosome structure and assembly, Mechanism of Protein Synthesis in Prokaryotes- initiation, elongation and termination. Regulation of transcription in prokaryotes: The lac operon- the elements of lac operon, regulation; The trp operon- the elements of trp operon, regulation	10	23%

Course Outcomes:

- Explain the structure and organization of DNA and genome and relate these concepts to forensic DNA typing and genetic evidence analysis.
- Describe the molecular mechanisms of DNA replication, transcription, and translation and understand their role in DNA-based forensic technologies.
- Interpret the genetic code and gene regulation mechanisms and apply this knowledge in understanding genetic variations used in forensic identification.
- Apply principles of molecular biology to explain the scientific basis of forensic DNA profiling, paternity testing, and molecular evidence evaluation in criminal investigations.

Reference Books:

1. Molecular Biology of the Gene – James D. Watson et al.
2. Molecular Biology of the Cell – Bruce Alberts et al.
3. Molecular Biology – Robert F. Weaver
4. Lehninger Principles of Biochemistry – David L. Nelson & Michael M. Cox
5. Forensic DNA Typing – John M. Butler
6. Forensic DNA Typing: Biology, Technology and Genetics of STR Markers – John M. Butler
7. Introduction to Forensic DNA Analysis – William Goodwin, Adrian Linacre & Sibte Hadi
8. Forensic Science: An Introduction to Scientific and Investigative Techniques – Suzanne Bell

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-4

Subject Code: 101760402	Subject Title: Forensic Law
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

- (1) To develop understanding of fundamental legal principles, criminal justice system, and relevant provisions of the Indian Penal Code (IPC) and Criminal Procedure Code (CrPC) applicable in forensic investigations.
- (2) To familiarize students with the role of forensic experts in the legal system, including evidence handling, expert testimony, and interpretation of forensic findings under the Indian Evidence Act and special criminal laws.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1	Fundamentals of Law and Criminal Justice System Definition of Law, Court, Judge, Basic Terminology in Law, Introduction to Criminal Procedure Code, FIR, Difference between civil and Criminal Justice, Object of Punishment, Kinds of Punishment, Primary and Sanctioning Rights Primary and Secondary functions of Court of Law. Law to Combat Crime-Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts.	10	23%
2	Criminal Procedure Code and IPC Provisions in Forensic Science Criminal Procedure Code. Cognizable and non-cognizable offences. Bailable and non-bailable offences. Sentences which the court of Chief Judicial Magistrate may pass. Laws specific to Forensic Science: Indian Penal Code pertaining to offences against persons – Sections 121A, 171B, 171 E, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375 & 377 and their amendments.	11	27%
3	Evidence and Expert Testimony under Indian Law Indian Evidence Act – Evidence and rules of relevancy in brief. Expert witness. Cross-examination and re-examination of witnesses. Sections 32,	11	27%

	45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141. CrPC – Sections 291, 291A, 292 & 293 in the code of criminal procedure.		
4	Special Acts Related to Environmental, Social, and Economic Offences Environment Protection Act, Wildlife Protection Act, Prevention of Food Adulteration Act. Prevention of Corruption Act. Untouchability Offences Act, Narcotic Drugs and Psychotropic Substances Act. Essential Commodity Act. Drugs and Cosmetics Act. Explosive Substances Act. Arms Act. Dowry Prohibition Act.	10	23%

Course Outcomes:

- Explain the structure and functioning of the criminal justice system in India, including courts, legal procedures, and classification of offences.
- Interpret important provisions of IPC and CrPC relevant to forensic science, particularly those related to crimes against persons and criminal investigation.
- Understand the evidentiary value of forensic evidence and the role of expert witnesses in court proceedings under the Indian Evidence Act.
- Recognize major special laws related to environmental, social, and economic offences and evaluate the application of forensic science in investigating such crimes.

Reference Books:

1. Medical Jurisprudence and Toxicology – K.S. Narayan Reddy & O.P. Murty
2. Forensic Science in Criminal Investigation and Trials – B.R. Sharma
3. The Indian Evidence Act – Batuk Lal
4. Ratanlal and Dhirajlal's The Indian Penal Code – Ratanlal & Dhirajlal
5. Ratanlal and Dhirajlal's The Code of Criminal Procedure – Ratanlal & Dhirajlal
6. Principles of Forensic Medicine and Toxicology – Rajesh Bardale
7. Textbook of Forensic Medicine and Toxicology – Krishan Vij
8. Crime Scene Management – Richard Saferstein

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. Forensic Chemistry

Semester-4

Subject Code: 101760403	Subject Title: Practicals
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidate must have studied core subjects like Mathematics, Physics, Chemistry and Biology at their Higher Secondary level.	

Course Objective:

(1) To develop practical understanding of molecular biology, genetics, and forensic science techniques, including DNA isolation, nucleic acid detection, chromosome observation, and basic biochemical tests used in biological investigations.

(2) To familiarize students with fundamental forensic investigation procedures and legal aspects, including detection of concealed evidence, bribery trap tests, documentation of crime reports, and interpretation of important legal provisions related to forensic science.

Teaching Scheme				Evaluation Scheme (Marks)				
Hours per week			Credit	Theory		Practical		Total
Lecture	Tutorial	Practical		University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	01		50	50	25	25	

Subject Contents

Sr. No	Topics	Total Hours	Weight (%)
1.	Study of Giant Chromosomes- Polytene Chromosomes Observation of Sex Chromatin (Barr Body) in Human Buccal Mucosa Cells Colorimetric estimation of DNA by Diphenylamine Method Isolation of DNA from the given material Phenolphthalein test for Bribery Trap To write report on different type of crime cases Simple techniques like heat to reveal invisible inks in Forensic Science Simple techniques like using turmeric solution to reveal invisible inks in Forensic Science Qualitative detection of RNA using Orcinol test Demonstration of semiconservative DNA replication using colored threads/paper strips. Study of genetic code using codon charts and decoding amino acids Case study analysis of important IPC sections related to forensic science (e.g., murder, assault, rape).	15	100%

	Preparation of a sample First Information Report (FIR) format. Study of Giant Chromosomes- Polytene Chromosomes Observation of Sex Chromatin (Barr Body) in Human Buccal Mucosa Cells		
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Course Outcomes:

- Demonstrate laboratory skills in basic molecular biology and cytogenetic techniques, such as DNA isolation, nucleic acid detection, and microscopic observation of chromosomes and Barr bodies.
- Apply biochemical and forensic detection methods to identify biological materials and hidden evidence, including tests for nucleic acids and techniques for revealing invisible inks.
- Interpret basic genetic concepts and molecular mechanisms, such as semiconservative DNA replication and the genetic code, through experimental demonstrations and analytical exercises.
- Develop the ability to analyze forensic case studies, understand relevant IPC provisions, and prepare basic legal documentation such as FIRs, thereby connecting scientific evidence with legal procedures in criminal investigations.

Reference Books:

1. Practical Forensic Medicine and Toxicology – K. S. Narayan Reddy
2. Forensic Science in Criminal Investigation and Trials – B. R. Sharma
3. Experiments in Molecular Biology – Sean R. Eddy
4. An Introduction to Practical Biochemistry – David T. Plummer
5. Practical Biotechnology – S. Janarthanan

GANDHINAGAR INSTITUTE OF SCIENCE
B.Sc. Forensic Chemistry
Semester-4

Subject Code: 10320401	Subject Title: Natural Resources & Management
Prerequisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board. Candidates must have studied core subjects like Chemistry and Biology at their Higher Secondary level and he/she may have completed a Certificate Course (First Year, B.Sc.) with Basic Microbiology and Chemistry subjects.	

Course Objective:

1. To introduce the students about basic knowledge of Natural resources, their significance, availability, and conservation.
2. The course also includes the methodology and technical aspects to provide comprehensive knowledge of the subject.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	02	04	50	50	25	25	150

Sr. No.	Topic	Total Hours	Weight %
1	Introduction to Natural Resources and Management. Introduction and importance of natural resources. Scopes of natural resource management. Renewal and non renewal resources. Trends and drivers of resource use (demography, ecological settings, economic growth, patterns of	10	25 %

	developments, etc.). Causes and consequences of resource depletion. Principles, Issues and approaches (community based, adaptive and integrated). Concept and evolution of sustainable development. Importance of legal, policy and governance in natural resource management. Organizational structure and stakeholders in NRM and livelihood.		
2	Water resources: Introduction of water resources. Description of hydrological cycle. Description of major sources of water for human. Use, causes and impacts of water resource depletion. Resource base, surface water, ground water, requirement. Policies (Water resource Act 1992, Water resource rule 1994), Strategy (Water Resources Strategy Nepal 2002) and Management practices (rain water harvesting, watershed management; multipurpose water resource management programs, etc.). Fishery: Fishery resources of Gujarat and their utilization (Fresh water and Marine), Fisheries of the important species/groups (Mackerel, Sardine, Bombay duck, Pomfrets, Hilsa, Mullet, Major Carps, game fishes and exotic fishes).	12	25%
3	Land Resources: Concept of land resource and land use, land use types, land use classification. Causes, types and effects of land degradation. Land use and land reform policy, land use planning, land resource management practice (mechanical, biological methods, fertility management). Importance of mountain as natural resources, degradation and its management. Mountain and tourism. Forest types and characteristics of India. Timber, fuel wood, fodder, NTFP, etc. Forest management- management policy, strategy and programs of India. Policy, programs and implementation of rules.	11	25%
4	Mineral Resources: Mineral resources, types (metallic and non-metallic minerals) and distribution of mineral resources,	11	25 %

	importance of mineral resources. Rapid depletion, wastage, environmental pollution. Policy, strategy and practice (reuse, recycle, sustainable extraction, etc). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies		
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Course Outcome: After completion of this course, student will be able to

CO 1. This course is designed to enable students to acquire understanding of the structure of Natural resources, their conservation and management.

CO 2. To introduce to the students various conceptual and analytical perspectives (drawn from different academic disciplines) to look at environmental problems

CO 3. It helps them to get knowledge of various Land resources

CO 4. The awareness of the Mineral resources will help them for further work.

References

- **Agarwal, K.M.,** Sikdar, P.K., Deb., S.C. 2005. A Text Book of Environment. Macmillan India Limited.
- Klee, G.A. 1991. Conservation of Natural Resources. New Jersey: Prentice Hall Publ. Co.
- Miller, G.T. (Jr.) and Spoolman, S.T. 2010. Living in the Environment. Brooks/Cole. Belmont, California, USA: Wardsworth Publishing Company.
- Nalini, K.S. 1993. Environmental Resources and Management. Anmol Publishers.
- Craig, J.R., Vaughan. D.J. & Skinner. B.J. 1996. Resources of the Earth: Origin, Use, and Environmental Impacts (2nd edition). Prentice Hall, New Jersey.
- Freeman, A.M. 2001. Measures of value and Resources: Resources for the Future. Washington DC.
- Freeman, A.M. 2003. Millennium Ecosystem Assessment: Conceptual Framework. Island Press.
- Ginley, D.S. & Cahen, D. 2011. Fundamentals of Materials for Energy and Environmental Sustainability. Cambridge University Press.

List of Suggested Practical

1. Water analysis: chemical Properties (pH, Acidity, Alkalinity, Hardness, Chloride, Nitrate, Sulphate).
2. Study of plant fossil forms from different geological periods.
3. Preparation of Herbarium.
4. Estimation of Halides in water sample by Potentiometer.
5. Study of Plant and animal Specimens.
6. Study of plant chordate (Minimum Size, Minimum Number, Frequency, Density).
7. Study of species diversity index of vegetation.
8. Study of Phytoplankton and Macrophytes from water bodies.

Gandhinagar Institute of Science
B.sc Forensic Chemistry
Semester- IV

Subject Code: IKS0401

Subject Title: Indian ancient Science and Philosophy

Course Objective:

- Foster an appreciation for the composite nature of Indian history, culture and heritage.
- Instill a sense of love and belonging among learners, contributing to nation-building efforts.
- Provide an overview of various components of cultural heritage, including fairs, festivals, dances, art, architecture, and historical landmarks, which are crucial for a deeper understanding of history.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
01	0	2	02	0	25/ Project	25/ Project		50

Subject Contents			
Sr. No	Topics	Total Hours	Credit
1	Ancient Science And Technology In India: Development of science in ancient India (Astronomy, Mathematics, Medicine, Metallurgy, Chemistry) Scientists of Ancient India and their contribution: Mathematics & astronomy (Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Mahaviracharya) Science (Kanad, Varahamihira, Nagarjuna) Medical science in ancient india (Susruta, Charak, Yoga & Patanjali)	15	1
2	Indian Philosophical Systems: Characteristics of Indian Philosophy, Pramanas, General Introduction to Indian Philosophical systems, i.e. Orthodox and Heterodox. Tenet of Nyaya philosophy, Principles of Vaisesika. Indian preaching on dharma, artha and Society- Bhagavadgita, Arthasastra, Gurukula systems, Nalanda, Takṣasila,	15	1

Course Outcome: After completion of this course, students will be able to

- Develop the ability to critically examine ancient sciences of India and narratives to understand the science and technology in ancient India.
- Develop a comprehensive understanding of the key characteristics of Indian philosophical systems.

List of Text Books:

1. An advanced history of India by B.C Majumdar & others, 1967, Macmillan
2. Ancient India by R.C. Majumdar, 1977, Motilal Banarsidas
3. History of Ancient India by Ram Shankar Tripathi, 1942, Motilal Banarsidas
4. History and culture of India to 1000 A.D. by H.V. Srinivasamurthy, 1980, S.Chand & Co.
5. Advance history of India by K.A. Nilakanta Sastry & C.S. Srinivasachari, 1980, Allied Publications.
6. Ashoka, V.A. Smith, 1970, Oxford University Press.
7. Society, Religion & Art of Kushana India, Kanchan Chakrabarti, 1930, Bagchi & Co.,
8. Ancient India by Romila Thapar, 2002, Oxford University Press, Delhi
9. Understanding Harappan civilization by Shereen Ratnagarh, Tulika Publication, Delhi

Annexure 2.

A. Ability Enhancement Courses (AEC)

Sl. No	Course Name	Course Code
1	Business Communication – Blended with ICSI	AEC001
2	Communication and Presentation for Technical Professionals (IEEE)	AEC002
3	Conversational Hindi (Modern Indian Language)	AEC003
4	Corporate Grooming and Business Etiquettes	AEC004
5	Digital Privacy: Understanding and Operational Framework (IEEE)	AEC005
6	Digital Transformation: Game Changing Opportunities (IEEE)	AEC006
7	Economics & Business Environment Blended with ICSI	AEC007
8	Freelancing and Content Writing	AEC008
9	French	AEC009
10	Functional Grammar and Composition	AEC010
11	German	AEC011
12	Gujarati	AEC012
13	Marathi	AEC013
14	Mass Communication and Journalistic Writing	AEC014
15	Personality Development for Effective Leadership	AEC015
16	Practical English	AEC016
17	Punjabi	AEC017
18	Spanish	AEC018
19	Radio Jocky	AEC019
20	Ethics for Engineers, Patents, Copyrights and IPR	AEC020
21	Digital Privacy: Understanding and Operational Framework	AEC021
22	Environmental Studies	AEC022

B. Skill Enhancement Courses (SEC)

Sl. No	Course Name	Course Code
1	Animation & Graphics Design	SEC001
2	Aptitude and Logical Reasoning Blended with ICSI	SEC002
3	AutoCAD and Basic Drafting	SEC003
4	Business Administration	SEC004
5	Current Affairs and Quantitative Aptitude Blended with ICSI	SEC005
6	Data Analysis using Spreadsheet	SEC006
7	Digital Marketing	SEC007
8	Eco-Engineering: Designing for the Future	SEC008
9	Engineering Mastery: Tools and Techniques	SEC009
10	Event Management	SEC010
11	ICT Skills for Leadership	SEC011
12	Innovation & Entrepreneurship	SEC012
13	Interpersonal Skills – Blended with ICSI	SEC013
14	Introduction of Cyber Security (IEEE)	SEC014
15	Office Automation Tools	SEC015
16	Performing Arts (Dance, Music, Drama)	SEC016
17	Personal Financial Planning	SEC017
18	Practical Workshop Training	SEC018
19	Social Media Management	SEC019
20	Tally Accounting	SEC020
21	Visual Arts	SEC021
22	Public Speaking	SEC022

C. Value Addition Courses (VAC)

Sl. No.	Course Name	Course Code
1	Anti-ragging – Blended with IEEE	VAC001
2	Art of Living for Wellness	VAC002
3	Awareness of Cyber Crime and Ethical Hacking	VAC003
4	Basic Life Support (BLS)	VAC004
5	Community Development	VAC005
6	Economics & Social Development	VAC006
7	Emotional Intelligence	VAC007
8	Environmental Studies	VAC008
9	Ethics and Values in Ancient Indian Tradition	VAC009
10	Gandhian Studies	VAC010
11	Indian Economy and Planning	VAC011
12	Indian Geography and Environmental Ecology	VAC012
13	Indian History and Cultural Heritage	VAC013
14	Integrated Personality Development Course	VAC014
15	Life Lessons from Bhagvad Gita	VAC015
16	Life Skills	VAC016
17	National Cadet Corps (NCC)	VAC017
18	National Service Scheme (NSS)	VAC018
19	Prevention of Sexual Harassment	VAC019
20	Psychology	VAC020
21	Stress and Time Management	VAC021
22	Sustainable Development and Environmental Studies	VAC022
23	Universal Human Values	VAC023
24	Yoga and Meditation for Wellness	VAC024