ACHARYA NAGARJUNA UNIVERSITY

A State Government University, Accredited with "A" Grade by NAAC

Nagarjuna Nagar - 522 510, Guntur, Andhra Pradesh, India.

M.Sc. FORENSIC SCIENCES

SYLLABUS

2022 - 2023 onwards

UNIVERSITY COLLEGE OF SCIENCES

PROGRAM CODE:

ANUCS07


ACHARYA NAGARJUNA UNIVERSITY
సత్యం సర్వం ప్రతిష్ఠితమ్

ABOUT UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY (ANU)

- A Brief Profile

Acharya Nagarjuna University, a State University established in 1976, has been constantly striving towards achieving progress and expansion during its existence for over four decades, in terms of introducing new courses in the University Colleges, affiliated colleges and professional colleges. Spread over 300 acres of land on the National High Way (NH-16) between Vijayawada and Guntur of Andhra Pradesh, the University is one of the front ranking and fastest expanding Universities in the state of Andhra Pradesh. The University was inaugurated on 11th September, 1976 by the then President of India, Sri Fakruddin Ali Ahmed and celebrated its Silver Jubilee in 2001. The National Assessment and Accreditation Council (NAAC) awarded "A" grade to Acharya Nagarjuna University and also has achieved 108 International ranks, 39 National ranks UI Green Metrics rankings and many more It is named after Acharya Nagarjuna – one of the most brilliant preceptors and philosophers, whose depth of thought, clarity of perception and spiritual insight were such that even after centuries, he is a source of inspiration to a vast number of people in many countries. The University is fortunate to be situated on the very soil where he was born and lived, a soil made more sacred by the aspiration for light and a state of whole someness by generations of students. With campus student strength of over 5000, the University offers instruction for higher learning in 68 UG & PG programs and guidance for the award of M.Phil. and Ph.D. in 48 disciplines spread over six campus colleges and one PG campus at Ongole. It also offers 160 UG programs in 440 affiliated colleges in the regions of Guntur and Prakasam Districts. It has a Centre for Distance Education offering 87 UG & PG programs. Characterized by its heterogeneous students and faculty hailing from different parts of the state and the country, the University provides most hospitable environment for pursuing Higher Learning and Research. Its aim is to remain connected academically at the forefront of all higher educational institutions. The University provides an excellent infrastructure and on- Campus facilities such as University Library with over one lakh books & 350 journals; Computer Centre; University Scientific Instrumentation Centre; Central Research Laboratory with Ultra-modern Equipment; Well-equipped Departmental Laboratories; Career Guidance and Placement Cell; Health Centre; Sports Facilities with Indoor & Outdoor Stadiums and Multipurpose Gym; Sports Hostel; Separate hostels for Boys, Girls, Research Scholars and International Students; Pariksha Bhavan (Examinations Building); Computers to all faculty members; Wi-Fi connectivity to all Departments and Hostels; Canteen, Student Centre & Fast-food Centre; Faculty Club; Dr. H.H. Deichmann & Dr. S.John David Auditorium cum Seminar Hall; Post office; Telecom Centre; State Bank of India; Andhra Bank; Energy Park; Silver Jubilee Park; Fish ponds; internet center; xerox center; cooperative stores; Water harvesting structures.

VISION, MISSION & OBJECTIVES OF THE UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY

VISION

To generate sources of knowledge that dispels ignorance and establish truth through teaching, learning and research.

MISSION

To promote a bank of human talent in diversified faculties – Commerce & Management Studies, Education, Engineering & Technology, Humanities, Law, Natural Sciences, Pharmacy, Physical Education & Sports Sciences, Physical Sciences and Social Sciences that would become an investment for a prosperous society.

OBJECTIVES

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop human talent necessary for the industry.
- To open up avenues of higher education and research through non-formal means.
- To invite and implement collaborations with other institutes of higher learning on a continuous basis for mutual academic progress.
- To motivate and orient each academic department/centre to strive for and to sustain advanced levels of teaching and research so that the university emerges as an ideal institute of higher learning.
- To focus specially on the studies involving rural economy, justifying its existence in the rural setting.

VISION & MISSION OF THE COLLEGE

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES

VISION OF THE COLLEGE:

University College of Sciences envisages to be a good team of people with scientific temperament, research bent and a flair for Teaching & Learning for the betterment of the Community, Society, State and the Country at large.

MISSION OF THE COLLEGE:

The College intends to incubate and nurture the Leaders, Mentors, Educators and researchers who can transform the country and contribute to advances in science while addressing the challenges faced by the society for the betterment of human life.

VISION & MISSION OF THE DEPARTMENT

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF CHEMISTRY
M.Sc. FORENSIC SCIENCES

VISION OF THE DEPARTMENT:

The Department envision establishing itself as a place of excellence for chemistry education and research programmes globally. The Department of Chemistry at Acharya Nagarjuna University is dedicated to the instruction, training, and intellectual growth of Post Graduate students through promotion of innovation, creative endeavors, and scholarly inquiry and to be a global destination of higher education and research. By maintaining its research programs, the Department of Chemistry enhances the recognition and reputation of Acharya Nagarjuna University locally, regionally, nationally, and internationally.

MISSION OF THE DEPARTMENT:

- The mission of the Department of Chemistry is to serve the State and the Nation by educating students, by advancing scientific knowledge, and by catalysing economic development.
- To create and maintain the programs of excellence in the areas of research, education, and public outreach.
- To offer research projects with high emphasis on concept-theory-practical training to build up research interest for the transformation of budding chemists into productive scientists, excellent teachers, entrepreneurs, and innovative independent researchers.
- Our specific goal is to become a nationally recognized centre of chemical sciences for modern education with a state of art centralized research facility.
- To serve a beacon of change, through multi-disciplinary learning, for creation of knowledge community, by building a strong character and nurturing a value-based transparent work ethics, promoting creative and critical thinking for holistic development and self-sustenance for the people of India.
- The University seeks to achieve this objective by cultivating an environment of excellence in teaching, research, and innovation in pure and applied areas of learning.
- To bridge the gap between academia and industry by regularly updating the curriculum on par with recent developments in science and encourage doing in house projects.
- To educate and invoke the students to deliver their maximum out puts in competitive examination sand meet industrial competences.
- To develop forensic scientists with significant knowledge on forensic crime scene investigation, collection of evidence, analysis of crime exhibits and documentation of report, analysis with presentation of analytical findings before the court of law.

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF CHEMISTRY
M.Sc. FORENSIC SCIENCES

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's):

Programme Educational Objectives (PEOs) are extensive reports that define the probable activities of graduates of a certain academic program in their professional careerand life. The M.Sc. Forensic Science program will enable the student to

PEO1	Understand the core and advanced chemistry concepts thoroughly.
PEO2	Have societal, health, safety, and cultural issues relevant to the science practices and Provide a strong foundation for acquiring advanced knowledge in chemistry.
PEO3	Acquire critical thinking supported by advanced analytical skills to address chemistry related problems.
PEO4	Demonstrate the ability to perform accurate quantitative measurements with anunderstanding of the theory and use of sophisticated instruments, analyze and interpret
PEO5	Enhance skills for employability through activities, such as, seminar, communication, skills, industrial visit, internship, and research project dissertation.

PROGRAMME SPECIFIC OUTCOMES (PSO's):

Upon successful completion of M.Sc. Forensic Science program, the student will be able to

PSO1	Acquire the knowledge recent advancement in the scientific field.
PSO2	Understand the features of molecules in organic /inorganic/physical domain
PSO3	Develop computational and experimental skills to explore molecular level phenomena.
PSO4	Apply technical skill in a sophisticated laboratory environment & secure challenging position in Industry & Academics.
PSO5	Enhance employability through laboratory activities, solving problems and co- curricular activities.

PROGRAMME OUTCOMES (PO's):

On successful completion of M.Sc. program (Two years), the student will be able to expected to know, understand, or be able to do upon successful completion of a program.The Program outcomes for M.Sc. Forensic Science students are:

PO1	Think critically and analyze pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at variableconclusions.
PO2	Prepare and present scientific and technical information resulting from laboratory outputs.
PO3	Design methodologies, analyze, and evaluate innovative scientific research problems.
PO4	Pursue higher education/become an employee/ entrepreneur/ professional training in Chemistry or related fields, or transition into a Chemistry-related career.
PO5	Work independently as well as in a team to exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams and in multidisciplinary settings.
PO6	Apply chemistry knowledge and skills to address real-world problems and encounters, and develop innovative resolutions.
PO7	Project management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational; skills and the ability to manage time and resources.
PO8	Environment and society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
PO9	Effectively communicated with spoken and written in scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.
PO10	Commitment to professional ethics and responsibilities.

STRUCTURE

ACHARYA NAGARJUNA UNIVERSITY :: UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF CHEMISTRY
M.Sc. FORENSIC SCIENCES :: COURSE STRUCTURE

Semester	Components of Study	Course Code	Title of the Course	No. of Credits	Hr/Week	Internal Assessment	Semester End	Total
SEMESTER – I	Mandatory Core	R22FS11	Forensic Science & Criminalistics	4	4	30	70	100
		R22FS12	Forensic Chemistry	4	4	30	70	100
	Compulsory Foundation	R22FS13	Essential Basic Concepts of Science for Forensics	4	4	30	70	100
	Elective Foundation(Opt' 1)	R22FS14A	Cyber & Mobile Forensics	4	4	30	70	100
		R22FS14B	Polymer Science					
		R22FS14C	Nuclear Chemistry and Applications					
	Core Practical-I	R22FS15	Crime Scene & Forensic Chemistry	4	6		100	100
	Core Practical -II	R22FS16	Essential Basic Concepts-Analytical Chemistry Lab	4	6		100	100
	Audit Course	R22FS17	*Human Values and Professional Ethics*		--	*50*	-	-
	SUB-TOTAL			24				600
SEMESTER – II	Mandatory Core	R22FS21	Forensic Physics	4	4	30	70	100
		R22FS22	Fingerprints & other Impression Analysis	4	4	30	70	100
	Compulsory Foundation	R22FS23	Forensic Biology & Serology	4	4	30	70	100
	Elective Foundation (Opt' 1)	R22FS24A	Instrumental Techniques in forensic Chemistry	4	4	30	70	100
		R22FS24B	Nano Science & Technology					
		R22FS24C	Material Science					
	Core Practical-I	R22FS25	Forensic Physics & Chemical Instrumentation Lab	4	6		100	100
	Core Practical -II	R22FS26	Forensic Biology &Serology Lab	4	6		100	100
	Core Practical-III	R22FS27	Comprehensive Viva-voce (1st & 2nd Semester)	2			50	50
	Audit / Skill Development	R22FS27	*Communicative English*		--	*50*		
	SUB-TOTAL			26				650
SEMESTER – III	Mandatory Core	R22FS31	Forensic Ballistics	4	4	30	70	100
		R22FS32	Instrumentation & DNA Fingerprinting	4	4	30	70	100
	Generic Elective-I(Opt' 1)	R22FS33A	Spectroscopic Methods of Analysis	4	4	30	70	100
		R22FS33B	Applications of Synthetic Products					
		R22FS33C	Green Chemistry					
	Open Elective-II(Opt' 1)	R22FS34A	Forensic Toxicology	4	4	30	70	100
		R22FS34B	Industrial Chemistry					
		R22FS34C	Chemistry of Aerospace Materials					
	Core Practical-I	R22FS35	Forensic Ballistics Lab	4	6		100	100
	Core Practical -II	R22FS36	Forensic Toxicology & DNA Fingerprinting Lab	4	6		100	100
	Skill Enhancement	R22FS37	*MOOC's-Online*		--	*50*		
	SUB-TOTAL			24				600
SEMESTER –IV	Mandatory Core	R22FS41	Forensic Medicine	4	4	30	70	100
		R22FS42	Indian Law to Combat Crime	4	4	30	70	100
	Core Elective-I (Opt' 1)	R22FS43A	Questioned Document Analysis	4	4	30	70	100
		R22FS43B	Engineering Chemistry					
		R22FS43C	Laboratory Quality Control & Quality Assurance					
	Open Elective-II (Opt' 1)	R22FS44A	Analysis of Foods & Drugs	4	4	30	70	100
		R22FS44B	Forensic Science in Solving Crime					
		R22FS44C	Chemistry of High Energy Materials					
	Core Practical-I	R22FS45	Impressions & Document Examination Lab	4	6		100	100
	Core Practical-II (Multi Disciplinary)	R22FS46	Project Work - Internship	4	6		100	100
	Core Practical-III	R22FS47	Comprehensive Viva-voce (3rd & 4th Semester)	2			50	50
	SUB-TOTAL			26				650
GRAND TOTAL				100				2500

FIRST SEMESTER

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF CHEMISTRY

M.Sc. FORENSIC SCIENCE
SEMESTER-I

R22FS11: FORENSIC SCIENCE & CRIMINALISTICS

COURSE OUTCOMES:

- The significance of Forensic science to human society.
- The fundamental principles and functions of Forensic science.
- The divisions in a Forensic science laboratory.
- The methods of securing, searching and documenting crime scenes.
- The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.

Unit-I: Introduction to Forensic Science **12H**

Need and functions of Forensic science. Historical aspects of Forensic science. Development of Forensic Science Laboratories. Definitions and concepts in Forensic science. Basic principles of Forensic science. Scope of Forensic science. Forensic Science in Indian scenario. Admissibility in Indian Courts. Frye standard and Daubert standard. Legal and Scientific problems.

Branches of Forensic science and their importance. Hierarchical set up of various Government Forensic Science Laboratories. Basic services of crime laboratories. Qualifications of Forensic scientists. Duties of Forensic scientists. NABL accreditation and laboratory management.

Unit-II: Crime Scene Management **12H**

Photography, videography, sketching- Baseline method, Triangulation method, coordinate method, extended coordinate method. Crime scene notes. Search – Definition, Objectives, Patterns- Strip/Lane method, Grid method, Zone method, Spiral method, Wheel method. Classification of crime scene evidence – physical and trace evidence. General collection, labelling, sealing and transportation of evidence. Hazardous evidence. Preservation of evidence. Chain of custody- objectives and importance. Crime scene Reconstruction need and application

Unit-III: Elements of Crime in Society **12H**

Criminology – definition, aim and scope; Schools of Criminology; Theories of criminal behavior, Criminal anthropology, criminal profiling, Deviant behavior understanding modus operandi and role of media.

Sociology – Introduction, definition & Origin, Nature and scope of the subject, Sociology as a science – methods and techniques used in social research, basic concepts, data & theories. Sociological causes of crime, Hate crimes, organized crimes White collar crimes, public

disorder, domestic violence and workplace violence. Ethics being a mankind.Penology – theories of punishment, types of punishments. Prisons and correctional institutions – objectives, administration, functioning and limitations. Victimology, Juvenile delinquency, Social change and crime.

Unit-IV: Forensic Psychology and Investigative Techniques 12H

Definition, goals and scope of Psychology. Role of psychologist in society. Perspectives Biological, Psychodynamic, Behavioristic, Humanistic, Evolutionary and Cognitive. Subfields of Psychology. Forensic Psychology-Duties and responsibilities of Forensic Psychologist Definition, meaning and scope of forensic psychology. Role of Forensic Psychology in the investigation of crime. Psychology and the Police. Overview of Polygraph (Lie-detection), Narco Analysis, Brain Mapping, their applications and legal implications.

Unit-V: Forensic Photography 12H

Basic principles and techniques of Black and White and Color photography, cameras and lenses, exposing, developments and printing. Different kinds os developers and fixers, modern developments in photography, linkage of cameras and film negative, 3D photography, Photographic evidence. Infrared and ultraviolet photography. How a Digital camera works and basics of digital imaging/ Videography/ High speed videography. Crime scene and laboratory photography. Applications of photography in forensic science.

REFERENCE BOOKS:

1) Nabar, B. S. (2012). Forensic science in criminal investigation.
2) Saferstein, R. (2013). Criminalistics. Pearson Education.
3) Nanda, B. B. (2001). Forensic Science in India: A vision for the twenty-first century. Select Publishers.
4) Bhasin, M. K. and S. Nath (2002). Role of Forensic Science in the New Millennium, University of Delhi, Delhi.
5) James, S. H. and J.J. Nordby (2005). Forensic Science: An Introduction to Scientificand Investigative Techniques, 2nd Edition, CRC Press, Boca Raton.
6) Sharma, D. B. (2005). Forensic Science in Criminal Investigation & Trials. Universal Law Publishing Company.

OUTCOME MAPPING:

Course Outcomes(CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1					2					
2	2		2							
3										2
4	2	2								
5	3	2	2	1	2	2	2	1	2	1

***1-Low*2- Medium *3- Strong**

R22FS12:FORENSIC CHEMISTRY

COURSE OUTCOMES:

- The methods of analyzing trace amounts of petroleum products in crime scene evidence. The methods of analyzing contaminants in petroleum products.
- The method of searching, collecting, preserving and analyzing arson evidence.
- The classification of explosives, including the synthesis and characterization of representativeanalogues.
- The techniques of locating hidden explosives.

Unit-I: Introduction to Forensic Chemistry **12H**

Types of cases , Preliminary Screening – Presumptive Tests (colour/spot tests) Examination procedure by Standard methods – Different types Test kits & contents -Analysis of fertilizers and Insecticides – Industrial chemicals – Organic Solvents- Significance of Forensic Chemistry.

Drugs of abuse: Introduction, drug addiction and its problems, classification of drugs of abuse, Depressants, stimulants, Hallucinogens, Identification, Field tests and laboratory tests. Drug abuse in sports: Introduction, common prohibited substances, analytical approach.

Unit-II: Petroleum and Petroleum Products **12H**

Examination of Petroleum products, Distillation and fractionation of petroleum. Standard methods of analysis of petroleum products – Adulteration of petrol. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits.

Comparison ofpetroleum products. Adulteration of petroleum products. Various fractions and their commercial use. Petroleum products -Essential commodities Act

Unit-III: Cases Involving Arson **12H**

Chemistry of fire. Conditions for fire. Fire triangle- Causes of Fire -Definition Arson – Nature of Fire, Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection & Evaluation of Evidences- Post-flashover burning-Information from smoke staining and preservation of arson evidence

Chemical & Instrumental analysis of fire debris &Ignitable liquid residue-Extraction of samples from debris (Direct and solvent extraction methods, Head Space method, SPME, Distillation), Clean-up (Filtration & Acid stripping), Analysis (GC, GC-MS, FTIR & SEM etc.), Interpretation of GC-MS spectra.

Unit-IV: Miscellaneous **12H**

Food adulteration. Brief Introduction to Drugs and cosmetic act, Suspected cosmetics, Toiletry, Excise Act, NDPS Act, Central excise act.

Characteristics, examination and legal aspects of gold, silver, sugar, salts. Analysis of Gold and Other metals in cheating cases

Detective dyes- cases and importance in trap cases, Purpose, examination of chemicals used in trap case.

Study of vitrolage- acid attacks and its forensic importance and cases.

Unit-V: Explosives **12H**

Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Improvised Explosive Device: Definition of IED, Components of IED, Explosives Initiation (Explosive Trains); Types (Molotov cocktail, Letter bomb, Pipe bomb, VBIED and CBRN), Detection of Hidden Explosives.

Bomb Scene: Specific approach to scene of explosion, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion.

Analysis of Explosive: Pre-blast and Post blast residue collection, Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.

REFERENCE BOOKS:

1) Modi's (1988) Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd.Allahabd.
2) Saferstein, R (1982) Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI.
3) Saferstein, R (2000) Criminalistics.
4) Curry (1986) Analytical Methods in Human Toxicology, Part II.
5) Curry, A.S. (1976) Poison Detection in Human Organs.
6) Mathew E. Johll (2009) Investigating Chemistry: A Forensic Science Perspective.
7) Suzanne Bell (2009) Drugs, Poisons, and Chemistry
8) DFS Manuals of Forensic Chemistry and Narcotics.
9) A Naquest (1984) legal chemistry. a guide to the detection of poisons, examination of tea, stains, etc.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	1	3	3	2	2	2	3	3	2
2	2	2	2	2	1	2	1	2	1	2
3	3	1	1	2	1	2	3	1	1	2
4	1	1	2	1	1	1	2	1	1	1
5	3	2	2	1	2	2	2	1	2	1

***1-Low *2- Medium *3- Strong**

R22FS13: ESSENTIAL BASIC CONCEPTS OF SCIENCE FOR FORENSICS

COURSE OUTCOMES:

- Understand the general scientific concepts and definitions used in Forensic Science.
- Understanding various analytical techniques.
- Qualitative analysis of organic & inorganic Compounds.
- Understanding Various fundamental concepts of physics
- Fundamentals of Cell Biology & Genetics.

Unit-I: Basic Concepts of Analytical Chemistry **12H**

Mole concept - Concentration terms: %w/w, %w/v, %v/v, ppm, ppb, Mole fraction, Molarity, Normality,Molality-P^H concept- Types of Acid & Bases-Acid-Base titrations, Concept of Acid-Base Indicators-Redox titrations - Conductometric Titrations- -Buffer solutions- Buffer Capacity- solubility,solubility product, Common Ion effect, Precipitation & Methods of precipitation-Qualitative analysis of Inorganic salts

Unit-II: Basic Concepts of Organic Chemistry **12H**

IUPAC Nomenclature & Classification of organic compounds - Purification methods of organic Compounds- Hydrocarbons- Tests for Saturation, Unsaturation & Aromaticity- Functional group- Functional group identification Tests for Alcohols, Phenols, Carbonyl compounds, Carboxylic acids, Esters, Amines, and Amides; Isomerism- Structural & Stereo Isomerism -Optical Isomerism-optical Activity- Specific rotation, Polarimetry.

Carbohydrates-Classification – Reducing & Non Reducing sugars-Basic Structure & Identification tests for Glucose, Fructose, sucrose, Starch- Specific rotation of Glucose, Fermentation

Unit-III: Basic Concepts of Physics **12H**

Fundamental physical quantities and units; Area, Volume of basic geometrical shapes; Metals, non metals, Glass, Soil, Cement; Concepts of Density, Relative density, Pressure, Friction, Surface tension, Viscosity; Light: Basic properties of light, refractive index, luminescence, fluorescence , electromagnetic spectrum, applications of UV, IR, X-rays; Electricity : Static electricity, Conductors, Resistors , Current, potential difference, Heating effects of Current,load, Short circuit, electric fuse ,MCB, electric cell; Heat: concept of Heat, Temperature, Melting, Boiling, Specific heat, Latent heat.

Unit-IV: Basic Concepts of Cell Biology **12H**

Cell as a Basic unit of Living Systems: Discovery of cell, The Cell theory Ultrastructure of an eukaryotic cell (both plant and animal cell). Structure and functions of cell organelles, Cytoskeletal structures (Microtubules, Microfilaments); cell motility

Cell Division: Cell cycle, mitosis and meiosis, Membrane transport: active and passive transport, introduction to signal transduction and its molecular mechanism, cell scenescence, Programmed Cell Death.

Unit-V: Basic Concepts of Genetics **12H**

Chromosomes: Structural Organization: centromere, telomere, chromonema, euchromatin and heterochromatin, chemical composition and karyotype, nucleosome model, Special types of chromosomes: Salivary gland and Lampbrush chromosomes, Chromosomal Variations, Chromosome mapping, structural and numerical aberrations.

Mendelism: Mendels laws of heredity, Test cross, Incomplete dominance and simple problems, Linkage and Crossing Over, Mechanism and importance.

REFERENCE BOOKS:

1) Concise Inorganic Chemistry by J D Lee
2) Physical Chemistry by P.W. Atkins
3) Organic Chemistry by Morrison & Boyd
4) Concepts of physics (Vol. 1 and 2) by H.C Verma
5) Fundamentals of Physics by Halliday, Resnick & walker
6) Molecular biology of cel -Brace Alberts et al, Garland Publications.
7) Cell Biology- Jack D, The william Twikins Company.
8) Saferstein, R (1982) Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI.

OUTCOME MAPPING:

Course Outcomes(CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1	1	2	1	1	1	2	1	2	1
2	2	1	1	1	1	1	2	2	1	1
3	1	2	1	1	2	1	1	2	2	1
4	1	1	1	2	1	1	1	1	1	1
5	2	1	1	1	2	1	1	1	1	1

***1-Low *2- Medium *3- Strong**

R22FS14A: CYBER & MOBILE FORENSICS

(ELECTIVE–A)

COURSE OUTCOMES:

- Various types of computer and cybercrimes.
- The basics of computer Forensic tools.
- The elements of cyber law and I.T. Act.
- The classification of Biometric processes
- The importance of behavioral Biometry and physiological Biometry.

UNIT-I: Introduction **12H**

Computer & Cyber forensic basics. Cyber forensic and cyber crimes .Online based crimes and crimes targeting computer. Introduction to IT Act 2000, Basic terms and elements of the act. Amendments made in IT Act. Electronic Governance, Certifying Authorities, Digital Signature and Electronic Signature Certificates. Legal Procedure to gather information from Outside India.

UNIT-II: Cyber Crimes **12H**

Types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems. Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs. Computer stalking, pornography, hacking, computer terrorism, hate speech, Private and national security in cyber space. An overview of hacking, spamming, phishing and stalking. Types of Cryptographic and steonography. Electronic / Digital Signature. Auditing V/s cyber forensic investigation.

UNIT-III: Cyber Forensic Investigation **12H**

General guidelines for investigation-Need & object. Cyber forensic evidence identification, acquisition, seizure, presentation, preservation & Athentication. Role of backup in data recovery, Data recovery procedures and ethics .Essential and non-essential data – Segregating Data, General procedures for collecting and analysing evidence .Preserving and safe handling of original media .Investigation of malicious application.

UNIT–IV: Cyber Forensic Tools and Utilities **12H**

Forensic tool kit, Metadata Analysis, Browser Forensics, History Extraction, Integrity, Hash Value, Data tampering, File Signature Analysis, Overview of Mobile Forensics, Network Forensics, Cloud Forensics and Malware Analysis. Selecting right incident tool for your Organization. Hardware based security & software based firewalls, cyber check suites, disk imaging, etc. Volatile and Non volatile Evidences collection. Restoration of deleted files. Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users.

UNIT-V: Mobile Forensic **12H**

History of Mobile Phones, Types of Mobile Phones, Advantage and Disadvantages of Mobile Phones and their Forensic Applications. Operating Systems: Introduction, Objective and Types of Operating System- Java, Symbian, Window, Android and iPhone. Evidence Collection from Mobile Phones and SIM Cards. Recovering and Reconstructing of Delete Data call records , phone books, massages , multimedia files i.e image , video etc. from Mobile Phones and SIM Cards. Process of Cloning of SIM Data and Password Extraction from Mobile Phones

REFERENCE BOOKS:

1) Nathan Clarke (2010) Computer Forensics.
2) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology.
3) Marjie T. Britz (2003) Computer Forensics and Cyber Crime: An Introduction.
4) Linda Volonino and Reynaldo Anzaldua (2008) Computer Forensics for Dummies.
5) Eoghan Casey (2009) Handbook of Digital Forensics and Investigation.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	1	1	2	1	3	2	1	2	3
2	3	2	1	2	1	3	1	1	2	2
3	1	2	1	1	1	2	1	1	2	1
4	1	2	1	1	2	1	2	2	1	1
5	1	2	1	1	1	1	1	1	1	1

***1-Low*2- Medium*3- Strong**

R22FS14B: POLYMER SCIENCE
(ELECTIVE–B)

COURSE OUTCOMES:

- To learn basic types of polymerization processes and techniques.
- To learn how to characterize polymers
- To learn the rheological characteristics of polymers.
- To learn how the processing and testing of polymers are done.
- To learn about high temperature polymers, polymers blends and composites

UNIT-I **12H**

Introduction to Polymer Science: Monomers, functionality, degree of polymerizations; classification of polymers, polymerization methods: addition and condensation; new techniques of polymerization; copolymerization, monomer reactivity and its significance; azeotropic copolymerization, block and graft copolymers; techniques for copolymerization: bulk, solution, suspension and emulsion.

UNIT-II **12H**

Polymer Synthesis and Characterization: Synthesis of thermoplastics, Fluoropolymers, Thermosetting polymers and unsaturated polyesters. Polymer Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights. Polymer crystallinity, analysis of polymers using optical and thermal techniques: Infra Red spectroscopy, X-Ray diffraction, DSC, DMTA and TGA.

UNIT-III **12H**

Polymer Rheology: The flow of Newtonian and non-Newtonian fluids and flow equations. Measurements of rheological parameters by capillary rotating, parallel plate and cone-plate rheometer. Mechanical models, control of rheological characteristics through compounding, rubber curing in parallel plate viscometer, Oscillating Disc Rheometer (ODR) and Moving die Rheometer (MDR).

UNIT-IV **12H**

Processing and Testing of Polymers: Types of mouldings: Compression moulding, transfer moulding, injection moulding, blow moulding, reaction injection moulding, extrusion, pultrusion, calendaring, rotational moulding and rubber processing. Testing for Mechanical-static and dynamic tensile, compressive, abrasion, hardness, tear, impact and toughness. Testing for thermal and electrical conductivity, dielectric constant, electric resistance, swelling, ageing and resistance and environmental resistance.

UNIT-V **12H**

Polymer Applications: *High temperature polymers:* synthesis, processing and applications of Aromatic liquid crystalline polyesters, Phenolics, polyimide and polyether ketones.

Polymer blends and Composites: Difference between blends and composites, their significance, miscible and immiscible blends, polymer alloys, polymer eutectics, plastic-plastic, rubber-plastic and rubber-rubber blends. Fibre Reinforced Polymers (FRP), particulate, long and short fiber-reinforced composites.

RECOMMENDED BOOKS:

1) Text Book of Polymer Science, 3rd Ed. (1984), F. W. Billmayer, Jr., Willey-Interscience.
2) Principles of Polymer Chemistry, P. J. Flory, Cornell Press (recent edition).
3) Principles of Polymerization, G. Odian, 3rd Edition (1991), John Wiley, Singapore
4) Principles of Polymer Sciences, P. Bahadur and N.V. Sastry, Narosa Publishing House, New Delhi (2002)
5) Polymer Sciences, V.R. Gowarikar, N.V. Vishwanathan, J. Shreedhar, Wiley Eastern, New Delhi (1986)
6) The Elements of Polymer Science and Engineering, Alfred Rudin, 3 rd Ed. Academic Press, New York (2012).
7) Experiments in Polymer Science, E. A. Coolins, J. Bares and E. W. Billmeyer, Wiley Interscience, New York (1973).
8) High performance materials in Aerospace, H.M.Flower, Ist ed, Chapman & Hall (1995).
9) Advanced Aerospace materials, B.Horst, B.Ilschner, K.C.Russel, Springer-verlag, Berlin (1992).
10) Applications of high temperature Polymers, R.R.Luise, I ed., CRC Press (1996).

OUTCOME MAPPING:

Course Outcomes(CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1		2	1	2	1	3	2	1	2	
2										
3										1
4		2	1			1				
5										

***1-Low *2- Medium *3- Strong**

R22FS14C: NUCLEAR CHEMISTRY AND APPLICATIONS (ELECTIVE–C)

COURSE OUTCOMES:

- To learn the principles and importance of nuclear chemistry.
- To learn about the detection of radiations from radioactive sources.
- To learn about the radio isotope tracers and their numerous applications.
- To learn about the nuclear reactors and their working methods.
- To learn about the handling, safety and protection from radiations.

UNIT-I **12H**

Nuclear Theory and Nuclear Reactions: Radioacive decay processes, Natural radioactive series, Determination of half - lives of short and long lived isotopes. α-β-γ decays and K-capture

Nuclear reactions (NR): NR induced by neutron and charged particles. Nuclear fission and fusion, Interaction of radiation and particles with matter. Determination of energies of α-β-γ particles.

UNIT-II **12H**

Detection of Radiations: Types and principles of measuring instruments, GM tubes and GM counter- their characteristics. Ionization chambers: Scintillation counters and solid state detectors. Neutron detection methods. Energy production in stars, Stellar evolution and Genesis of chemical elements.

UNIT-III **12H**

Radioisotope Tracers: Radiometric analysis, various types of dilution techniques. Applications of radio isotopes in the study of isotopic exchange and electron transfer reactions. Applications of radio nuclides in therapeutic and diagnostic purposes. Radio carbon dating and age of earth and minerals by various dating techniques. Radiolysis of water and aqueous solutions. Identification reactions and properties of solvated electrons.

UNIT-IV **12H**

Nuclear Reactors: Homogenous and heterogenous reactors: Power reactors, Boiling water reactors, Pressurized water reactors, Fast breeder reactors, Research reactors and Reactors for special purposes. Neutron sources and moderation, Criticality factors, moderators, coolants, Cladding and structural materials.

UNIT-V **12H**

Radio Activity in the Environment, Safety and Protection: Natural radioactive nuclides and their distribution in the environment, nuclear process in the atmosphere, radio activity contributions to the environment from nuclear tests, nuclear reactors, nuclear fuel reprocessing plants and waste management of radioactive isotopes like Cs-137, I-131, H-3 and Ra-226. Plutonium isotopes in the environment. Hazards associated with radiations, Biological effects of radiations, Radioactive waste handling, disposal and treatment.

REFERENCE BOOKS:

1) Principles of Radiochemistry, H.A. CMcKay, Butterworths, London (1971).
2) Essentials of Nuclear Chemistry, H.J.Arnikar, 4th ed, New age International, New Delhi, (1997).
3) Nuclear Chemistry and its Applications, M.Haissinsky, Wesely publishing comp. Inc, London(1964).
4) Radiochemistry, An.N.Nesmeyanov, Mir publishers, Moscow (1974).
5) Nuclear and Radiochemistry, G. Friedlander, J.W.Kennedy, Wiley-Inter. NY, (1981).
6) Nuclear Radiation Detection, W.J.Price, 2nd ed, Mc Graw Hill, NY, (1968).

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1		1					1		
2	1		1					2		
3	1		1					2		
4	1		1					2		
5	1		1					2		

***1-Low *2- Medium *3- Strong**

PRACTICAL-I

R22FS15:CRIME SCENE & FORENSIC CHEMISTRY LAB

(MINIMUM FIVE EXPERIMENTS MUST BE CARRYOUT)

LIST OF EXPERIMETNS:

SECTION-I:

1) Sketching of Outdoor crime scene.
2) Sketching of Indoor crime scene.
3) Photography of crime scene.
4) Collection, packing & Forwarding of physical evidence from the scene of crime.
5) Reconstruction and evaluation of indoor crime scene.
6) Reconstruction and evaluation of outdoor crime scene.
7) Examination of a bribe traps case
8) Analysis of Cloth materials for Corrosive poisons (HCl, H_2SO_4, HNO_3) in Acid attack cases.

SECTION-II:

1) Detection of methanol, chloral hydrate and alprazolam in alcoholic liquors.
2) Extraction and detection of inorganic explosive / explosion residues by spot/ colourtests.
3) Extraction and detection of organic explosive / explosion residues by spot/ colour tests and TLC.
4) Detection of Narcotic Drugs and Psychotropic Substances (NDPS) eg. Opiates, barbiturates, benzodiazepines, amphetamines and cannabis by spot / colour tests.
5) Detection of (NDPS) by TLC.
6) Determination of a drug of forensic interest by spectrophotometry.
7) Determination of a drug of forensic interest by GC.
8) Determination of a drug / explosive of forensic interest by HPLC.
9) Determination of Inflammable substance in partially burnt materials by GC.

PRACTICAL-II

R22FS16: ESSENTIAL BASIC CONCEPTS-ANALYTICAL CHEMISTRY LAB

(MINIMUM FIVE EXPERIMENTS MUST BE CARRYOUT)

LIST OF EXPERIMENTS:

1) Determination of concentration of Strong Acid by Acid-Base Titration
2) Determination of concentration of Strong Base by Acid-Base Titrations
3) Determination of concentration of Oxidant by Redox titrations
4) Determination of concentration of reductant by Redox titrations
5) Conductometric titration of strong acid vs. strong base.
6) Conductometric titration of weak acid vs. strong base.
7) Conductometric titration of mixture of acids vs. strong base.
8) Qualitative analysis of Inorganic salts: Detection of Cation & anion
9) Identification of Functional group in Organic compounds
10) Preparation of Acidic Buffer with a desired Ph value
11) Preparation of Basic buffer with a desired Ph value
12) Calculation of density of the liquid by using Specific Gravity Method
13) Identification Tests for Carbohydrates.(Glucose/Fructose/sucrose)
14) Separation of amino acids by Paper chromatography.
15) Paper electrophoresis for separation of amino acids.

R22FS17: HUMAN VALUES AND PROFESSIONAL ETHICS

COURSE OUTCOMES:

- Knowledge on the nature of ethics and goals.
- Understand the basic moral concepts.
- Understand the non-violance of non-possession.
- Understand crime and theories of punishment.
- Knowledge on the Bhagavd Gita, Buddhism, Jainism.

UNIT-I:

Definition and Nature of Ethics – Is relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics – Goals – Ethical Values in Various Professions.

UNIT-II:

Nature of Values-Good and Bad, Ends and Means, Actual and Potential Values, Objective and Subjective Values, Analysis of Basic Moral Concepts-Right, Ought, Duty, Obligation, Justice, Responsibility and Freedom, Good Behavior and Respect for Elders, Character and Conduct.

UNIT-III:

Individual and Society: Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non Possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues) - Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

UNIT-IV:

Crime and Theories of Punishment –

a) Reformative, Retributive and Deterrent,
b) Views on Manu and Yajnavalkya.UNIT-V:

BHAGAVD GITA –

a) Niskama Karma,
b) Buddhism – The Four Nobel Truths – Aryaastanga marga,
c) Jainism - Mahavratas and Anuvratas. Values Embedded in Various Religions, Religious Tolerence, Gandhian Ethics.

REFERENCE BOOKS:

1) Johns S Mackenjie: A Manual of ethics
2) "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3) Management Ethics – Integrity at work by Joseph A. Petrick and John F. Quinn, Response Books, New Delhi.
4) "Ethics in Management" by S.A. Shelekar, Himalaya Publishing House.
5) Harold H. Titus: Ethics for Today
6) Maitra, S.K: Hindu Ethics

7) William Lilly: Introduction to Ethics
8) Sinha: A Manual of Ethics
9) Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed) G.C. Haughton.
10) Sasruta Samhita: Tr. Kaviraj Kunjanlal, Kunjanlal Brishagratha, Chowkamba Sanskrit Series, Vol I, II and III, Varanasi, Vol I PP, 16-20, 21-32 and 74-77 only.
11) Charaka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series Office. Varanasi I, II, III Vol I PP 183-191.
12) Ethics, Theory and Contemporary Issues. Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13) Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14) An Introduction to Applied Ethics (Ed.,) John H. Piet and Ayodya Prasad, Cosmo Publications.
15) Text Book for Intermediate First Year Ethics and Human Values, Board of Intermediate Education – Telugu Academy, Hyderabad.
16) I.C. Sharma Ethical Philosophy of India. Nagin & Co Julundhar.

OUTCOME MAPPING:

Course Outcomes(CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	3	3	2	2	3		3	3	2
2	3	3	3	2	2	3		2	3	3
3	3	3	3	3	3	2		2	3	3
4	3	3	2	2	3	2		3	3	3
5	3	3	3	2	1	3		2	3	2

***1-Low *2- Medium*3- Strong**

SECOND SEMESTER

M.Sc. FORENSIC SCIENCE
SEMESTER-II

R22FS21: FORENSIC PHYSICS

COURSE OUTCOMES:

- Understand the importance of various physical evidences and their analysis.
- Understand the importance of tool marks and their analysis,
- Understand the importance of cement, motor, concrete and their analysis.
- The physics of speech which is important in speaker identification.
- Causes and investigation of vehicular accidents, and its legal implications.

Unit I: Introduction **12H**

Glass – Composition, types, collection, packaging and examination of glass samples, glass fracture. Soil – Composition, types, collection, packaging and examination of soil samples. Paint – Composition, types, collection, packaging and examination of paint samples. Fibre – Composition, types, collection, Packaging and examination of fibre samples. Tampering of electric meters.

Unit II: Tool Marks **12H**

Tool Marks - Types, Class and individual characteristics, Comparisons, Impression marks, Compression marks, Striated marks, Combination of impression and striated marks, Repetitive marks, Materials for making test tool marks, Methods of preparation of test tool marks, Comparison of test and evidence tool marks, Rubber stamp impressions, Metallic seal impressions, Embossed impressions and indentation marks, Mechanical impressions. Cast, Engraved and punched marks – Methods of their restoration.

Unit III: Forensic Engineering **12H**

Cement – Cement and other constituents of building materials and their properties, Identification of adulterated cement and adulterants, Sampling of evidence materials, Physical and chemical analysis of cement, cement mortar and cement concrete, Methods of analysis of different constituents of building materials, Steel bars and metal physics.

Unit IV: Audio and Video Forensics **12H**

Forensic Voice Identification: Resonance and overtones, synthesis of complex waves, Place Theory of Hearing, Anatomy of Vocal Tract, Vocal Formants, analysis and recording of voice samples in trap/sting investigation

Photography and Forensic Image analysis: Light and Illumination, Optics and Lenses, Zoom and close-up Photography, Introduction to forensic use of digital images, resolution, colour space, file formats, photo sensors, memory and media, computing images

Forensic Video Analysis: Introduction to video, Video Cameras, Video images, Video Captures, CCTVs, Retrieval of images and their evidence analysis

Unit V: Forensic Investigation of Miscellaneous Crime Scenes **12H**

Role of trace evidence analysis and source correspondence, Arson Investigation, Accident Investigation and Hit and Run cases. Introduction to Nano-science, Nano-Physics and Nano-Geo Physics. Investigation and Reconstruction: Causes and Prevention of Road Accidents, Liability to accidents, Communication on the road, Reconstruction and proactive measures.

REFERENCE BOOKS:

1) Forensic Examination of Fibres, Second Edition - Kindle Edition - Kindle eBook (Apr. 16, 2007) by Ichael Grieve
2) Sharma, B.R.: Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
3) Nickolas: Scientific Criminal Investigation.
4) Forensic Digital Imaging and Photography – (2001) by Herbert L. Blitzer and Jack Jacobia
5) Advanced Crime Scene Photography (2010) by Christopher D Duncan
6) Kirk (2000) Vehicular Accident investigation and reconstruction.
7) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press
8) Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
9) Lundquest & Curry: Forensic Science, Vol I to IV, 1963, Charls C. Thomas, Illinosis, USA.
10) Saferstein (1976) Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA. 13. Saferstein (2000) Criminalistics, Prentice Hall Inc. USA.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	2	1				2	2		2
2	2	2	2				2	2		2
3	2	2	2				2	2		2
4	2	2	2				2	2		2
5	2	2	2				2	2		2

***1-Low *2- Medium *3- Strong**

R22FS22: FINGERPRINTS & OTHER IMPRESSION ANALYSIS

COURSE OUTCOMES:

- The fundamental principles on which the science of fingerprinting is based.
- The method of classifying criminal record by fingerprints was worked out in India,and by Indians.
- The physical and chemical techniques of developing fingerprints on crime scene evidence.
- The significance of foot and analysis.
- Study importance of palm prints, ear prints, lip prints iris prints and bite marks.

Unit I: Basics of Fingerprinting **12H**

Introduction and history, with special reference to India.Biological basis of fingerprints. Formation of ridges. Fundamental principles of fingerprinting. Types of fingerprints. Fingerprint patterns. Fingerprint characters/minutiae. Plain and rolled fingerprints.

Unit II: Classification of Fingerprints **12H**

Classification and cataloguing of fingerprint record. Classification of finger print- primary, secondary, single digit, etc. Computerization of finger print Automated Fingerprint Identification System. Significance of poroscopy and edgeoscopy. Role of fingerprint bureau and fingerprint expert.

UNIT III: Preservation and Development of Fingerprints **12H**

Latent prints. Constituents of sweat residue. Latent fingerprints' detection by physical and chemical techniques. Mechanism of detection of fingerprints by different developing reagents. Application of light sources in fingerprint detection. Preservation of developed fingerprints. Digital imaging for fingerprint enhancement. Fingerprinting the deceased.

Techniques for developing fingerprints – conventional and contemporary.

Unit IV: Footprints and Footwear Impressions **12H**

Footprints – types and its significance. Casting of foot prints, Electrostatic lifting of latent foot prints. Foot and Footwear prints on different surfaces and their comparison Gait and Gait characteristics Gait Pattern – Types. Forensic Gait analysis.

Unit V: Other Impressions **12H**

Palm prints – their historical importance. Latent palm prints, Palm prints photography and examination. Lip prints - Nature, location, collection and examination of lip prints.

Ear prints and their significance.

Iris patterns – Biometric forensic tool.

Bite marks- Importance and its Applications.

REFERENCE BOOKS:

1) Saferstein, Richard. Criminalistics. An Introduction to Forensic Science, 5th ed., Prentice Hall, 1998.
2) Saferstein, R., Handbook of Forensic Science (Vol. 1, 2, 3).
3) Eckert, An Introduction to Forensic Science.
4) James, S. H. and Nordby, J.J.: Forensic Science: An Introduction to Scientific and Investigative Techniques, CRC Press, 2003 & 2005.
5) Siegel, J. A., Sukoo, R. J, and Knupfer, G. C: Encyclopedia of Forensic Science, Vol.I, II and III, Academic Press, 2000.
6) Kirk, P.: Criminal Investigation, Interscience, 1953.
7) Hara, C.E.O., & Osterburg, J.W., An Introduction to Criminalistics Indiana University Press, (1972).

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	3	2	1	1	2	3	2	1	1
2	2	2	1			1	2	2	2	1
3	2	2	2			1	2	2	1	1
4	2	2	2			1	2	2	1	2
5	3	3	2			2	2	2	2	2

***1-Low *2- Medium *3- Strong**

R22FS23: FORENSIC BIOLOGY & SEROLOGY

COURSE OUTCOMES:

- The significance of biological evidence.
- The importance of biological fluids – blood, saliva, semen, sweat, urine, faecal stainsand milk - in crime investigations.
- Study Serogenetic Markers.
- Blood stain pattern and analysis.
- How wildlife Forensics aid in conserving natural resources.

Unit-I: Forensic Biology **12H**

Scope of Forensic Biology, Cell Biology- Structure and function of Cell, Human body organ system.

Hair: Significance and origin of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair.

Diatoms test for drowning. Diatoms types & morphology- collection of diatom samples & examination Identifying Bacteria with Microbial Forensics: Forensic Microbiology Finds Source of Bacterial Crime Scene Evidence

Unit-II: Common Body fluids **12H**

Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood- Origin determination. Determination of blood groups. Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins. Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination. Composition, functions and Forensic significance of saliva, sweat, urine, feacal stains, milk, menstrual blood, tears, pus and vomit. Tests for their identifications through various techniques.

Unit III: Serogenetic Markers **12H**

Introduction of blood groups- History- Biochemistry and genetics of ABO, MN, Rh, Lewis, Lutheran, Kidd, Duffy and P systems- Serum proteins- Km-Gm- Hp- Gc- Transferrin- LDH. PCE- Cellular proteins- PGM-AK-ADA-PepA-EsD-GLO-GPT-G6PD Determination of sex and race from blood- White blood group system HLA and its forensic significance.

Unit-IV: Blood Pattern Analysis **12H**

Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

Unit-V: Wildlife Forensics **12H**

Introduction and importance of wild life. Relevant provision of wild life and environmental act. Wildlife protection act, Organizations involved. IUCN Red List, endangered species, CITES, Types of wildlife crimes, different methods of killing and poaching of wildlife animals. Smuggling and poaching, crime scene search, criminal investigation- identification of animals by teeth, claws, ivory, antlers, furs, skins, bite marks, pugmarks. . Identification of Physical evidences pertaining to wildlife crime.

REFERENCE BOOKS:

1) Alan Gunn, 2nd Edition, Essential Forensic Biology.
2) Jenny Mackay, Forensic Biology Crime Scene Investigations
3) Heather Miller Coyle, CRC Press, Forensic Botany- Principles and Applications to Criminal Casework.
4) Adrian Linacre., CRC Press., Forensic Science in wildlife Investigations.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	2	2		2	2	2	2	2	2
2	3	2	1		2	2	2	2	2	2
3	3	2	1		2	2	2	2	2	2
4	3	2	1		2	2	2	2	2	2
5	3	2	1		2	2	2	2	2	2

***1-Low *2- Medium *3- Strong**

R22FS24A: INSTRUMENTAL TECHNIQUES IN FORENSIC CHEMISTRY
(ELECTIVE–A)

COURSE OUTCOMES:

- To know the fundamentals in separation analysis using various chromatographic techniques.
- To know the techniques involving reliable separation by HPLC.
- To know the purification by ion exchange chromatography and GC.
- To know the instrumentation and applications of AAS & amp; ICP-OES.
- To know the basic principles, instrumentation and advantages UV, IR, NMR, ESR, TEM, SEM- techniques in structural analysis.

UNIT-I **14H**

Chromatography – Adsorption and Partition

1) Introduction to Chromatography: Different types of Chromatography. Adsorption chromatography- adsorbents, solvents, solutes, apparatus. Column Chromatography- stationary phase, Mobile phase, packing of column, advantages and disadvantages.
2) Thin Layer Chromatography: Basic Principles. Common stationary phases, Methods of preparing TLC plates, Selection of mobile phase, Development of TLC plates, Visualization methods, R_f value. Application of TLC in monitoring organic reactions.
3) Paper Chromatography: Basic Principles. Ascending and descending types. Selection of mobile phase, Development of chromatograms, Visualization methods. Application of paper chromatography in the identification of sugars and amino acids. One and two dimensional paper paper chromatography.

UNIT-II **14H**

High Performance liquid chromatography (HPLC):

Basic Principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative estimation of organic compounds. Concepts on HPLC method development.

UNIT-III **12H**

Gas Chromatography: Basic Principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative analysis of organic compounds.

Ion Exchange Chromatography:

Basic Principles. Preparation of cross linked polystyrene resins. Different types of cation and anoin exchange resins. Application in the purification of carboxylic acids and amines.

UNIT-IV **10H**

AAS: Principle, instrumentation and applications

ICP-OES: Principle, instrumentation, applications and advantages over AAS.

UNIT-V **10H**

UV, IR, NMR, ESR, TEM, SEM-Basic principles, instrumentation and applications.

REFERENCE BOOKS:

1) Principles of Instrumental Analysis by D. A. Skoog, F. J. Holler and T. A. Nieman, Harcourt College Pub.
2) Separation Techniques by M. N. Sastri, Himalaya Publishing House (HPH), Mumbai.
3) Bio Physical Chemistry by A. Upadhyay, K. Upadhyay and N. Nath, (HPH) , Mumbai.
4) A Hand Book of Instrumental Techniques for Analytical Chemistry- Ed-F. A. Settle, Prearson Edn., Delhi. Introduction to Organic Laboratory Techniques-D. L. Pavia, G. M. Lampman, G.
5) S. Kriz and R. G. Engel, Saunders College Pub. (NY).
6) Instrumental methods of Chemical Analysis by B. K. Sharma, Goel Publish House, Meerut.
7) Instrumental methods of Chemical Analysis by H. Kaur, Pragati Prakasan, Meerut.
8) The students understand the working principles and advantages of the UV, IR, NMR, ESR, TEM, SEM-techniques.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	2	1			2	3	2	2	1
2	2	2	1			2	3	2	2	1
3	2	2	1			2	3	2	2	1
4	2	2	1			2	3	2	2	1
5	2	2	1			2	3	2	2	1

***1-Low *2- Medium *3- Strong**

R22FS24B: NANO SCIENCE & TECHNOLOGY
(ELECTIVE–B)

COURSE OUTCOMES:

- The student is provided with basic theoretical background on nanoscience and nanostructures.
- Understands various synthetic and characterization techniques for nanostructures,
- Equipped with necessary chemistry knowledge involved in various functional nanostructures.
- Student is encouraged to pursue the development of new Nanostructures for energy efficiency.
- Student is encouraged to pursue the development of new Nanostructures for energy efficiency.

UNIT-I **12H**

Introduction to Nanoscience: Definition of Nano, emergence and challenges of nano science, influence of nano over micro/macro, Types of nanostructures: One dimensional, Two dimensional and Three dimensional nano structured materials, Quantum Dots structures, metal oxides, semiconductors and composites. Nanoscience and Interface: Intermolecular Forces, Vander Waals forces. Kessorn, Debye, and London Interactions. Surface nanoscience and surface active agents.

UNIT-II **12H**

Synthesis and Characterization of Nanostructures: Fabrication techniques: Self assembly, self replication, sol-gels, Langmuir-Blodgett thin films, Nanolithography, Bio inspired synthesis, and chemical vapor deposition. Characterization techniques: Electron microscopy, Scanning probe microscopy, Near field microscopy, Micro- and near field Raman spectroscopy, Surface enhanced Raman spectroscopy and X-Ray photo electron spectroscopy.

UNIT-III **12H**

Chemistry of Nanostructures Carbon nanotubes (CNT): Structure of carbon nanotubes, synthesis and functionalization of Carbon nanotubes, electronic-vibrational- mechanical and optical properties of Carbon nanotubees; Graphene nanostructures. Carbon based nanomaterials in environment and biological systems. Biological aspects of Carbon Nanostructures, Fullerene and its derivatives. Environmental effects of nanostructures.

UNIT-IV **12H**

Applications of Nanostructured Materials: Nanostructures in Ferroelectric materials and coatings, polymer based applications, Hydrophilic - hydrophobic surface-cleaning materials, nanostructures in energy conversion and storage for renewable energy, semiconductor materials, solar cells, fuel cells, Carbon nanotubes for energy storage and hydrogen storage, as nanoscale catalysts to save energy. Nanostructures in waste reduction and improved energy efficiency, in water purification, sensors for bio-medical applications and Carbon nano-adsorbents for environmental purification.

UNIT-V **12H**

Nanotechnology in Sensor Devices: Nanosensors: Introduction to sensors, fundamentals and terminology of sensors, static and dynamic characteristics and of sensors. Micro and

Nano sensors, biosensor and micro fluids and organic and inorganic Nano sensors. Nanotechnology based devices: nanomaterials, nanostructured films, nanoscale electronic and ionic transport devises. Sensor for bio-medical applications. Biosensors: generation of biosensors and nanomaterial based biosensors.

RECOMMENDED BOOKS:

1) Nanomaterials: Synthesis, properties and Applications, Edited by A.S.Adelstein.
2) Nanostructured carbon for advanced Applications, Edited by G.Benedek, Kluwer academicpublishers, 1996.
3) Chemistry of nanomaterials: Synthesis, properties and applications CNR Rao et.al.
4) Nanoparticles: From theory to applications G. Schmidt, Wiley Weinheim (2004).
5) Processing & properties of structural nanomaterials - Leon L. Shaw
6) Nanochemistry: A Chemical Approach to Nanomaterials, Royal Soc. of Chemistry, Cambridge, UK (2005).
7) Environmental Chemistry for a Sustainable World, Volume -1: Nanotechnology and
8) Health Risk Editors: Lichtfouse, Schwarzbauer, Robert
9) Advances in Nanotechnology and the Environment, Juyoung Kim, CRC Press, Taylor and Francis Group.
10) Nanomaterials for Biosensors, Cs. Kumar, Wiley – VCH (2007).
11) Naostructures and Nanomaterials: Synthesis, properties and applications, G.Cao, Imperial College Press (2004).
12) The chemistry of nanomaterials: Synthesis, properties and applications, C.N.R.Rao, A.Muller, A.K.Cheetham (Eds), Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
13) Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
14) Nanotubes and Nanowires-CNR Rao and A Govindaraj, RCS Publishing.
15) Carbon Nanomaterials for Environmental and Biological Applications, Bergmann and Machado., Springer.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1					2		2			
2					2		2			
3					2		2			
4					2		2			
5					2		2			

***1-Low *2- Medium *3- Strong**

R22FS24C: MATERIAL SCIENCE
(ELECTIVE-C)

COURSE OUTCOMES:

- The student is provided with basic theoretical background on Material Science and molecular structures.
- Understands various types of widely used conducting materials.
- Gains necessary knowledge about material testing and characterization.
- Understands properties of materials used to protect severe environments and extreme stresslevels in space craft's.
- Understands global energy scenario and the role played by materials in energy storage and conservation.

UNIT-I **12H**

Material Science: Introduction, Condensed states of matter- crystalline and amorphous states. Ionic, covalent, metallic and molecular bindings- Bond angle, bond length and bond energy. Hybridisation - Delocalised chemical bonding. Basics in crystal morphology, Lattice energy - Madelung constant. Inert gas crystals - van der Waals interaction - Lennard Jones' potential. Simple crystal structures - Sodium Chloride, Cesium Chloride, Diamond and Zinc sulphide structures. Close packed structures - packing efficiency and density of materials.

UNIT-II **12H**

Conducting Materials: Metals, Alloys, Semiconductors-Definition, electrical properties, optical properties, mechanical properties and thermal properties. Specific examples of metals-Copper, Aluminium, Iron, Gold, Silver. Uses of metals. Drawbacks of metals. Alloys-advantages of alloying. Examples-Brass, Bronze, Steel, Stainless steel, Gold alloys, silver alloys and their uses. Semiconductors: Elemental semiconductors- Silicon, Germanium. Doping-n-type and p-type semiconductors, p-n junctions. Qualitative ideas of devices- diodes to Integrated circuits (ICs).

UNIT-III **12H**

Materials Testing and Characterization Vacuum Techniques: Vacuum pumps: Rotary, Vapour diffusion, Turbomolecular and Cryogenic pumps. Vacuum measurement: Thermal conductivity gauges and Pirani and thermocouple gauges. Ionisation gauges: Hot and cold cathode ionisation gauges. Non- Destructive Testing of Materials: X-Ray and Neutron Radiography. Mechanical Testing of Materials: Tensile, Compression and Hardness tests, B-V-R hardness numbers. Impact and Fatigue tests.

Materials Characterisation: Electron Microscopy, Transmission Microscopy (TEM)-Scanning Microscopy (SEM) - Atomic Absorption, IR, Raman, Low Energy Electron Diffraction (LEED) and X-ray Photoelectron Spectroscopy (XPS).

UNIT-IV **12H**

Aerospace Materials, Super Alloys and Smart Materials: Aerospace materials- Evaluation of materials for space environment. Materials for Cryogenic applications: Metals for low temperature applications, Austenitic stainless steel, Nitrogen containing steel, Al-Li alloys, Titanium alloys and cryoinsulation materials. Materials for space environment: Radiation shielding materials, Space suit materials and materials for life support system. Metallic materials, super alloys and Smart Materials: Iron based-nickel based–cobalt based super alloys-applications. Smart materials-shape memory effect (SME). Ti-Ni(SM) alloys, Cu based alloys and applications.

UNIT-V **12H**

Materials in Energy Production: Global Energy Scene, Forms of energy, Conservation of energy, Solar Cells, Types of Solar cells. Solar Cell Fabrication Technology. Hydrogen energy-merits as a fuel-Hydrogen storage, sea as source of deuterium. Fuel cells-components, working and performance of fuel cells, Types of fuel cells-Solid oxide fuel cells (SOFC), Molten carbonate fuel cells (MCFC), Phosphoric acid fuel cells (PAFC) Polymer Electrolyte fuel cells and applications. Superconductors: Types - high Tc superconductors - applications of Superconductors.

RECOMMENDED BOOKS:

1) Elements of Materials Science and Engineering–Lawrence H van Vlack, Addision Wesley(1975).
2) Materials Science and Engineering, V. Raghavan, Prentice Hall India (1993).
3) The Structure and Properties of Materials, Rose, Shepard and Wulff, Vol.I-IV Wiley eastern, (1987).
4) X-Ray Crystallography, M .J Buerger, John Wiley (1942).
5) Introduction to Solids, A J Dekker, McMillan India (1981).
6) Electronic Processes in Materials, L. V Azaroff and J.J. Brophy. McGraw Hill (1963).
7) Materials Science and Technology–A comprehensive treatment, R.W Cahn, P Haasen& E J Kramer.
8) Electronic and Magnetic Properties of Metals and Ceramics: Part I Materials Science and Technology: A Comprehensive Treatment, Vol. 3, R. W. Cahn, P. Haasen, 1991, John Wiley.
9) High performance materials in Aerospace, H.M.Flower, I st ed, Chapman & Hall (1995).
10) Advanced Aerospace materials, B.Horst, B.Ilschner, K.C.Russel, Springer-verlag, Berlin (1992).

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1			2				2			
2			2				2			
3			2				2			
4			2				2			
5			2				2			

***1-Low *2- Medium *3- Strong**

PRACTICAL-I

R22FS25: FORENSIC PHYSICS & CHEMICAL INSTRUMENTATION LAB

(MINIMUM FIVE EXPERIMENTS MUST BE CARRYOUT)

LIST OF EXPERIMENTS:

1) Examination of glass fractures.
2) Determination of refractive indices of glass & liquids.
3) Physical examination of soil for colour, moisture, organic matter, pH, presence of anthropogenic material and presence of biological material.
4) Determination of particle size distribution of soils.
5) Soil comparison by density gradient method.
6) Examination of paint samples by microscopy.
7) TLC and spectrophotometric comparison of paint evidence.
8) Examination of counterfeit currency.
9) Comparison of tool marks.
10) Restoration of erased identification marks from metal surfaces.
11) Verification of Beer's law and calculation of molar absorption coefficients for CuSO4.
12) Verification of Beer's law and calculation of molar absorption coefficients for KMnO4.
13) Potentiometric titration of strong acid vs. strong base.
14) Potentiometric titration of weak acid vs. strong base.
15) Potentiometric redox titration of potassium dichromate-ferric ammonium sulphate.

PRACTICAL-II

R22FS26: FORENSIC BIOLOGY & SEROLOGY LAB

(Minimum Five Experiments must be carryout)

LIST OF EXPERIMENTS:

1) Isolation and Identification of diatoms 8. Isolation and Identification of pollen grains.
2) Identification of starch granules.
3) Microscopic and chemical comparison of paper pulp.
4) Morphological & Microscopic characteristics of plant material (Datura, Cannabis, Nerium, etc.)
5) Morphological & Microscopic Examination of human and animal hairs.
6) Morphological / Microscopic Examination of natural and synthetic fibres.
7) Examination of blood and its stains: Chemical and crystal tests.
8) Examination of semen and its stains: Chemical and crystal tests.
9) Examination of saliva and its stains: Chemical and crystal tests.
10) Examination of urine and its stains: Chemical and crystal tests.
11) Agarose gel electrophoresis for separation of proteins. Examination of blood and its stains: Chemical and crystal tests.
12) Identification of spermatozoa by differential staining method.
13) Determination of Species of Origin of blood, semen and saliva by gel diffusionmethod.
14) Grouping of dried stain of blood, semen, saliva and hair by absorption elutiontechnique.

R22FS27: COMPREHENSIVE VIVA-VOCE

The students will be analyzed with questions covering 1st & 2nd semester topics.

R22FS28: COMMUNICATIVE ENGLISH

COURSE OUTCOMES:

- Course helps to improve easy and fluent communication skill among the students.
- This English Communication Skill based course mainly focuses on to improve the Linguistic Listening, Communicative Competence and Presentation Skills of the students.
- Activities in the English Communication Skill based course will simulate actual discourses that students will engage in their interaction with their peers, teachers or strangers in their day-to-day situations.
- To learn the employability skills and descriptions.
- To learn the extempore and presentations.

Unit-I: Communication Skills

i) Verbal: a) Types of Communication; b) Barriers to Communication.

ii) Strategies for effective communication.

Nonverbal Skills - a) Body Language-Voluntary and Involuntary;

iii) Kinesics Facial Expressions;

iv) Proxemics;

v) Oculesics;

vi) Haptics and Chronemics.

Unit-II: Advanced Vocabulary

a) Synonyms & Antonyms; b) Phrasal verbs; c) Idioms; d) One wordSubstitutes.

Unit-III: Employability Skills & DescriptionsEmployability Skills:

a) Interview Skills; b) Group Discussion c)Resume Writing. Descriptions:

a) Process Description; b) Picture Description; c) Narration; d) Email etiquette.

Unit-IV: Role Play/Dialogue Writing

(a) Introducing oneself & others;

(b) Asking for & giving permissions;

(c) Asking for and responding to give directions;

(d) Seeking request;

(e) Inviting and responding invitations;

(f) Apologizing.

Unit-V: Presentation Skills

Extempore (JAM) Sessions; Paper Presentation.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	3	3	3		3	2	3	3	3
2	3	2	3	2		2	3	3	3	3
3	3	3	3	2		2	3	3	3	3
4	3	3	3	1		3	3	3	3	3
5	3	3	3	2		3	3	3	3	3

***1-Low *2- Medium *3- Strong**

THIRD SEMESTER

M.Sc. FORENSIC SCIENCE

SEMESTER-II

R22FS31: FORENSIC BALLISTICS

COURSE OUTCOMES:

- Know in detail regarding the field of Forensic ballistics including history of firearms, about ammunitions and how firearms are classified.
- Learn about the various types of mechanism of firing and also on what principles the identification and comparison of firearms, bullets and cartridge cases is based upon.
- Comprehend and get an in-depth knowledge of internal, external and terminalballistics.
- Understand about what are gunshot residues, and how can they be analyzed using chemical and instrumental techniques.
- Understand the importance of various physical evidences and their analysis.

Unit-I: Introduction **12H**

Definition of Forensic Ballistics & Firearms. History of firearms- Parts of firearm, classification of firearms. Rifling and its significance- Firing mechanism. Improvised/Country made, company made, frek guns/toys. Action mechanism of revolver, pistol.

Unit-II: Internal & External Ballistics **12H**

Internal Ballistics- Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting.

External Ballistics – Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Unit-III: Terminal / Wound Ballistics **12H**

Terminal Ballistics – Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range. Ricochet and its effects, stopping power.

Wound Ballistics - Nature of wounds of entry and exit, Identification and nature of firearms injuries. Patterns/ impact of injuries found on living person and dead persons identification. Reconstruction with respect to accident, suicide, murder and self defence.

Unit-IV: Ammunition **12H**

Ammunition Types of ammunition. Constructional features and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Headstamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit-V: Evidentiary Values **12H**

Firearm Evidence Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire. Mechanisms of formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothings.

REFERENCE BOOKS:

1) Hatcher Jury & Weller, 1987: Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
2) Gunther & Gunther, 1935: The Identification of Firearms, Wouldies, New York.
3) Jauhri, M. 1980: Monograpnh on Forensic Ballistics, Govt. of India Publication, New Delhi.
4) Burrad, 1951: The Identification of Firearms and Forensic Ballistics.
5) Sharma, B.R.: Firearms in Criminal Investigation and Trails, 1990.
6) Di Maio: Gunshot Wounds, 1987. 8. Kumar: Forensic Ballistics in Criminal Justice, 1987.
7) Yallop Explosion Investigation, 1980.
8) Edward Hueske: Firearms and Fingerprints.
9) Brian J Heard: Handbook of Firearms and Ballistics, Examining and Interpreting Forensic Evidence, Second Edition.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2		2	3		2				
2	2		2	3		2				
3	2		2	3		2				
4	2		2	3		2				
5	2		2	3		2				

***1-Low** ***2- Medium** ***3- Strong**

R22FS32: INSTRUMENTAL TECHNIQUES & DNA FINGER PRINTING

COURSE OUTCOMES:

- The basic principle of DNA analysis.
- The Forensic significance of DNA typing.
- The importance of Short Tandem Repeats and Restriction Fragment Length Polymorphism in DNA technique.
- Understand the range of molecular laboratory techniques used routinely in human Forensic analysis and population genetic analysis including sex typing, DNA profiling, Single Nucleotide Polymorphism (SNP) detection and DNA sequencing.
- Role of DNA typing in disputed paternity and maternity testing, child swapping, kidnapping, murder, rape cases and immigration cases.

Unit-I: Microscopy Techniques **12H**

Compound Microscope, Polarized Light Microscopy, Fluorescence Microscopy, Comparison Microscope, Stereo-zoom Microscope. Transmission Electron Microscope, Video-zoom Microscope. Scanning Electron Microscope – Energy Dispersive X-Ray. Atomic Force Microscope.

Immunochemical Techniques

General principles, production of antibodies, precipition reaction, Gel immunodiffusion, Immune-electrophoresis, complement fixation. Radio immunoassay (RIA), enzyme immunoassay, metalloimmunoassay, chemiluminiscent/fluorescence immunoassay

UNIT-II Preparation of Buffers &Centrifugation Techniques **12H**

General principles of Biological/chemical Analysis pH and buffers, physiological solution, Basic principles of sedimentation, Types of centrifuges, Density gradient centrifugation, Prerogative centrifugation, Analysis of sub-cellular fractions, ultracentriguge, refrigerated centrifuge

Unit-III: Basic Principles DNA as biological blueprint of life **12H**

History of DNA Fingerprinting, Human Genetics- Heredity, Allels, Mutation and Population Genetics, Molecular Biology of DNA, Extraction OF DNA, Organic & automatic method-PCR-Principle & Procedure –Amplification & Identificaton amplification STR Alleles using genetic analyser.

Unit-IV: Forensic DNA Typing Collection of specimens **12H**

Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence. Restriction Fragment Length Polymorphism (RFLP), Short Tandem Repeats (STR) – role of fluorescent dyes, nature of STR loci, genetic markers, typing procedure and interpretation of results. Touch DNA.

Unit-V: Forensic Significance DNA Profiling **12H**

Parentage Testing, Principles of heredity and Individual Identification. Genetics of paternity. DNA testing in disputed paternity. Mandelian laws of parentage testing. Mathematical basis of parentage identification. Missing body cases. Reference populations and databases. Allele frequency determination. Hardy-Weinberg law. Probability determination in a population database.

REFERENCE BOOKS:

1) Saferstein, R. (1982) Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
2) Kirby: DNA Fingerprinting Technology.
3) DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
4) DNA Profiling and DNA fingerprinting (1999) Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland.
5) Forensic DNA Profiling Protocols (1998) Patrick J. Lincoln and Jim Thomson; Humana Press, Inc.
6) DNA and other Polymorphism in Forensic Science (1990) Henry C. Lee and R.E. Gaensslen; Year book Medical Publishers, Inc.
7) Keith In man and Norah Rudin (1997) An Introduction to Forensic DNA Analysis, CRC Press; Ny.
8) Koblinsky et al. (2005) DNA - Forensic and Legal Implications.
9) John M. Butler (2005) Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers Academic Press.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2		2	2		2				
2	2		2	2		2				
3	2		2	2		2				
4	2		2	2		2				
5	2		2	2		2				

***1-Low *2- Medium *3- Strong**

R22FS33A: SPECTROSCOPIC METHODS OFANALYSIS
(ELECTIVE–A)

COURSE OUTCOMES:

- To provide knowledge about various fields of Instruments.
- To understand the basic principles in various instrumental methods.
- To understand the importance of Chromatographic and Spectroscopic techniques.
- To understand about various concepts of Industrial and Pharmaceutical techniques.To understand Forensic application by using various latest techniques.

Unit-I: Basic Concept of Spectroscopy **12H**

General idea on spectroscopy, electromagnetic spectrum, various source of radiation their utility and limitation. Interaction of radiation with matter i.e., reflection, absorption, fluorescence etc. Detection of radiation i.e. photographic, photoelectric etc. Forensic application of spectroscopy.

Unit-II: Basic Concept of Atomic and Molecular Spectra **12H**

Atomic spectra – Energy level, quantum number and designation of states, selection rule. Molecular Spectra – Quantitative discussion of molecular bindings, molecular orbital, type of molecular energies, discussion of rotational, vibrational and electronic spectra.

Unit-III: Ultraviolet-visible and Infrared Spectrophotometry **12H**

Basic principle, instrumentation, qualitative and quantitative analysis, interpretation of spectra etc. Forensic application of UV-Vis. and IR spectrophotometry.

Unit-IV: Mass Spectrometry (MS): **12H**

Principle and Instrumentation, Correlation of MS with molecular structure. A brief idea about the various forms of Mass Spectrometry Coupling MS with GC, LC, and CE etc. Application of MS in Forensic Science.

Unit-V: Radiochemical Techniques: **12H**

Basic principles and theory, introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis (NAA), Nuclear Magnetic Resonance Spectroscopy (NMR). Basics of Electrostatic Detection Apparatus.

Application of radiochemical techniques in forensic science.

REFERENCE BOOKS:

1) Frank A Settle (1997) Handbook of Instrumental Techniques for Analytical Chemistry.
2) James R et al. (2005) Undergraduate Instrumental Analysis.
3) Wildard, H. H., et al: Instrumental Methods of Analysis, 1974.
4) Lee & Gaensslen: Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
5) Settle, F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.
6) Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology.
7) Barbara P. Wheeler and Lori J. Wilson (2008) Practical Forensic Microscopy A Laboratory Manua.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1		2	2		2				
2	1		2	2		2				
3	1		2	2		2				
4	1		2	2		2				
5	1		2	2		2				

***1-Low *2- Medium *3- Strong**

R22FS33B: APPLICATIONS OF SYNTHETIC PRODUCTS (ELECTIVE–B)

COURSE OUTCOMES:

- The students able to understand dyes and their industrial importance.
- The students understand the cleansing action of soaps, manufacture of cosmetics and use of flavours and sweetness.
- The students able to understand effects of pesticides and insectides to the environment.
- The students understand about explosive materials and preparation & use of polymersin industries.
- Students understand the biodegradable and Non-biodegradable polymers and their industrial importance.

UNIT-I **12H**

Dyes: Colour and constitution, classification, dyeing method, and their industrial importance.
Drugs: Basic concepts, classification, sources, the requirement of an ideal drug.

UNIT-II **12H**

Synthetic Drugs: Structure and medicinal properties.

Sulphanilamide: An example of sulpha drug - paracetamol, aspirin, oil of wintergreen; Mephensin.

A muscle relaxant; Ibuprofen-an anti-inflammatory drug; L-dopa-cures Parkinson's disease;

UNIT-III **12H**

Soaps and Detergents: Production and their cleansing action. Liquid crystals and their applications. Surfactants

Cosmetics: Detailed study of formulations and manufacturing of cream and lotions, lipstick and nail polish, shampoos, hair dyes, and toothpastes.

Flavours: Natural flavouring materials and classification.

UNIT-IV **12H**

Sweeteners: Natural and Synthetic sweeteners.

Pesticides: Introduction, Classification, Applications and their effect on the environment.
Insecticides: Introduction, Classification, Applications and their effect on the environment.
Explosives: Introduction, RDX, Gun Powder.

UNIT-V **12H**

Polymers: Introduction, biodegradable and non-biodegradable polymers and their industrial importance, plastics (uses and effects on environment), natural and synthetic rubbers, polyamides, and polyesters like nylon, decron, terelyne. Thermoplastics–Poly carbonates, Poly acrylates in lens applications, Polyurethanes, and conducting polymers.

REFERENCE BOOKS:

1) I.L. Finar, Organic Chemistry, ELBS Longmann, Vol. I & II, 1984.742.
2) K. Albert, L Lehninger, D. L. Nelson, M.M. Cox, Principles of Biochemistry, CBZ Publishers, 1st Edition, New Delhi, 1993.
3) Harper's Biochemistry, Ed. R. Harper, 22nd Edition, Prentice Hall Press, New York, 1990.
4) Encyclopedia of Chemical Technology – Kirck – Othmer Series.
5) Harper's Review of Biochemistry – P.W. Martin, P.A. Mayer & V.W. Rodfwell, 15th Edition, Maurzen Asian Edition, California, 1981.
6) Polymer Science, Gowarikar.
7) Industrial Chemistry, B.K. Sharma.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1		2	2		2	1			
2	1		2	2		2	1			
3	1		2	2		2	1			
4	1		2	2		2	1			
5	1		2	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS33C: GREEN CHEMISTRY
(ELECTIVE–C)

COURSE OUTCOMES:

- To learn the principles and importance of Green chemistry.To learn the use of biocatalysts in chemical reactions.
- To learn about the solvent free techniques in chemical reactions.To learn the synthesis and applications of ionic liquids.
- To learn about the Ultrasound and Microwave assisted green synthesis.

UNIT-I **12H**

Fundamentals and significance of Green Chemistry:

Discussion of the current state of chemistry and the environment and the definition of Green chemistry. Assessment of the impact of chemistry in the environment and definition of risk hazard. An introduction to the tools of green chemistry and its fundamental principles. Principles of Green Chemistry: Prevention of waste / by-products , Hazardous products- Designing of safer chemicals- Selection of appropriate solvents and starting materials- Use of protecting groups and catalysis- Designing of biodegradable products.

UNIT-II **12H**

Catalysis for Green Chemistry:

Use of biocatalysts- Biochemical Oxidation, Biochemical Reduction, Enzyme Catalyzed Hydrolytic Process, Modified biocatalysis- transition metal catalysis- Reformatsky reaction, Wurtz reaction, Pinacol coupling, Simmons-Smith reaction, Mukaiyama reaction, Heak reaction, Ullmann's coupling.

UNIT-III **12H**

Solvent Free Reactions:

Solvent free techniques- Reactions on solid mineral supports, Phase Transfer Catalysis- C-alkylation, N-alkylation, S-alkylation, Darzen's reaction, Wittig reaction. Green synthesis- Oxidation, Reduction, Hydroboration, Bouveault reaction, Strecker reaction, Green synthesis- Biginelli reaction, Aza-Michael reaction, Suzuki reaction, Stille reaction, Sonogashira reaction.

UNIT-IV **12H**

Ionic liquids:

Definition- Types of Ionic Liquids-Synthesis of Ionic Liquids- Selection of ionic liquids- physical properties- Application in organic synthesis- alkylation, allylation, oxidation, reduction, polymerization, hydrogenation, hydroformylation, alkoxycarbonylation, carbon-carbon bond forming reactions, alkene metathesis. Phase transfer catalysis in green synthesis: Introduction, mechanism of phase transfer catalyst reactions, types and advantages of phase transfer catalyst reactions.

UNIT-V **12H**

ULTRASOUND AND MICROWAVE ASSISTED GREEN SYNTHESIS

Ultrasound: Introduction, instrumentation and the phenomenon of cavitation. Chemical reactions: Sonochemical esterification, substitution, addition, alkylation, oxidation, reduction and coupling reactions. Microwave: Introduction, concept, reaction vessel/ medium, specific effects, atom efficiency (% atom utilization) and advantages and limitations. Chemical reactions: N-alkylation and alkylation of active methylene compounds and Diels –Alder reactions. Reactions in water and reactions in organic solvents. Solvent free reactions and deprotection of esters.

RECOMMENDED BOOKS:

1) Green Chemistry theory and Practice, P. T. Anastas and J. C. Warner Oxford Univ.press, Oxford (1988).
2) Green Chemistry and Introductory text, Mike Lancaster, II Edition 39
3) New Trends in Green Chemistry, V.K. Ahluwalia, M. Kidwai.
4) Green Chemistry: Environment Friendly Alternatives, Rashmi Sanghi, M M Srivastava, Narosa, New Delhi (2003).
5) Green Solvents for Organic Synthesis, V.K. Ahluwalia, Rajender S. Varma.
6) Green Analytical Chemistry, Mihkel Koel and Mihkel Kaljuran
7) Green Chemistry – an introduction text, Royal Society of Chemistry, UK(2002)
8) Phase Transfer Catalysis in Organic Synthesis, W. B. Weber, G. W. Gokel, Springer (1977).
9) Phase Transfer Catalysis, E. V. Dehmlov, S. S. Dehmlov, 2nd Edn., Verlagchemie.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2		1	2		2	1			
2	2		1	2		2	1			
3	2		1	2		2	1			
4	2		1	2		2	1			
5	2		1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS34A: FORENSIC TOXICOLOGY
(ELECTIVE–A)

COURSE OUTCOMES:

- That the students understand the various types of drugs and toxic substances encountered in an investigation.
- Familiarize the student with the most frequently encountered substances in forensic toxicology and drug-related casework.
- Develop an understanding of the uses, effects and pharmacology and toxicology of these drugs.
- Apply important chemical and physical properties of drugs to explain how drugs are extracted or isolated from non-biological and biological evidence including blood, urine and human tissues.
- To ensure that the student understand nature of the toxicological investigations undertaken in forensic laboratories.

Unit-I: Fundamentals of Forensic Toxicology **12H**

Introduction and concept of forensic biological examination and significance of toxicological findings. Techniques used in toxicology. Toxicological analysis and chemical intoxication tests. Definitions – Toxins, Drug, Toxicodynamics, Toxicokinetics, Dose, Dose-response relationship Lethal Dose, LD50, least count and effective dose 50. Tolerance, Postmortem Toxicology. Human performance toxicology. Role of Forensic Toxicologist in Criminal Justice System.

Unit-II: Poisons **12H**

Classification of poisons. Physico-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisonings. Classification – Corrosives/caustics – Strong acids & Alkalis, Irritants – Organic (Vegetable, Animal & Organic acids) Inorganic (Metallic & Non Metallic) & Mechanical Poisons,

Animal poisons. Snake venom. Mode of action. Carbon monoxide poisoning. Vegetable poisons. Poisonous seeds, fruits, roots and mushrooms. Identification of biocides and metal salts in body fluids. Radioactive poisons. Neurotoxic Poisons – Cerebral & Spinal. Cardiovascular Poisons. Asphyxiants. Miscellaneous poisons – Pesticides. Metabolism and excretion of poisons. Application of immunoassays in forensic work.

Unit-III: Beverages /Alcohols **12H**

Toxicology of alcohol – Alcohol testing for intoxication Alcoholic and non-alcoholic illicit liquors. Analysis and identification of ethyl alcohol. Estimation of ethyl alcohol in blood and urine. Proof spirit. Alcohol in Circulatory system. i.e., Mode of Action. Analysis of alcohol samples.

Introduction, Principle, Instrumentation, Working & Applications of Thin Layer Chromatography,Gas Chromatography, High Performance Liquid Chromatography and Mass Spectrometry. Crime scene management in illicit liquor cases.

Unit-IV: Narcotics, Drugs and Psychotropic Substances 12H

Definition of narcotics, drugs and psychotropic substances and classification. General characteristics and common example of each classification. Natural, synthetic and semi-synthetic NDPS Substances Designer drugs and their forensic examination, Clandestine drug laboratories: Collection and preservation of drug evidence. Drugs of abuse in Sports: Collection and preservation of drug evidence.

Testing of narcotics, drugs and psychotropic substances. Isolation techniques for purifying narcotics, drugs and psychotropic substances–thin layer chromatography, gas-liquid chromatography and high performance liquid chromatography. Presumptive and screening tests for narcotics, drugs and psychotropic substances. Microcrystalline testing of drugs of abuse.

Unit-V: Clinical Toxicology 12H

Definition and concept of clinical toxicology, Signs and symptoms of common poisoning and their antidotes. Collection and preservation of viscera, blood and urine for various poison cases. Analysis of narcotics, drugs and psychotropic substances in postmortem blood, urine. Postmortem changes affecting the analysis of narcotics, drugs and psychotropic substances Analysis of narcotics, drugs and psychotropic substances in breast milk, saliva, urine, hair andantemortem blood. Drugs, Drunk and driving. Dope tests.

REFERENCE BOOKS:

1) DFS Manual of Forensic Toxicology.
2) A C Moffat Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set. 45
3) Casarett & Doll Toxicology (2003) The Basic Science of poisons.
4) Chadha PV (2004) Hand Book of Forensic Medicine and Toxicology, JaypeeBrothers New Delhi.
5) Clark, E.G.C.: Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
6) Curry A.S (1986) Analytical Methods in Human Toxicology, Part II, CRC Press Ohio
7) Curry, A.S. (1972) Advances in Forensic Chemical Toxicology.
8) Curry, A.S. (1976) Poison Detection in Human Organs.
9) Michael J. Deverlanko et al (1995) Hand Book of Toxicology CRC Press.
10) Morgan B.J.T (1996) Statistics in Toxicology, Clarendon Press, Oxford.
11) Mule, S.J et.al. Immunoassays for Drugs subjects to ab, CRC Press, 19 Parikh C.K.
12) Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology(1999) CBS Pub. New Delhi.
13) Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1		1	1	2		2	1			
2		1	1	2		2	1			
3		1	1	2		2	1			
4		1	1	2		2	1			
5		1	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS34B: INDUSTRIAL CHEMISTRY

(ELECTIVE–B)

COURSE OUTCOMES:

- Understand the importance of Inorganic chemicals in chemical industry.
- Knowledge about role played by various inorganic compounds.
- Understand the Inorganic chemicals in Fertilizer industry.
- Knowledge on the applications of Inorganic fibres and inorganic fillers.
- Understand the hazardous chemicals and safety measures.

UNIT-I:

Inorganic Compounds and Industry: Importance of the chemical industry in India and abroad. Primary inorganic materials: Water, Hydrogen, Hydrogen peroxide and inorganic peroxo compounds, Nitrogen and nitrogen compounds, Phosphorous and phosphorous compounds, Sulphur and sulphur compounds and Halogens, halogen compounds and iodine and iodine compounds. Bulk and commodities chemicals: metals and their compounds: Metallic lithium and its compounds; Metallic sodium and sodium borates; Potassium and its compounds, KOH and K_2CO_3. Alkaline earth metals and its compounds: Beryllium and magnesium, Calcium, strontium and barium; Manganese and its compounds. Performance /function based fine and specialty chemicals

UNIT-II:

Fertiliser Industry: Introduction, Essential plant Nutrients, primary and secondary Nutrients, Micro- and Macro- nutrients. Classification of Fertilizers: Straight Fertilizers, Compound/Complex fertilizers, Nitrogenous fertilizers, Phosphatic fertilizers, and Potassic fertilizers. Nitrogenous fertilizers: Ammonium sulphate, Ammonium nitrate, Calcium ammonium nitrate, Calcium nitrate, Ammonium chloride and Urea. Phosphatic fertilizers: Ground rock phosphate, Single superphosphate and Triple superphosphate. Potassic fertilizers: Potassium chloride, Potassium sulphate and Potassium nitrate. Complex fertilizers: Ammonium phosphate sulphate, Ammonium phosphates, Mono- and Di-Ammonium phosphate, Nitrophosphates, Urea and NPK Complexfertilizers.

UNIT-III:

Core Inorganic Compounds in Industry Organo-Silicon Compounds:

Antifoamers, adhesives, coatings and in herbicides and fungicides. Inorganic solids: CsCl, NaCl, ZnS, NiAs, perovskite, spinels, corundum, beta tungsten and graphite. Zeolites and catalysts for water purification and softening. Inorganic fibers: glass fiber, amorphous fiber or rock wool, carbon fiber, alumina fiber and potassium titanate fiber. Construction materials: Enamel and ceramics. Carbon modifications: diamond, graphite, carbonization and graphitization, Glassy and foamed carbon and carbon black. Fillers - synthetic and natural fillers and their applications. Metallic hard materials.

UNIT-IV:

Inorganic Chemicals in Corrosion Protection: Fundamentals of corrosion. Corrosion related damage and types of corrosions. Corrosion problems and passivity. Methods of prevention and control: Protective coatings, inhibitors, cathodic and anodic protection and material selection and design improvement. Metal finishing and processing: Metal finishing and technologicalimportance, process of electrodeposition of Copper and Nickel and Corrosion protection pigments. Inorganic pigments: TiO2, lithopone, ZnS, ZnO and Fe_2O_3; Luminescent pigments and magnetic pigments.

UNIT-V:

Industrial Hazards and Safety: Classification of hazardous chemicals, storage, transportation, handling, risk assessments, checklists, hazardous chemical surveys, safety program and safety reviews. Flammable material handling and fire fighting equipment, control measures for toxic chemicals, safety in laboratories, plants and in the transportation and storage of toxic chemicals. remote control systems, tear gas, chemical weapons and ocean dumping of chemical weapons. Chemical Explosives and safety measures. Hazardous waste management, bioconversion of waste materials to Industrial products. Industrial hygiene: air and biological monitoring, occupational diseases and personal protective equipment.

RECOMMENDED BOOKS:

1) Industrial Inorganic Chemistry by K H Buechel, H -H Moretto, P Woditsch; Wiley-VCH 2nd Ed.
2) Inorganic Chemistry: An Industrial and Environmental Perspective by T W Swaddle, AP 1997.
3) Industrial Chemistry, B.N. Chakrabarty, Oxford & IBH Publishing Co, New Delhi (1981).
4) Industrial Chemistry, B.K. Sharma Goel Publishing House, Meerut.
5) Introduction to Industrial Chemistry, Howard, W.L., Wiley-Interscience (1986).
6) Chemistry of Water Treatment, S.D. Faust and O.M. Aly, Butterworths (1983).
7) Principles of Industrial Chemistry, C. A. Clausen and G. Matts.
8) Safety and Hazards management in Chemical industries, Vyas M. N. Atlantic Publication (2013).
9) Safety evaluation of environmental chemicals, Dikshith T.S.S, New Age International, (1996)
10) Fertilizers, Organic Manures and Biofertilizers–A Product Quality Guide for Major & Micronutrients, HLS Tandon, Fertilizer Development and Consultation Organisation, New Delhi.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	3	3	3		3	3	3	2	
2	2	3	3	3		2	2	2	2	
3	3	2	2	3		3	2	2	2	
4	3	3	3	3		3	2	2	2	
5	3	3	3	3		3	2	2	2	

***1-Low *2- Medium *3- Strong**

R22FS34C: CHEMISTRY OF AEROSPACE MATERIALS

(ELECTIVE–C)

COURSE OUTCOMES:

- Students will get introduced to different classes of aerospace materials.
- Students understand property requirements of materials used in different areas of a spacecraft.
- Students will get an insight into composition-structure-processing-property correlation of aerospace materials to enable them to design new materials with improved properties
- Students can understand the metallic materials for cryogenic applications.
- Students can understand the evaluation of materials for space environment andspace worthiness.

UNIT-I **14H**

Carbon Based Materials: Carbon fiber, carbon-carbon composites, carbon aerogels and foams, Ceramic Materials: Polymer derived ceramics- synthesis, processing of pre-ceramic polymers, ceramic fibers, Ceramic matrix composites, Thermal barrier coatings, Ablative materials, Silica tiles, Ceramic aerogels, Porous ceramics and ceramic foams, Ultrahigh temperature ceramics- TiB_2, ZrB_2, HfB_2 and their composites, Materials with zero thermal expansion-glass ceramics-preparation and application.

UNIT-II **14H**

Metallic Materials: Super alloys, Titanium alloys, Intermetallics and metal matrix composites, Functionally graded materials -production, properties and application.

UNIT-III **10H**

High Temperature Polymers: Aromatic liquid crystalline polyesters, Phenolics, Polyimide, Poly ether ether ketones- synthesis, processing and applications.

UNIT-IV **12H**

Materials for Cryogenic Applications: Metals for low temperature applications, Austenitic stainless steel, Nitrogen containing steel, Aluminium, Aluminium-lithium alloys, Titanium alloys, Cryo insulation materials, Polymers and adhesive for cryo temperature applications.

UNIT-V **12H**

Materials for Space Environment: Radiation shielding materials, Atomic oxygen resistant materials, Space suit materials and materials for life support systems, Evaluation of materials for space environment and space worthiness.

REFERENCE BOOKS:

1) G. Savage, Carbon-Carbon Composites, 1st ed., Chapman and Hall, 1993.
2) M. Scheffler, P. Colombo, Cellular Ceramics, Structure, Manufacturing, properties and Applications, 1st ed., Wiley-VCH, 2006.
3) W.D. Kingery, H.K. Bowen, D.R. Uhlmann, Introduction to Ceramics, 2nd ed., WileyInterscience, 1976.
4) J.S. Reed, Principles of Ceramic Processing, 2nd ed., Wiley-Interscience, 1995.
5) H.M. Flower, High Performance Materials in Aerospace, 1st ed., Chapman & Hall, 1995.
6) B.Horst, B. Ilschner, K.C. Russel, Advanced Aerospace Materials, Springer-Verlag, Berlin, 1992.
7) F. Mohammad, Speciality Polymers: Materials and Applications, I.K. International publishing House Pvt. Ltd, 2007.
8) W. Krenkel, R. Naslain, H. Schneider, (Eds.) High Temperature Ceramic Matrix composites, 1st ed., Wiley-VCH, 2006.68 13
9) T.W. Clyne, P.J. Withers, E.A. Davis, I.M. Ward, Introduction to Metal Matrix Composites, Cambridge Solid State Science Series, 1st ed., Cambridge University Press, 1993.
10) R.R. Luise, Applications of High Temperature Polymers, CRC press, 1st ed., 1996.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1		1	1	2		2	1			
2		1	1	2		2	1			
3		1	1	2		2	1			
4		1	1	2		2	1			
5		1	1	2		2	1			

***1-Low *2- Medium *3- Strong**

PRACTICAL-I

R22FS35: FORENSIC BALLISTICS LAB

(MINIMUM FIVE EXPERIMENTS MUST BE CARRYOUT)

LIST OF EXPERIMENTS:

1) Characteristics of Firearms – Calibre, Choke, Trigger pull, Proof marks etc.
2) Examination and Comparison of fired bullets – Calibre, rifling characteristics, probable type of firearms.
3) Examination and Comparison of fired Cartridges/cases (Calibre, firing pin, breech face, Extractor / Ejector marks etc.)
4) Determination of shot number from size and weight of shots.
5) Identification of propellants.
6) Chemical tests for powder residues (Walker's test) and Barrel wash.
7) Identification of Shooter by GSR collection.
8) Examination of air guns / rifles as per Arms Act

PRACTICAL-II

R22FS36: FORENSIC TOXICOLOGY & DNA FINGERPRINTING LAB

(MINIMUM FIVE EXPERIMENTS MUST BE CARRYOUT)

LIST OF EXPERIMENTS:

1) Preliminary tests directly on blood / urine / vomitus / tissues for heavy metals, alkaloids, pesticides, cyanide, phenolic compounds and alcohol.
2) Detection and determination of ethyl alcohol in blood / urine / visceral tissue by kozelka & Hine's method.
3) Identification of basic drugs (from the extract) by colour tests and TLC.
4) Identification of neutral and acidic drugs (from the extract) by colour tests and TLC.
5) Identification of pesticides (from the extract) by TLC.
6) Determination of a drug in urine by visible / UV spectrophotometry.
7) Determination of a drug / pesticide in toxicological specimen by HPLC.
8) Determination of secretor status from semen and saliva stains by absorption inhibition technique.
9) Isolation of DNA from blood – purification.
10) Amplification of DNA using PCR.
11) Gel electrophoresis of proteins.
12) Assay of amylase.
13) Assay of urease.

FOURTH SEMESTER

M.Sc. FORENSIC SCIENCE
SEMESTER-IV

R22FS41: FORENSIC MEDICINE

COURSE OUTCOMES:

- Introduction, definition, various branches of forensic medicine,
- Anthropology, analysis of skeleton bones and determination of sex by using bones.
- Autopsy, time since death.
- Teeth, bite mark analysis.
- Natural and unnatural sexual offences types.

Unit-I: Introduction to Forensic Medicine **12H**

Fundamental aspects and scope of forensic medicine. Definitions of Forensic Medicine, Pathology, Medical Jurisprudence. Medical Law and Ethics.History and scope of Forensic Medicine. Role of first responding officer. Approaching a crime scene of death. Documenting the death scene. Medical Jurisprudence. Personal identification of living and non-living persons. Medical certification and medico-legal reports. IPC sections relating to Forensic Medicine.

Unit-II Forensic Anthropology **12H**

Forensic Anthropology - Scope of forensic anthropology. Role of forensic anthropologist - Collection and preservation of evidences - Human osteology - Study of human skeleton. Nature, formation, and identification of human bones. Determination of age, sex, race from skeletal material. Determin ation of personal identity by superimposition technique - Video image analysis - Facial reconstruction - Legal provisions and tools involved in it.

Unit-III Forensic Odontology **12H**

Development, scope and role of forensic odontology in mass disaster and anthropology. Types of teeth and their comparative anatomy. Bite marks. Forensic significance of bite marks. Collection, preservation and photography of bite marks evidence. Legal aspects of bite marks. Estimation of age from teeth.

Unit IV: Forensic Pathology **12H**

Death- Post mortem examination (autopsy) – Medico legal aspects of death – Causes of death – Post mortem changes and their importance in determination of time after death - Preservation of pathological evidence - Examination of decomposed, mutilated and burnt bodies – Exhumation procedure - Deaths from poisoning – Mechanical Asphyxia – Drowning - Starvation - Lightning – Electrocution. Injuries - Types and classification. Antemortem and post mortem injuries. Aging of injuries. Artificial injuries. Burns and scalds.

Unit V: Sexual Offences **12H**

Rape – Unnatural sexual offences and medicolegal aspects - Abortion & Infanticide – Medico legal aspects – Impotence and sterility – Virginity, Pregnancy and Delivery - Medicolegal aspects - MPT Act - Linkage with forensic science laboratory.

Forensic Psychiatry- Classification of mental disorders, Legal aspects and criminal responsibility

REFERENCE BOOKS:

1) Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.
2) Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxiford University, Press; 1998.
3) Forensic Taphonomy, edited by Wouldiam D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
4) Glaister (Ed)-Rentoul & Smith (1973): Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
5) Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
6) Glaister Anatomy (Ed) - Rentoul & Smith (1973): Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1	1	1	2		2	1			
2	1	1	1	2		2	1			
3	1	1	1	2		2	1			
4	1	1	1	2		2	1			
5	1	1	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS42: INDIAN LAW TO COMBAT CRIME

COURSE OUTCOMES:

- Know the judiciary system.
- Learn the elements of Criminal Procedure Code related to forensic science.
- Study and understand the Preamble, and Articles of the Constitution of India.
- Know Acts governing socio-economic crimes.
- Know Acts governing environmental crimes.

UNIT –I: Role of Judiciary **12H**

Introduction – Administration of civil and criminal justice, Hierarchy of courts – Powers of courts, Types of courts, Lok Ayukta system. Sentences which the court of Chief Judicial Magistrate may pass, Summary trials – Section 260(2), Judgments in abridged forms – Section 355.

Constitution of India-Preamble of the Constitution, Fundamental rights (Part III) Articles 12-35, Directive principles of state policy (Part IV) Articles 36-51 and Fundamental duties (Part V)-51A.

UNIT–II: Criminal Law **12H**

Indian Penal Code pertaining to offences against persons – Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, Sections 375 & 377 and their amendments. Indian Penal Code pertaining to offences against property Sections – 378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503, 511.

Indian Evidence Act – Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses. Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141, Section 293 in the code of criminal procedure.

UNIT –III: Criminal Procedure Code **12H**

Criminal Procedure Code Act. Definitions – Offence and its connotations, cognizable and non-cognizable offences, bailable and non-bailable offences, prosecutors and defense, warrant and summons, First Information Report (FIR), arrest with and without warrant, rights of arrested individual under CrPC. Human rights and criminal justice system in India. Role of Forensic science to aid the criminal justice system.

Unit-IV Role of Police in Investigations **12H**

Policingstyles and principles, police powers in investigation, investigation officer,community policing, policing a heterogeneous society, criminal investigation, urban and ruralpolicing.

Police reforms and administration.

UNIT-V: Special Acts **12H**

Narcotic, Drugs and psychotropic substances act, Essential commodity act, Drugs and cosmetics act, Drugs and pharmaceuticals act, Explosive substances act. Arms act, Dowry prohibition act, Prevention of food adulteration act. Prevention of corruption act. RTI Act (2005) 2019, Wildlife protection act 1972, I.T. act. Environment protection act. SC/ST atrocities act, POCSO, UAPA, Senior citizens act and PETA.

REFERENCE BOOKS:

1) Ratan Lal and Dhiraj Lal: Indian Penal Code, Wadhwa & Co., 2000.
2) Achutan Pillai: Criminal Law, Butterworth Co., 2000.
3) Major Act and Minor Act Law Books
4) Gour K.D.: Criminal Law - Cases and Materials, Butterworth Co., 1999.
5) Kenny's: Outlines of Criminal Law, (1998 Edition).
6) O.P. Srivastava: General Principles of Criminal Law.
7) Constitution of India
8) Indian Evidence Act C
9) Criminal Procedure code.
10) Indian Penal Code.
11) Barak, Gregg: Integrative Criminology.
12) Johnson: Crime, Correction and Society.
13) Riderman: The Manipulation of Human Behaviour.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1	1	1	2		2	1			
2	1	1	1	2		2	1			
3	1	1	1	2		2	1			
4	1	1	1	2		2	1			
5	1	1	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS43A: QUESTIONED DOCUMENT ANALYSIS
(ELECTIVE–A)

COURSE OUTCOMES:

- The basic concepts and principles of questioned documents examination.
- Apply the principles of jurisprudence procedure in presenting questioned document in court proceeding.
- Collaborate the questioned document techniques effectively and independently in multi-disciplinary and multi-cultural teams.
- Forgeries, types of forgery and examination.
- Instruments used for examination of different types of questioned documents.

Unit-I: Introduction **12H**

Introduction to questioned document- Definition of questioned documents -Nature and Scope of Questioned Documents -Terminology of documents- History of forensic document examination. Classification of documents-procurement of standard admitted/specimen writings-handling and marking of documents-preliminary examination of documents – Types of crimes related to documents – criminal investigation.

Unit-II: Handwriting: The Purposes and complexities in Examination **12H**

Comparison of Documents Comparison of handwriting. Development of individuality in handwriting. Natural variations and fundamental divergences in handwritings. Principle of Handwriting Identification, general and individual characteristics,Class and individual characterstics. Merits and demerits of exemplar and non-exemplar samples during comparison of handwriting. Standards for comparison of handwriting. Comparison of paper, ink, printed documents, typed documents, Xeroxed documents.

Unit-III: Forensic stylistics **12H**

Basic tools needed for forensic documents' examination – ultraviolet, visible, infrared and fluorescence spectroscopy, photomicrography, microphotography, visible spectral comparator, electrostatic detection apparatus. Various stages of document examinations. Determining the age and relative age of documents by different methods.

Qualifications, duties and responsibilities of Questioned document examiner. Government Examiner of Questioned Document and state forensic questioned examinations.

Forensic stylistics- Forensic linguistics, e-documents, digital signatures Opinion- Reporting to the court juxtaposed charts - evidence in the court- cross examination, Related Case Studies.

Unit-IV: Forgery **12H**

Definition of forgery, various types of forensic documents: genuine and forged documents, classification of forensic documents, Forgeries and their detection, specimen writings, admitted writings, Characteristics of forged and genuine signatures and writings. - Identification of writer. Alterations in documents, including erasures, additions, over-writings and obliterations. Indented and invisible writings and decipherment of secret writings.

Charred documents and examination of documents. Disguised writing and anonymous letters. Built-up document and forensic significances.

Unit -V: Examination Methods **12H**

Examination of Paper: Types of Paper, Manufacture of Paper, Paper GSM, Testing of Paper, Nondestructive Tests, Destructive Tests, Comparison of Paper, Mechanical Fits, Watermarks, Dating of Paper, Envelopes, Writing Materials, Pencils, Inks, Liquid Inks, Ball-Point Inks, Fiber-Tipped, Roller Ball, and Gel Pens.

Examination of Inks: Visual Examination, Examination of Color, Absorption Spectra and the Examination of Inks, Ultraviolet and Infrared Radiation, Detection of Infrared Radiation, Infrared 51 Absorption, Ultraviolet Fluorescence, Infrared Luminescence, Comparison of Inks Using Infrared Luminescence, Erasures, Obliterations, Other Luminescence Effects, Destructive Techniques, Chromatography, Thin-Layer Chromatography, High-Performance Liquid Chromatography, Chemical Tests, Other Components of Ink, Further Techniques, Relative Aging of Ball-Point Inks, Dating of Inks.

Examination of counterfeit Indian currency notes, stamps, seals, passports, visas and Examination of computer printouts- dot matrix, ink jet and laser printers, electronic type writers, credit cards, E-documents ,scanned documents, digital signatures.

REFERENCE BOOKS:

1) O. Hilton, *Scientific Examination of Questioned Documents*, CRC Press, Boca Raton (1982).
2) A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, Foundation Press, New York (1995).
3) R.N. Morris, *Forensic Handwriting Identification: Fundamental Concepts and Principles*, Academic Press, London (2000).
4) E. David, *The Scientific Examination of Documents – Methods and Techniques*, 2nd Edition, Taylor & Francis, Hants (1997).

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	1	2	1	2		2	1			
2	1	2	1	2		2	1			
3	1	2	1	2		2	1			
4	1	2	1	2		2	1			
5	1	2	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS43B: ENGINEERING CHEMISTRY

(ELECTIVE–B)

COURSE OUTCOMES:

- Knowledge on Chemistry of engineering materials and their applications.
- Understand the Principles of polymer chemistry and engineering applications of polymers.
- Knowledge on Principles of electro chemistry, electrochemical cells, Reference electrodes,
- Solar and fuel cells,Energy Storage Devices.
- Understand the mechanism of corrosion and Principles of corrosion control.
- Knowledge on analytical techniques and their importance.

UNIT-I: Engineering Materials

Refractories: Classification – Acidic, Basic and Neutral refractories; Properties: refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling; Preparation, Properties and applications of alumina, magnesite and zirconia bricks,

UNIT-II: Polymer Chemistry

Introduction, polymerization: types – addition and condensation polymerization; Mechanism of free radical addition polymerization with suitable example; Polymer Tacticity and Ziegler Natta polymerization (mechanism).

Plastics: Classification (Thermoplastic and thermosetting); Preparation, properties and uses of PVC, Teflon, Bakelite, Nylon-6,6.

Rubbers: Natural rubber**,** drawbacks of raw rubber**,** Vulcanization of rubber; Synthetic rubbers: Buna-S, Buna-N and Poly urethane.

UNIT-III: Electro Chemistry:

Electrode potential, Determination of single electrode potential; Nernst equation (problems); Electrochemical series – significance; Electro chemical cells, Reversible and irreversible cells, Reference electrodes – Standard Hydrogen electrode, Calomel electrode, Ion selective electrode (glass electrode) – measurement of pH;

Solar cells: Introduction, Solar Panels, Applications; Fuel Cells: Hydrogen – Oxygen Fuel Cell; Batteries: Lead – acid, NiCad and Lithium Batteries.

UNIT-IV: Corrosion and Corrosion Control:

Corrosion: Types of corrosion - Chemical or dry corrosion, Pilling – Bedworth rule; Electrochemical orwet corrosion; Galvanic corrosion, pitting, stress and differential aeration corrosion; factors influencing corrosion;

Corrosion control – sacrificial anodic method and impressed current cathodic methods, corrosion inhibitors; Protective coatings: Metallic coatings – electro plating (Au) and electroless plating (Ni). Paints – constituents and functions.

UNIT-V: Analytical Techniques:

Beer-Lambert's law; Colorimetry: principle, instrumentation (with block diagram) and Estimation of iron, Flame photometry: principle, instrumentation (with block diagram) and estimation of sodium; Atomic Absorption Spectroscopy: principle, instrumentation (with block diagram) and estimation of nickel.

Conductometric titrations (Acid-Base) and Potentiometric titrations (Redox titrations–Fe^{2+} *vs* dichromate).

REFERENCE BOOKS:

1) P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi 15^{th}edition (2010).
2) S.S. Dara & Mukkanti K. "A text book of engineering chemistry" S. Chand & Co. Ltd., NewDelhi (2006).
3) B. Sivasankar "Engineering Chemistry" Tata McGraw Hills co., New Delhi (2008).
4) Dr. B. K. Sharma, Instrumental methods of analysis, Krishna Prakashan Media, 2000.
5) Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
6) Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	2	3	2		2	2	3		
2	2	2	2	3		2	1	3		
3	2	2	3	2		2	2	2		
4	2	2	2	1		2	2	3		
5	2	2	3	2		2	1	3		

***1-Low *2- Medium *3- Strong**

R22FS43C: LABORATORY QUALITY CONTROL & QUALITY ASSURANCE

(ELECTIVE–C)

COURSE OUTCOMES:

- Knowledge about the basics of quality audit like SOP, ICH, ISO etc.
- Understand the various documentation processes and handling of materials.
- Understand the organizational responsibilities and personal responsibilities in the pharmasector.
- Knowledge acquire basic knowledge about the regulatory aspects and quality control.
- Knowledge about the Basic concepts of Quality Assurance

UNIT-I:

Pharmaceuticals Concept of drug, lead compound and lead modification, prodrugs and soft drugs. Importance of quality control, drugs and pharmaceuticals, sources of impurities in pharmaceutical chemicals, analytical quality control in finished/final products, common methods of assay.

UNIT-II:

Quality Audit, Documentation Quality audit. Standard operating procedure (SOP); international conference harmonization (ICH); ISO-9000; ISO-14000, WHO specifications, USFDA guidelines and ICMR. Documentation and Handling: Manufacturing documents, Master Formula, batch formula, Record, Distribution of records, Handling of returned goods, Recovered materials and Reprocessing.

UNIT-III:

Organization and Personnel Responsibilities Training, Hygiene, Premises: Location, Design, Plant layout, Construction, Maintenance and Sanitations. Environmental control, sterile areas, control of contamination.

UNIT-IV:

Regulatory Aspects and Quality Control Regulatory aspects. Validation f Personnel, Equipment and cleaning methods, regulatory aspects of pharmaceutics. Quality Control. In-process quality Control on various dosage forms, Sterile and non-sterile operations.

UNIT-V:

Basic concepts of Quality Assurance Basic concepts, principles or prescription, Needs, requirements and expectations, characteristics of quality, Achieving, sustaining and improving quality, Quality dimensions and costs of quality. Elements of quality Assurance, Quality Management System, Quality management concepts and principles: ISO 9001:2000, QMS Case studies on ISO 9001: 2000 in chemical industries.

REFERENCE BOOKS:

1) R. Pannerselvam, Production and Operations Management, Prentice Hall India Learning Pvt. Ltd3rd Ed., 2012.
2) M. Savsar, Quality Assurance and Management, InTech-Croatia, 2012, ISBN 978-953-51-0378-3.
3) D.C. Montgomery, Statistical Quality Control, John Wiley & Sons, 5th Ed., 2005.
4) M. K. Starr, Production and Operations Management, Biztantra, Delhi, 2004.
5) D.H. Shah, QA Manual, Business Horizons, 2000.
6) D.H. Besterfield, C. Besterfield-Michna, G.H. Besterfield, M. Besterfield Sacre, Total QualityManagement, Pearson Education, Inc., 3rd Ed., 2003.
7) P. Konieczka, J. Namiesnik, Quality Assurance and Quality Control in the Analytical ChemicalLaboratory: A Practical Approach, 1st Ed., CRC press 2009.
8) D. Hoyle, ISO 9000 Quality Systems Handbook, 5th Ed., Butterworth Heinemann-Elsevier, NewYork, 2006.
9) E. Prichard, V. Barwick, Quality Assurance in Analytical Chemistry, John Wiley & Sons, 2007.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	3	2	3	2		3	3	3	2	1
2	3	2	2	2		3	3	3	1	2
3	3	2	3	2		2	3	3	1	2
4	3	2	3	2		3	3	3	1	2
5	3	3	3	3		3	3	3	1	2

***1-Low *2- Medium *3- Strong**

R22FS44A: ANALYSIS OF FOODS & DRUGS
(ELECTIVE–A)

COURSE OUTCOMES:

- To know the different drugs used for analgesic, antipyretics and infections.
- Provides the basic knowledge about antihistamine and sedative drugs.
- Having an idea of anti-epileptic, anticonvulsant and cardiovascular drugs.
- To know the various dairy products, preservatives, flavouring agents and foodadulterants.
- Provides the knowledge about biochemical and clinical analysis of blood

UNIT I **12H**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of analgesics and antipyretics like aspirinand paracetamol Analysis of antimalerials like choloroquine. Analysis of drugs in the treatmentof infections and infestations: Amoxycillin., chloramphenicol, metronidazole, penicillin, tetracycline. Antituberculous drug- isoniazid.

UNIT II **12H**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of antihistamine drugs and sedatives like: allegra, zyrtec(citirizine), alprazolam, trazodone, lorazepem.

UNIT III **12H**

Analysis of antiepileptic and anticonvulsant drugs like phenobarbital and phenacemide. Analysis of drugs used in case of cardiovascular drugs:atenolol, norvasc (amlodipine), Analysis of Lipitor (atorvastatin) a drug for the preventin of productin of cholesterol.

Analysis of diuretics like: furosemide (Lasix), triamterene Analysis of prevacid (lansoprazole) a drug used for the prevention of production of acids in stomach.

UNIT IV **12H**

Analysis of Milk and Milk Products: Acidity, total solids, fat, total nitrogen, protenines, lactose, phosphate activity, casein, chloride Analysis of food materials.

Preservatives: Sodium carbonate, sodium benzoate sorbic acid Flavoring agents - Vanilla, diacetyl, isoamyl acetate, limonene, ethylpropionate, allyl hexanoate and Adulterants in rice and wheat, wheat flour, sago, coconut oil, coffee powder, tea powder, milk.

UNIT V **12H**

Food and Drug interactions: Risk factors for food and drug interactions. Effect of food on drug therapy. Effect of drug on food and nutrition. Modifications of drug action by food and nutrition. Effect of drug on nutritional status.

REFERENCE BOOKS:

1) F.J.Welcher-Standard methods of analysis,
2) A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
3) F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
4) J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on
5) Analytical chemistry and its applications -- Inter Science- Vol I to VII.,
6) Aanalytical Agricultrual Chemistry by S.L.Chopra & J.S.Kanwar - Kalyani Publishers
7) Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi, CBS Distributors, New Delhi.
8) G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.
9) H.Wincciam and Bobbles (Henry J)- Instrumental methods of analysis of food additives.,
10) H.Edward-The Chemical analysis of foods; Practical treatise on the examination of food stuffs and the detection of adulterants,
11) The quantitative analysis of drugs- D.C.Garratt-Chapman & Hall,
12) A text book of pharmaceutical analysis by K.A.Connors-Wiley- International,
13) Comprehensive medicinal chemistry-Ed Corwin Hansch Vol 5,Pergamon Press.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	2	1	2		2	1			
2	2	2	1	2		2	1			
3	2	2	1	2		2	1			
4	2	2	1	2		2	1			
5	2	2	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS44B: FORENSIC SCIENCE - IN SOLVING CRIME (ELECTIVE–B)

COURSE OUTCOMES:

- The significance of Forensic science to human society.
- The fundamental principles and functions of Forensic science.
- The divisions in a Forensic science laboratory.
- The various steps to be taken to thoroughly record the crime scene.
- The legal importance of chain of custody.
- Knowledge about the Basic concepts ofQuality Assurance

UNIT-I **12H**

Introduction to Forensic Science: Need and functions of Forensic science. Historical aspects of Forensic science. Development of Forensic Science Laboratories. Definitions and concepts in Forensic science. Basic principles of Forensic science. Scope of Forensic science. Governing principals of Forensic Science. Forensic Science in Indian scenario. Admissibility in Indian Courts. Frye standard and Daubert standard.

Unit-II **12H**

Divisions of Forensic Science

Branches of Forensic science and their importance. Hierarchical set up of various Government Forensic Science Laboratories.

Forensic Evidences: Concise of Forensic Physical, Biological, Chemical and Psychological evidences, Medico-Legal Cases. Legal and Scientific problems. Forensic intelligence and Interviews.

UNIT-III **12H**

Crime Scene

Types of crime scenes. Safety measures at crime scenes. Role of First Responding Officer. Coordination between police personnel and Forensic scientists at crime scenes. The evaluation of 5Ws (who? what? when? where? why?) and 1H (how?)

UNIT-IV **12H**

Police and Forensic Science

Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene, Importance of Chain of custody, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police, Mobile device forensics, Role of Media, Human Rights Commission & Criminal Justice System.

UNIT-V **12H**

Administration and Organizational Setup:

DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR & D, Qualifications and duties of Forensic Scientists Academic centres of education and research: Indian and Academy of Forensic Science, American Board of Forensic Science, American Board of Forensic Odontology, Bureau of Alcohol Tobacco and Firearms, Interpol and FBI, Australian Academy of Forensic Sciences. Forensic Science in India: Teaching Courses and Research fields in Forensic Science, Scope and jobs in Forensic Science.

REFERENCE BOOKS:

1) Nabar, B. S. (2012). Forensic science in criminal investigation.
2) Saferstein, R. (2013). Criminalistics. Pearson Education.
3) Nanda, B. B. (2001). Forensic Science in India: A vision for the twenty-first century. Select Publishers.
4) Bhasin, M. K. and S. Nath (2002). Role of Forensic Science in the New Millennium, University of Delhi, Delhi.
5) James, S. H. and J.J. Nordby (2005). Forensic Science: An Introduction to Scientific andInvestigative Techniques, 2nd Edition, CRC Press, Boca Raton.
6) Sharma, D. B. (2005). Forensic Science in Criminal Investigation & Trials. Universal LawPublishing Company.

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1		2	1	2		2	1			
2		2	1	2		2	1			
3		2	1	2		2	1			
4		2	1	2		2	1			
5		2	1	2		2	1			

***1-Low *2- Medium *3- Strong**

R22FS44C: CHEMISTRY OF HIGH ENERGY MATERIALS (ELECTIVE–C)

COURSE OUTCOMES:

- Knowledge about the definitions of high energy materials.
- Understand about the basis of energetic materials.
- Knowledge about the theoretical basis of thermodynamics.
- Understand about the importance of various novel energetic materials.
- Knowledge on the handling & synthesis of energetic materials.

UNIT -I:

High Energy materials: Introduction, Definitions, Combustion, Deflagration, Detonation, Fire and Combustion, Deflagration and Detonation.

UNIT-II:

Classification of Energetic Materials: Primary Explosives, High (Secondary) Explosives, Propellant Charges, Rocket Propellants, Chemical Thermal Propulsion (CTP), Pyrotechnics, Detonators, Initiators, Delay Compositions and Heat-Generating Pyrotechnics, Light-Generating Pyrotechnics, Decoy Flares, Smoke Munitions, Near-Infrared (NIR) Compositions.

UNIT-III:

Detonation, Detonation Velocity and Detonation Pressure,

Thermodynamics: Theoretical Basis, Computational Methods, Thermodynamics, Detonation Parameters, Combustion Parameters, Example: Theoretical Evaluation of New Solid Rocket Propellants 101 4.2.5 Example: EXPLO5 Calculation of the Gun Propellant Properties of Single,Double and Triple Base Propellants.

UNIT-IV:

Design of Novel Energetic Materials: Classification, Polynitrogen Compounds, High-Nitrogen Compounds, Tetrazole and Dinitramide Chemistry, Tetrazole, Tetrazine and Trinitroethyl Chemistry, Ionic Liquids, Dinitroguanidine Derivatives, Co-Crystallization, Future Energetics.

UNIT-V:

Synthesis of Energetic Materials: Molecular Building Blocks, Nitration Reactions, Processing, Safe Handling of Energetic Materials in the Laboratory, General, Protective Equipment, Laboratory, Equipment. Energetic Materials of the Future.

REFERENCE BOOKS:

1) G.Majano, S. Mintova, T.Bein, T.M.Klapotke, Advanced Materials.
2) R.M.Doherty, Novel Energetic Materials and Applications.
3) H.D.B. Jenkins, Chemical Thermodynamics at a Glance, Black well, Oxford.
4) J.P. Agarwal, R.D. Hodgson Organic Chemistry of Explosives.
5) Prof. Dr. Thomas Kal Potke Energetic Materials-LMU Munich. (https://www.hedm.cup.uni-muenchen.de/personen/professors/klapoetke/index.html)
6) https://www.uidaho.edu/sci/chem/people/faculty/jshreeve

OUTCOME MAPPING:

Course Outcomes (CO)	Program Outcomes (POs)									
	1	2	3	4	5	6	7	8	9	10
1	2	2	1		2	1		1		1
2	2	2	1		2	1		1		2
3	2	2	1		2	1		1		2
4	2	2	1		2	1		1		2
5	2	2	1		2	1		1		

***1-Low *2- Medium *3- Strong**

PRACTICAL-I

R22FS45: IMPRESSIONS & DOCUMENT EXAMINATION LAB

Part I: One theory question relating to any topic out of four semesters or as wish by the examiner. 15M

Part II: Experiment from following Syllabus List. 55M

LIST OF EXPERIMENTS:

1) Identification of Handwriting General Characteristics.
2) Study of letter formations in handwriting.
3) Identification of individual characteristics.
4) To study alterations in the document.
5) To decipher the indented and invisible writings.
6) To examine the watermarks in the document.
7) To examine currency notes.
8) To study the type scripts.
9) To obtain Plain and rolled inked finger prints.
10) To identify the finger Print Patterns.
11) To perform ridge tracing and ridge counting.
12) To identify the ridge characteristics.
13) To perform ten digit classification of fingerprints.
14) To compare the finger Prints.
15) To develop and lift latent finger Prints with powder, fuming and chemical methods.

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R22FS46: PROJECT WORK-INTERNSHIP

Title Selection: Project Work

PROJECT WORK:

Project – Internship is compulsory and how to submit dissertation containing background of the work, experimental, results and discussion and summary.

R22FS47: COMPREHENSIVE VIVA-VOCE

The students will be analyzed with questions covering 3rd & 4th semester topics.

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