

University of Mumbai



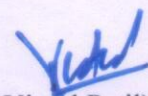
No. AAMS(UG)/ 57 of 2022-23

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No.UG/112 of 2016-17 dated 25th October, 2016 relating to the revised syllabus as per the CBCS for S.Y.B.Sc. (Forensic Science) (Sem III & IV).

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Forensic Science** at its meeting held on 07th May, 2022 and subsequently passed by the Board of Deans at its meeting held on 17th May, 2022 vide item No. 6.3 (R) have been accepted by the Academic Council at its meeting held on 17th May, 2022 vide item No. 6.11 (R) and that in accordance therewith, the revised syllabus of **S.Y.B.Sc. (Forensic Science) (Sem III & IV) (CBCS)** has been brought into force with effect from the academic year 2023-24. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032
28th June, 2022


(Dr. Vinod Patil)
I/c Registrar

To

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

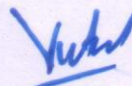
A.C/6.11(R)/17/05/2022

No. AAMS(UG)/ 57 -A of 2022-23

28th June, 2022

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Ad-hoc Board of Studies Forensic Science,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.


(Dr. Vinod Patil)
I/c Registrar

Copy to :-

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

for information.

UNIVERSITY OF MUMBAI



**Revised Syllabus for S.Y.B. Sc.
(Forensic Science)**

**Sem – III & IV
(Choice Based Credit System)**

(With effect from the academic year 2023-24)


UNIVERSITY OF MUMBAI



Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course O. _____	S.Y.B. Sc. (Forensic Science)
2	Eligibility for Admission O. _____	Ordinance no. O.5719 Circular no. UG/284 of 2007 dated 16th June 2007
3	Passing Marks R. _____	40%
4	Ordinances / Regulations (if any)	As applicable for all B.Sc. Courses
5	No. of Years / Semesters R. _____	Three years – Six Semesters
6	Level	P.G./ U.G. / Diploma / Certificate (Strike out which is not applicable)
7	Pattern	Yearly / Semester (Strike out which is not applicable)
8	Status	New / Revised (Strike out which is not applicable)
9	To be implemented from Academic Year	From the Academic Year <u>2023-24</u>

Dr. Pratima Jadhav
BOS Chairperson in Forensic Science


Dr. Anuradha Majumdar
Dean, Science and Technology

Preamble

In a world where crime is incessantly improvising and rapidly evolving; it calls for equally competent minds and tools to solve it. Aiming towards the dream of a crime free society not only promises safety to the people but also fosters the progress of the nation. To achieve this, there are Central, State and Regional Laboratories by the Public sector; with many private laboratories and agencies recently operational in the country. There are also various public organizations such as Intelligence Bureau (IB), Central Bureau of Investigation (CBI) and the crime branch-Central Investigation Department (CID) in the country. To provide them with experts who are efficient, able and competent is the goal of the Institute. Department of Higher and Technical Education, Government of Maharashtra has started three Institutes of Forensic Science at Aurangabad, Mumbai and Nagpur to cater the need of quality human resources in the field of forensic sciences in the year 2009 and 2011. A study committee was appointed in 2021 to revise and update the syllabus of B.Sc. of all three Institutes and implement content similarity in all the three Institutes in the state. The study committee was comprised of experts from various subjects from Directorate of Forensic Science Laboratory, academic subject experts from the three Institutes and from other sectors. Accordingly, the curriculum of the B.Sc. course was revised and designed with the advice of the experts in the field and ensures the students are equipped with adequate skills and knowledge to provide expertise in the respective fields after successful completion of the course. It also encourages them to develop critical thinking and analytical skills, new ideas and strategies for effective crime solving.

The second-year syllabus are designed to get the students acquainted with the advanced knowledge, laws and principles of basic sciences like biology, physics, chemistry and psychology including instrumentation for its application in the field of Forensic Science.

Dr. Anuradha Majumdar (Dean, Science and Technology)

Dr. Shivram Garje (Associate Dean, Science)

Dr. Pratima Jadhav (Chairperson, Ad Hoc BOS in Forensic Science)

Dr. Sanjay Jagtap (Member)

Dr. Yuvaraj Malghe (Member)

Dr. Krishna Kulkarni (Member)

Dr. Rupendra Jadhav (Member)

S. Y. B.Sc. (Forensic Science) (Semester III) Credits

To be implemented from Academic Year 2023-2024

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 301	Forensic Science–III	4		60		50		100		2		2
USFS 302	Chemical Science – III	4		60		50		100		2		2
USFS 303	Physical Science – III	4		60		50		100		2		2
USFS 304	Biological Science – III	4		60		50		100		2		2
USFS 305	Psychology – III	4		60		50		100		2		2
USFS 306	Computer Science – III	4		60		50		100		2		2
USFS 307	Law – III	4		60		50		100		2		2
USFS 3P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 3P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 3P3	Psychology and Computer Science Practical		6		90		72		100		2	2
Total	--	28	18	420	270	350	216	700	300	14	6	20

S. Y. B.Sc. (Forensic Science) (Semester IV) Credits

To be implemented from Academic Year 2023-2024

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 401	Forensic Science–IV	4		60		50		100		2		2
USFS 402	Chemical Science – IV	4		60		50		100		2		2
USFS 403	Physical Science –IV	4		60		50		100		2		2
USFS 404	Biological Science – IV	4		60		50		100		2		2
USFS 405	Psychology – IV	4		60		50		100		2		2
USFS 406	Computer Science – IV	4		60		50		100		2		2
USFS 407	Law – IV	4		60		50		100		2		2
USFS 4P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 4P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 4P3	Psychology and Computer Science Practical		6		90		72		100		2	2
Total	--	28	18	420	270	350	216	700	300	14	6	20

B. Sc. (FORENSIC SCIENCE)

Semester III - Theory

Course Code	Title	Credits
USFS 301	Forensic Science – III	2
Course Overview: The course covers important biometric fingerprints in detail with its formation to development on various surfaces and topics on forensic medicine dealing with autopsy, thanatology and injuries		
Course Objectives: <ul style="list-style-type: none">• To learn the formation of fingerprint pattern, its types, recording, classification and comparison parameters• To learn the various developmental techniques used for developing fingerprint evidence on various surfaces.• To understand basic concepts of forensic medicine and its legal aspects• To understand thanatology and its medicolegal significance• To understand the objectives, procedure of medical autopsy and medico legal aspects of injuries		
Course Outcome: <ul style="list-style-type: none">• Differentiate various fingerprint patterns, perform ridge tracing and counting, Collect, evaluate and compare fingerprints• Develop fingerprint pattern on various surfaces• Understand the basics of forensic medicine and various stages of death.• Understand the collection procedure of samples during post- mortem and to differentiate between various types of injuries.		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Fingerprint-I <ol style="list-style-type: none">1. Definition, History and Development2. Dermatoglyphics, Embryology: Primary and Secondary Ridge Formation, Morphology and Anatomy of Dermal Skin.3. Theories of Pattern Formation, Basic Fingerprint Patterns, Ridge Counting, Ridge Tracing4. Classification System in Fingerprints: Henry, Single Digit: Batley5. Recording of Fingerprints: Requirements, Procedure, Precautions, Purpose, Plain Print, Rolled Print and Palm Print.6. Conditions affecting Latent Prints, Search Method for Fingerprints on Crime Scene	15
Unit II	Fingerprint-II <ol style="list-style-type: none">1. Fingerprint at Crime Scene: Chance, Patent, Plastic	15

	<p>and Latent</p> <ol style="list-style-type: none"> 2. Morphology and Anatomy of Sweat Gland: Eccrine Gland, Sebaceous Gland, Apocrine Gland; Chemical Constituents of Sweat Gland: Water, Inorganic, Organic, Metallic and Drugs etc. 3. Fingerprint Development: Physical methods 4. Fingerprint Development: Chemical methods 5. Fingerprint Development: Instrumental (Lights) 6. Automated Fingerprint Identification System 7. Legal Aspects of Fingerprint Evidence and Court Testimony 	
Unit III	<p>Forensic Medicine-I</p> <ol style="list-style-type: none"> 1. Introduction and scope of Forensic Medicine-Definition, duties and responsibilities of medicolegal examiner. 2. Legal aspects in view of Forensic Medicine: Inquest, exhumation, dying declaration, dying deposition, medical certificates, post-mortem reports and MLR. 3. Forensic Thanatology- Definition and stages of death: somatic and molecular death. Modes of death: Syncope, asphyxia and coma. Cause, mechanism and manner of death. 4. Signs of death, changes after death: Early changes- Algor mortis, rigor mortis, cadaveric spasm, heat and cold stiffening, changes in blood, cerebrospinal fluid and vitreous humour, post mortem lividity. Late changes- putrefaction, adipocere, mummification, skeletonization, destruction of body tissues by maggots and insects. 5. Asphyxia: Hanging, strangulation, smothering, suffocation and drowning with case studies. 	
Unit IV	<p>Forensic Medicine-II</p> <ol style="list-style-type: none"> 1. Medical Autopsy: Introduction and objectives. Precautions while conducting autopsy. 2. External and internal examination of body, examination of clothing and other artifacts. Collection of post-mortem samples: viscera, blood, CSF, vitreous humor, hair, urine. 3. Injuries: Introduction and classification of injuries. Medico legal aspects of injuries. 4. Mechanical injuries-Abrasions, contusions, lacerations, incised wounds, stab wounds, Défense wound and self-inflicted wounds. 5. Thermal injuries- Classification of burns, Age of burns, Rule of nine, Cause of death from burn, antemortem and post-mortem burns. 	15

Text books and Additional References:

1. Advances in Fingerprint Technology, Second Edition. (2001). United Kingdom: Taylor & Francis.
2. Plotkin, S. L., Hawthorne, M. R., Douglas, B. (2021).

- Fingerprints: Analysis and Understanding the Science.
(n.p.): Taylor & Francis.
3. Hawthorne, M. (2008). Fingerprints: Analysis and Understanding. United States: Taylor & Francis.
 4. S. N. (2010). Fingerprint Identification. India: Shiv Shakti Book Traders.
 5. Forensic Fingerprints. (2016). United States: Elsevier Science.
 6. Lacaze, K. (2021). Impression Evidence: Identifying Fingerprints, Bite Marks, and Tire Treads. United States: MASON CREST PUBL
 7. De Puit, M., Croxton, R. S., Bleay, S. M. (2018). Fingerprint Development Techniques: Theory and Application. Germany: Wiley.
 8. The Fingerprint: Sourcebook. (2014). United States: CreateSpace Independent Publishing Platform.
 9. Stoilovic, M., Margot, P., Champod, C., Lennard, C. J. (2017). Fingerprints and Other Ridge Skin Impressions. United States: Taylor & Francis.
 10. APC Textbook of Forensic Medicine and Toxicology - Avichal Publishing Company. (n.d.). (n.p.): Avichal Publishing Company.
 11. Bardale, R. (2011). Principles of Forensic Medicine & Toxicology. India: Jaypee Brothers Medical Publishers Pvt. Limited.
 12. Concise Textbook Of Forensic Medicine & Toxicology. (2007). India: Elsevier India Pvt. Limited.
 13. Guharaj, P. (2003). Forensic Medicine. India: Orient Longman.
 14. Phanindra, S. V., Subrahmanyam, B. V. (2018). Forensic Medicine, Toxicology and Medical Jurisprudence. India: CBS Publishers & Distributors.

Course Code	Title	Credits
USFS 302	Chemical Science –III	2
<p>Prerequisites for the course: Students should have preliminary knowledge about these topics from their higher secondary classes.</p> <p>Course Objectives: Introduction to more basic chemistry required for application in advanced concepts of the forensic chemistry and toxicology</p> <p>Course Outcome: To understand the advanced chemistry of the Chemical Kinetics, Chemical Thermodynamics, Electrochemistry, Organic Functional groups and Reactions Mechanism..</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Chemical Kinetics Introduction, reaction rate, factors affecting the rate of a reaction, Order and molecularity, zero order rate expression, integrated rate equation for first order reaction; concept of Steady State Approximation; Half-life of reactions, activation energy, Transition state theory and Collision theory, Significance of Chemical kinetics in Forensic Science, Related Numerical problems.</p> <p>Chemical Thermodynamics Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics and its significance; Key concepts, statements and important relationships from first, second and third law of thermodynamics; Thermochemistry: Heats of reactions, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.</p>	15
Unit II	<p>Electrochemistry Redox Reaction, Oxidation and reduction Potential; Half-cell, cell potential, Cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Application of conductance measurement (determination of solubility product and ionic product of water); Conductometric titrations; Types of electrochemical cells and examples, cell reactions, emf; Standard cells, different types of electrodes (with examples); Standard electrode potential; Types of concentration cells; Glass electrode and determination of pH of a solution.</p>	15
Unit III	Organic Functional Groups	15

	Alcohols, phenols, ethers, amines, aldehydes, ketones, acids, esters, amides, anhydrides, etc. and their nomenclatures, structures, preparations, physical properties and reactions. Utilization of reactions of various functional groups in colour tests/ spot tests. Aromaticity Aromaticity, Conditions for aromaticity, Hückel rule, aromatic ions (cyclopentadienyl cation, cyclopentadienyl anion and cycloheptatrienyl cation), Aromaticity of heterocyclic compounds, Antiaromatic, Non- aromatic, Homoaromatic Compounds; Polyaromatic hydrocarbons (PAHs), their toxicity and forensic significance of some aromatic compounds.	
Unit IV	Mechanism of Organic Reactions Elementary ideas of Inductive effect, Electromeric effect, Resonance effect, Hyperconjugation; Reactive intermediates: Formation, geometry, and stability of carbocations, carbanions, free radicals and carbenes; Types of organic reactions: Addition, substitution, elimination and rearrangement reaction.	15

Text books and Additional References:

1. Principles of Physical Chemistry by Puri, Sharma and Pathania
2. Advanced Inorganic Chemistry by Madan, Malik and Tuli
3. Concise Inorganic Chemistry by J.D. Lee, 5th Ed, ISBN 978-0-632- 05293-6, 1999
4. Atkin's Physical Chemistry by P.W. Atkins, Julio de Paula, James Keeler, 11th Ed, Oxford University Press, ISBN 978-0-19-108255- 9, 2018
5. Fundamentals of Analytical Chemistry by Douglas Skoog, et. al., 9th Ed, 2014
6. Organic Chemistry by Jonathan Clayden, 2nd Ed, Oxford University Press, ISBN 978-0-19-927029-3, 2012
7. Advanced Organic Chemistry by Francis A. Carey, Richard A. Sundberg
Organic Chemistry by Robert N. Boyd and Robert T. Morrison

Course Code	Title	Credits
USFS 303	Physical Science –III	2
	<p>Course Outcomes: - At the completion of this course the candidate can: Know and understand</p> <ul style="list-style-type: none"> • Nuclear reactions dating , radiation protection methods and nuclear waste disposal • Basic about the sound and its propagation generation of ultrasound and its applications , in SONAR • Basics of components , basic fundamental electrical, digital and analog circuits, • The various wave shaping circuits and oscillators • About the power electronics components and their applications in power controllers 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Nuclear Reaction and Safety: Nuclear Reactions, Conservation Laws in Nuclear Reactions, Q-value of Nuclear Reaction. Applications of Radio Isotopes, Radiometric Dating, Radiation Hazards, Radiation Levels of Safety, Biological Effects of Nuclear Radiation, Radiation Protection Methods, Nuclear Disasters, Nuclear Waste Disposal, Radiation Damage, Roentgen and Roentgen Equivalent Physical (Rep) and Man (Rem), Radiation Dose, Shielding of Radioactive Sources.</p>	15
Unit II	<p>Sound Generation of Sound, Definition of Sound Intensity, Loudness, Pitch, Quality and Timber, Acoustic Intensity Level Measurement, Acoustic Pressure and It's Measurement, Reverberation Time and Reverberation of a Hall, Sabine's Formula (without Derivation), Stroboscope. Ultrasonic: Introduction, Properties, Production and Detection of Ultrasonic Waves, Piezoelectric Effect & Piezoelectric Generator, Magnetostriction Effect and Oscillators, Applications of Ultrasonic Waves (Measurement of Depth of Sea, SONAR System and Medical Science).</p>	15
Unit III	<p>Basic Electronics and Signal Processing: Active and Passive Components (Resistors, Capacitors, Inductors, Diodes, Transistors), IC's and IC packages, Identification Techniques of Components, Basics of LCR Circuits, Rectifier Circuits, Timer Circuits (using IC 555 &UJT), Introduction to OPAMP (Inverting & Non-inverting Amplifier) and Applications.</p>	15

	<p>Active Filters: Low Pass, High Pass, Band Pass.</p> <p>Waveform Generators: Working Principle of Oscillators, Waveform Generators; Sine (Phaseshift and Wien Bridge), Square, Triangular, Sawtooth.</p> <p>Signal Converters: Analog to Digital Converters (Dual Slope & Successive Approximation), Digital to Analog Converters (Weighted Resistors & R-2R Ladder).</p> <p>Wave Shaping Circuits: Wave Clipping, Clamping Circuits.</p>	
Unit IV	<p>Power Electronics:</p> <p>Construction, operation, equivalent circuit, I-V characteristics and applications of SCR, TRIAC, DIAC, UJT, Power Transistors and MOSFET Optocouplers.</p> <p>Phase Firing Circuits, Solid State Relay, Regulated Power Supplies, Switch Mode Power Supply,</p> <p>Principle and working of Inverter.</p>	15

Text books and Additional References:

1. Nuclear Physics; S. N. Ghoshal
2. Nuclear Physics: An Introduction; S. B. Patel
3. Nuclear Forensic Analysis; Kenton J. Moody
4. Electronics Principles; Malvino, Bates
5. Basic Electronics; B. L. Theraja
6. Principles of Electronic Devices and Circuits; B. L. Theraja
7. Principles of Electronics; V. K. Mehta
8. Integrated Electronics; Millman, Halkias
9. Digital Principles and Applications; Malvino, Leach
10. Digital Design; Morris Mano
11. Measurements, Instrumentation and Experiment Design in Physics and Engineering; Michael Sayer
12. Instrumental Analysis; Skoog, Holler and Crouch
13. Transducers and Instrumentation; D. V. S. Murty
14. Electronic devices and Circuit and Introduction; Allen Mottershed
15. Engineering Physics; R.K.Gaur, S.L. Gupta
16. Basic Acoustic; D.E.Hall
17. Fundamentals of Acoustics; Kinsler
18. Textbook of Sound; Khanna, Bedi

Course Code	Title	Credits
USFS 304	Biological Science– III	2
	<p>Course Overview: The course covers human anatomy and physiology, serology, immunology and microbiology</p> <p>Course Objectives:</p> <ul style="list-style-type: none"> • To understand the various systems of human body • To familiarize the students with the concepts of the immune system and its many roles. • To understand the composition and make of different body fluids in humans. • To introduce the concepts of microbiology and virology to the students <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Thorough understanding of the working and functions of the human body Examination of blood and classification of the different blood group systems • Culturing micro-organisms through various plating techniques, and understanding of the necessary growth conditions • Understanding of the features of the immune system and significance of the antigen-antibody interactions. 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Human Physiology and anatomy</p> <p>Digestive system: BMR, calorific value, obesity, mechanism of digestion.</p> <p>Excretory system: structure and functions of the kidney. Muscles: types and physiology of muscle contraction.</p> <p>Respiratory system: mechanism of respiration Circulatory system: Anatomy and Physiology</p> <p>Reproductive system: Anatomy and Physiology</p>	15
Unit II	<p>Serology:</p> <p>Composition of the blood, plasma proteins, Coagulation of blood, Structure of haemoglobin and its functions, forensic significance Classification of blood group antigens, biochemistry and genetics of ABO, Bombay blood group, Rhesus, MNO, Lewis Antigens blood grouping system, Secretor, and non-secretor status.</p> <p>Composition of Semen, Saliva, Amniotic fluid, gastrointestinal secretions, menstrual blood, sweat, urine, vaginal fluid.</p>	15

Unit III	<p>Microbiology and Virology Methods of classification of microorganisms (bacteria). Prokaryotic cell – Gram-positive and Gram-negative cell wall structure, slime layer, components of the cell membrane, Pure culture techniques. Growth rate and generation time, growth curve, synchronous cultures and continuous cultures. General structure and classification of viruses. Lytic and lysogenic life cycle, structure and life cycle of HIV and Influenza virus.</p>	15
Unit IV	<p>Immunology Immunity: Definition, types- natural, acquired, active, passive. Antigens- Definition, properties, antigenic determinants, incomplete antigen, adjuvants. Factors influencing antigenicity. Antibody-Definition, structure, types, properties and functions of Immunoglobulin, Antigen-Antibody interaction: precipitation, agglutination. Immune system: - Organs (Primary and secondary lymphoid organs) & cells (T & B cells), Complement pathways, Hypersensitivity reactions.</p>	15

Text books and Additional References:

1. Microbiology: an introduction: Tortora, Funke, Case
2. Textbook of microbiology: Ananthanarayan and Pannikar
3. Microbiology: Black
4. Clinical microbiology and infectious diseases: John Spicer
5. Perscott's microbiology: Willey, Sherwood and Woolverton
6. Microbiology: Pelczar, Chan and Krieg
7. Microbiological applications: laboratory manual in general microbiology: Brown and Smith
8. Cellular and molecular immunology: Abbas, Lichtman and Pillai
9. Kuby immunology: Goldsby, Kindt, Osborne
10. Roitt's essential immunology: Delvis, Martin, Burton and Roitt
11. An introduction to immunology: C. V. Rao
12. Fundamental immunology: William Paul
13. Understanding immunology: Peter Wood

Course Code	Title	Credits
USFS 305	Psychology – III	2
	<p>Course Objectives:</p> <ul style="list-style-type: none"> • In this, a learner understands the social aspect of human behavior with cultural influences to it. • It also explains that not only the social factors influence the behavior but also how biological aspects influence too. • Apart from theoretical part of study, the learner also becomes trained with the research methodologies for further enabling him/her to take up research projects. • This also explains about the nature of violence that are contributing factors in crime. <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Identify- The learner understands the individual differences by the study of various socio-cultural dimensions. • Describe- These socio-cultural dimensions of human behavior can be described by learner after learning the different social theories related to attitude, prejudice etc. • Differentiate- The learner learns to conduct research, studies of various social and contributing allied topic with research methodology. Also can go for future research with reference to different social parameters existing in the society. • Analyze- The learner learns various research statistical tools that can be used for effective research purpose. • Review- Over all learner learns gets an insights regarding socio-cultural aspect. 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Domains of Psychology</p> <ol style="list-style-type: none"> 1. Social Psychology –Definition, Introduction 2. Attitude – Formation, Attitude-Behavior Link, Concept of Persuasion 3. Attitude Change, Biased Assimilation, Polarization, Cognitive Dissonance, Stereotyping, Prejudice and Discrimination 4. Attribution-Definition, Correspondent Inference, Non-Common Effects, Sources of Error 5. Aggression- Definition, Theoretical Perspectives, Contemporary & 	15

	Modern Theories, Determinants-Social, Personal, Situational, Prevention and Control of Aggression	
Unit II	Biological Perspective Of Psychology <ol style="list-style-type: none"> 1. Hormones, Biology of Emotions-Fear, Stress, Anxiety & Depression 2. Stress- Definition, Sources, Physical Stress Reactions 3. The General Adaptation Syndrome, Stress & Immune System 4. Factors Influencing the Reactions to Stress 5. Personality and Stress 6. Cognitive Factors in Stress Reactions 7. Stress & Coping- Emotion and Problem Focused Coping 8. Stress Management 	15
Unit III	Research Methods in Psychology <ol style="list-style-type: none"> 1. Introduction to Research Methods in Psychology: Importance, Goals, Need and Types of Research 2. Quantitative Methods: Experimental and Non-Experimental Methods in Psychology, Descriptive Statistics (Mean, Median, Mode, Frequency, Normal-Distribution, Central Tendency, Hypothesis testing, Probability, T-Tests, Chi-Square, Correlation) 3. Qualitative Methods :Methods for Analysis, Textual Methods (Conversationanalysis,Discourseanalysis,Thematicanalysis,Narrativeanalysis is),Field Methods (Grounded Theory) 	15
Unit IV	Violence <ol style="list-style-type: none"> 1. Definition, Nature- Self-Directed, Interpersonal, Family & Community And Interpersonal & Collective. 2. Types – Physical, Sexual, Emotional, Psychological, Spiritual, Cultural 3. Domestic Violence- Nature, Types- Reciprocal And Non-Reciprocal- Physical, Sexual, Emotional, Verbal, Economic. 4. Theories of Sexual Offending 5. Working With Sexual Offenders, Sexual Offending 6. Psychological Impacts of Violence and Sexual Offences, Post-Traumatic Stress Disorder, Victimization 	15

Text books and Additional References:

1.

Baron.R.A.,Byrne,D.&Bhardwaj.G(2010).SocialPsychology(12thEd).NewDelhi:Pearson

2. Deaux.K & Wrightsman,L.(2001).Social Psychology. California: Cole Publishing

3. Misra,G.(1990).Applied Social Psychology. New Delhi: Sage.

4. Misra,G.(2009).Psychology in India,Volume 4:Theoretical and Methodological Developments(ICSSRSurvey of advances in research).New Delhi: Pearson.

5. Alcock, J.E., Carment, D.N.,Sadava, S.N.,Collins, J.E.& Green J.M.(1998).A text book of Social Psychology. Scarborough, Canada: Prentice Hall.

6. Aronson,E.,Wilson,T.D.,&Akert,R.M.(2010).Social Psychology(7thEd.).Upper Saddle River, NJ: Prentice Hall.

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- Baumeister, R. F., & Bushman, B. J. (2008). *Social Psychology and Human Nature*. International student edition, Thomson Wadsworth USA.
9. Delamater, J. D., & Myers, D. J. (2007). *Social Psychology* (6th edition.), Thomson. Wadsworth International student edition, USA
10. Franzoi, S. L. (2003). *Social Psychology*. (3rd ed.). New York McGraw Hill co.
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- 12.
- Aron, A., Aron, E. N., & Coups, E. J. (2007). *Statistics for Psychology*. (4th ed.) India: Pearson Education, Prentice Hall.
13. King, B. M. & Minium, E. W. (2007). *Statistical Reasoning in the Behavioral Sciences*. (5th Ed.) USA: John Wiley.
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- Coakes, S. J., Steed, L., & Ong, C. (2009). *SPSS: Analysis Without Anguish Using Version 16.0 for Windows*. Milton, QLD: Wiley Students Edition.
15. Field, A. (2009). *Discovering Statistics using SPSS* (3rd Ed). New Delhi: Sage
16. Breakwell, G. M., Hammon, S, Fife-Shaw, C., & Smith, J. (2006). *Research methods in Psychology* (3rd edition). London: Sage.
- 17.
- Haslam, S. A., & McGarty, C. (2003). *Research methods and statistics in psychology*. London: Sage.
18. Aiken, L. R., & Groth-Marnet, G. (2009). *Psychological testing and assessment* (12th edition) New-Delhi: Pearson Education.
- 19.
- Gregory, R. J. (2005). *Psychological testing: History, principles, and applications* (5th edition). New Delhi: Pearson Education.
20. Howell, D. C. (2010). *Statistical methods for psychology*. Belmont: Wadsworth.
21. Kaplan, R. M., & Saccuzzo, D. P. (2005). *Psychological testing: Principles, applications and issues*. New Delhi: Cengage.
22. Singh, A. K. (2008). *Tests, measurement research methods in behavioral sciences*. Patna: Bharti Bhawan.

Course Code	Title	Credits
USFS 306	Computer Science – III	2
	<p>Course Objectives: To introduce the concepts of security in web applications</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Illustrate about the concept of HTML,DHTML, CSS and Java Script • Apply the core concepts of web applications to create web pages • Apply the concepts of servers side programming 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>HTML: Introduction, Basic Tags, Elements, Attributes, Attributes, Formatting, Phrase Tags, Meta Tags, Comments, Images, Tables, Lists, Frame, Iframe, Fonts, Colors, Forms, Embed Multimedia, Marquees, Headers.</p> <p>CSS: Introduction, Content and Style, CSS 1 Rules, Length, Percentage, Color and URLs, Font Properties, Color and Background Properties, Text Properties, Box Properties, Classification Properties, Structure and Control, Linking Style Sheets to HTML.</p>	15
Unit II	<p>Scripting: What is a Scripting Language, Types of Scripting Languages and Advantages of scripting languages.</p> <p>JavaScript: Introduction, Syntax, statements, comments, variables, Operators, Data types, control structure, Function, Array, Errors.</p>	15
Unit III	PHP: Introduction, Environment, Syntax, Variable Types,	15

	Constants, Operator Types, Decision Making, Loop, Arrays, String, Web Concepts, Methods, File System, Functions, Cookies, Sessions, Sending Emails, File Uploading.	
Unit IV	<p>Database: File system Vs DBMS, Structure of DBMS, Users of DBMS, Advantages of DBMS, Conceptual Design of DBMS (E-R model), Overview of DB design, ER data model (entities, attributes, entity sets, relations, relationship sets)</p> <p>MySQL: Introduction, Installation, Syntax, Connection, SQL statements (DDL and DML), Temporary Tables, Handling Duplicates, Data base export, Data base Import.</p> <p>Web vulnerabilities and countermeasures: SQL Injection, XSS, Parameter manipulation, OSWAP.</p>	15

Text books and Additional References:

1. The Complete Reference HTML and CSS, Fifth Edition, Thomas A. Powell
2. JavaScript Bible, 5th Edition, Danny Goodman's.
3. PHP5 and MySQL Bible by Tim Converse, Tim Converse, Joyce Park, Clark Morgan
4. Databases: A Beginner's Guide, Andrew J. Opel

Course Code	Title	Credits
USFS 307	Law – III	2

Course Objectives:

- To Provide students with a learning experience that will instil deep interest in the subject of criminology and to develop broad, balanced knowledge about key criminological concepts, principles and theories;
- To equip students with the appropriate tools of analysis to tackle problems in the forensic field.
- To provide students with the knowledge and skill base that would enable them to undertake further studies in Criminology and related forensic areas.

Course Outcomes:

- Explain the history, origin, scope and definition of crime, its relevance in the present scenario and its relation to other social sciences.
- Understand the interdisciplinary nature of Criminology and the role of criminologist in the criminal justice system.
- Describe the different schools of Criminology and critically identify the contribution of each school of thought for the growth and development of Criminology.
- Describe the different typologies of crime including crimes against body, crimes against property, contemporary crimes like cybercrime, white collar crime, etc.

Unit No.	Contents of Unit	No. of Lectures
Unit I	Introduction to crime, causes and kinds :	15

	<p>Nature and Concept of crime, Essential elements of crime, Types of crime, Causes of crime: Social Causes of Crime, Economic Causes of Crime, Physical and Psychological causes of crime, Geographical Causes of Crime.</p> <p>Organized Crimes ,Environmental Crimes, Crime and Politics Economic Crimes ,White Collar Crimes Juvenile Delinquency and Female Delinquency Terrorism Cyber Crimes</p>	
Unit II	<p>Criminology : Concept and Schools/Theories Definition, Scope and Nature of Criminology Interrelationship between Criminology, Penology and Criminal Law Schools of Criminology Pre-Classical, Classical and Neo Classical Schools Lombroso Theory/Positive School Typological School Sociological School Psychological school</p>	15
Unit III	<p>Penology : Punishments, Prison Reforms and Correctional Administration Introduction and history Theories of Punishments Kinds of punishments Correctional administration Prison system: Traditional Prison, Open Air Prison etc Prison Reforms in India Probation and Parole</p>	15
Unit IV	<p>Introduction to Victimology Nature, Scope and Objective of Victimology Definitions and meaning of Victimology Role of Victim in crime Typology of victim Recidivism Victim offender relationship Post crime effects on victims Rights of victims of crime Victimology in India Victims Compensatory Justice Emerging Trends in Victimology</p>	15

Text books and Additional References:

1. Criminology and Penology, Second Edition, Paranjape N.V., Central Law Publication, Allahabad, U.P, 2001
2. Crime and Criminology, Rohinton Mehta
3. Crime and Science: The New Frontier in Criminology, Jurgen Thorwald
4. The Oxford Handbook of Criminology, Maguire Mike, Morgan Rod and Reiner Robert, Oxford University Press, 2007
5. Principle of Criminology, E.H. Sutherland, Times of India Press, (6th Edition), Bombay, 1968
6. Criminology, Siegal Larry J, Wordsworth Thomson Learning, New Delhi, 2007

**B.Sc. (FORENSIC SCIENCE)
Semester III – Practical**

Course Code	Title	Credits
USFS 3P1	Forensic Science and Chemical Science Practical	2
Practical No.	Title of the Practical	No. of Practical
Forensic Science Practical		
1	Recording of Rolled and Plain Fingerprint for Ten Digit Classification	1
2	Collection and Identification of Fingerprint Pattern	1
3	To study the minutiae and matching of fingerprints	1
4	To perform ridge counting and ridge tracing	1
5	Study of palm prints	2
6	Study the effect of various conditions on the development of latent prints	2
7	To develop fingerprints using powder method	1
8	To develop fingerprints using ninhydrin method	1
9	To develop fingerprints using iodine fuming	1
10	To develop fingerprints using silver nitrate method	1
	To develop fingerprints using superglue fuming	
Chemical Science Practical		
1	TLC analysis of a given dye and pesticide. – 04	04
2	Separation and individual analysis of one the organic compounds in given binary mixture. - 02	02
3	Solvent extraction technique.	1
4	Detection of explosive ions from explosion residues by colour tests.	1
5	Detection of adulteration in the given food sample.	1

6	Estimation of Aspirin from in tablet.	1
7	Titration – Complexometric (EDTA titration)	1
8	pH- metric Titration – 01	1
9	Conductometric Titration (Mixture of strong acid and weak acid vs strong base)- 02	2
10	Industry/Laboratory Visit	1

Text books and Additional References:

1. Jerry Mohrig's Laboratory Techniques In Organic Chemistry 4th Ed by W.H. Freeman, ISBN 1464134227
2. Vogel's textbook of macro and semi-micro qualitative inorganic analysis, 5th Ed, Longman Group Ltd, 1979
3. Vogel's textbook of quantitative chemical analysis, 5th Ed, Longman Scientific and Technical, 1989
4. Practical Aspects of Forensic Chemistry by Anil Kumar Theotia, Rishi Pal, 1st Ed, Selective and Scientific Books, Delhi, 2013

Course Code	Title	Credits
USFS 3P2	Physical Science and Biological Science Practical	2

Practica 1 No.	Title of the Practical	No. of Practical' s
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Physical Science Practical

1	LCR series resonance	1
2	Bridge rectifier (to study load and Input regulation)	1
3	Transistor (CE) characteristics	1
4	Study of Analog to Digital Converter	1
5	Study of Digital to Analog Converter	1
6	Study of Timer Circuit using IC 555	1
7	Study of Active Filters	1
8	Study of Clipping and Clamping Circuits	1
9	Study of Regulated Power supply.	1
10	Study of V-I characteristics of Diac.	1
11	Study of V-I characteristics of SCR	1
12	Study of V-I characteristics of Triac	1
13	Study of SMPS load and input characteristics.	1
14	Study of optocoupler	

Biological Science Practical

1	Study of muscle types	1
2	Study of morphological types of red blood cells	1
3	ABO Grouping & Rhesus Factor	1
4	Study of the skeletal system of human	1
5	Isolation of microorganism by streak, spread, pour plate method.	1

6	Study of the growth curve of microorganism	1
7	Measurement of growth of microorganism by standard plate count method	1
8	To study factors affecting the growth of microorganism – ph, temperature	1
9	Separation of serum protein by agarose gel electrophoresis	1

Course Code	Title	Credits
USFS 3P3	Psychology and Computer Science Practical	2
Practica 1 No.	Title of the Practical	No. of Practica 1
Psychology Practical		
1	Assertiveness scale	2
2	Motivation and Performance experiment [Blind fold]	3
3	Apperception test –CAT	3
4	Koh's Block test	1
5	Thurstone's interest schedule test	1
6	Social Adjustment Inventory	1
7	Whole Vs Part learning experiment	1
8	Raven's Standard Progressive Matrices (SPM)	1
9	Emotional Maturity Scale	1
10	Demonstration of Bhatia's Battery of Intelligence	1
Computer Science Practical		
1	Creating webpages with various HTML tags	1
2	Linking multiple webpages with each other	1
3	Cascade stylesheet (inline, internal, external)	1
4	To write a simple JavaScript program	1
5	Interacting with user with JavaScript (input and output)	1
6	Conditions in JavaScript	1
7	Looping in JavaScript	1
8	Handling cookies in JavaScript	1
9	Performing browser related operations in JavaScript	1
10	Installing and configuring XAMPP server	1
11	Writing a simple program in PHP	1
12	Conditions in PHP	1
13	Looping in PHP	1

14	Handling cookies, sessions in PHP	1
15	Database handling in PHP	1
16	Making an interactive web application to demonstrate user interaction + input validation + database operation	1

S. Y. B.Sc. (Forensic Science) (Semester IV) Credits

To be implemented from Academic Year 2023-2024

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 401	Forensic Science–IV	4		60		50		100		2		2
USFS 402	Chemical Science – IV	4		60		50		100		2		2
USFS 403	Physical Science –IV	4		60		50		100		2		2
USFS 404	Biological Science – IV	4		60		50		100		2		2
USFS 405	Psychology – IV	4		60		50		100		2		2
USFS 406	Computer Science – IV	4		60		50		100		2		2
USFS 407	Law – IV	4		60		50		100		2		2
USFS 4P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2

USFS 4P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 4P3	Psychology and Computer Science Practical		6		90		72		100		2	2
Total	--	28	18	420	270	350	216	700	300	14	6	20

B.Sc. (FORENSIC SCIENCE)

Semester IV– Theory

Course Code	Title	Credits
USFS 401	Forensic Science – IV	2
<p>Course Overview: The course covers core topic of forensic science viz Questioned Documents, emerging field of investigative journalism and essentials of Quality management and accreditation of laboratories.</p> <p>Course Objectives:</p> <ul style="list-style-type: none"> • To learn the principle and examination of questioned documents and learn the principles of handwriting. • To learn the examination of ink and other documents and means to detect their forgeries • To understand the role of forensic in investigative journalism with case studies • To understand the quality management and accreditation process and its significance. <p>Course Outcome:</p> <ul style="list-style-type: none"> • Examine, detect and interpret forgeries related to handwriting • Examine, detect and interpret forgeries related to ink and other documents. • Investigate concealed topics in journalism and fake news. • Perform the quality management and accreditation process of laboratory. 		
Unit No.	Contents of Unit	No. of Lecture

		s
Unit I	<p>Questioned Documents-I</p> <ol style="list-style-type: none"> 1. Questioned Document: Nature, Scope, Significance, Handling of Documents, Integrity of Documents, Guidelines for Preservation. 2. Classification and Types of Documents: Financial, Academic, Personal, Historical, Official and Non-official Records, Government Documents, Service Documents and Certificates 3. Preliminary Examination and marking of document 4. Handwriting and development of handwriting 5. Principles of Handwriting Identification, Natural Variation in Handwriting, General and Individual Characteristic of Handwriting 6. Types and collection of Handwriting Exemplars: Specimen Writing, Admitted Writing 7. Identification of writer from specimen/admitted writings/signatures. 8. Examination of anonymous writings. 	15
Unit II	<p>Questioned Documents-II</p> <ol style="list-style-type: none"> 1. Examination of paper and Ink: Physical examination of paper, Types of inks and their chemical analysis for identification. 2. Age of document 3. Examination and decipherment of secret and indented writings Examination of charred documents. 4. Examination of seal, rubber stamps and other mechanical evidences. 5. Examination of security documents: Passports, currency and stamp papers. 6. Examination of printed/computer generated documents: Photocopiers, Computer Printers, Typewriters 	15
Unit III	<p>Investigative Journalism</p> <ol style="list-style-type: none"> 1. Introduction, History, Need and Scope of Investigative Journalism 2. Role of Investigative journalist 3. Role of journalism in Police investigation. 4. Investigative journalism and social media 5. Case studies related to Investigative journalism 6. Role of Media on the outcome of cases. Media trial, branding/labelling of the suspects/victims/accused, effect on the society 7. Fake news detection 	15
Unit IV	<p>Quality Management and Accreditation</p> <ol style="list-style-type: none"> 1. Introduction and requirements of quality management system for forensic science laboratories 2. Quality management requirement: Testing and calibration procedure, Total quality assurance 3. Accreditation: Introduction and objectives, organizations and certifying bodies (NABL, ILAC, APLAC), 	15

	<p>Requirements as per ISO/IEC or ISO for accreditation of laboratory.</p> <p>4. Audit: Internal and external</p> <p>5. Proficiency testing and Report Writing</p> <p>6. Quality management in Forensic science</p>	
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Text books and Additional References:

1. Hilton, O. (1992). Scientific Examination of Questioned Documents, Revised Edition. United States: CRC-Press.
2. Bisesi, M. S. (2006). Scientific Examination of Questioned Documents. United Kingdom: Taylor & Francis.
3. Koppenhaver, K. M. (2007). Forensic Document Examination: Principles and Practice. Netherlands: Humana Press.
4. Bansal, B. L., Raheja, R. (2009). Capital's Handwriting & Finger Prints Analysis in Criminal Trial & Investigation: Including Case-law on Expert Evidence. India: Capital Publishing House.
5. Harralson, H. H., Miller, L. S. (2017). Huber and Headrick's Handwriting Identification: Facts and Fundamentals, Second Edition. United States: Taylor & Francis.
6. Ellen, D., Day, S., Davies, C. (2018). Scientific Examination of Documents: Methods and Techniques, Fourth Edition. United States: Taylor & Francis.
7. Headrick, A., Huber, R. A. (1999). Handwriting Identification: Facts and Fundamentals. United States: CRC Press.
8. Harrison, W. R. (1981). Suspect Documents: Their Scientific Examination. United States: Nelson-Hall.
9. Handwriting and fingerprint analysis in criminal trail and investigation by B L Bansal and Rajiv Raheja.
10. Gearing, A. (2021). Disrupting Investigative Journalism: Moment of Death Or Dramatic Rebirth?. United Kingdom: Taylor & Francis.
11. Leigh, D. (2019). Investigative Journalism: A Survival

<p>Guide. Germany: Springer International Publishing.</p> <p>12. Investigative Journalism. (2021). United Kingdom: Taylor & Francis.</p> <p>13. Carson, A. (2019). Investigative Journalism, Democracy and the Digital Age. United Kingdom: Taylor & Francis.</p> <p>14. Hunter, M. L. (2011). Story-Based Inquiry: A Manual for Investigative Journalists. Switzerland: UNESCO.</p> <p>15. Doyle, S. (2018). Quality Management in Forensic Science. United Kingdom: Elsevier Science.</p> <p>16. Iso 17025 2017 Lab Quality Management System: Requirements Interpretation and Implementation. (2018). (n.p.): Educreation Publishing.</p> <p>17. Laboratory Quality Management System: Handbook. (2011). Philippines: World Health Organization.</p> <p>18. Kumar, P., Tomar, V. P. S. (2005). Laboratory Manual: Quality Systems Standardization, Quality Assurance Accreditation, Quality Management. India: CBS Publishers & Distributor</p> <p>19. Mehta, B. (2019). Implementing ISO/IEC 17025:2017. United States: ASQ Quality Press.</p>		
Course Code	Title	Credits
USFS 402	Chemical Science – IV	2
<p>Course Overview: Students should have preliminary knowledge about these topics from their previous classes</p> <p>Course Objectives: Introduction to advanced concepts of Forensic Analytical Chemistry that has applications in the forensic chemistry and toxicology.</p> <p>Course Outcome: To understand the advanced chemistry of the Gravimetric analysis, Volumetric analysis, Fire and arson, Atomic and Vibrational spectroscopy</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Gravimetric Analysis Principle, theory and types of Gravimetric analysis, properties of precipitates and precipitating agents, application of gravimetric methods; Forensic significance and Related Numerical problems.</p> <p>Volumetric Analysis Principle, theory and types of volumetric analysis, Acid-base, complexometric, redox and precipitation titrations, applications of volumetric analysis; Forensic significance and Related Numerical problems. <i>Non-aqueous titrations:</i> phthalic acid, potassium hydrogen phthalate, perchloric acid, acetic acid, etc.</p>	15

Unit II	<p>Fire and Arson Chemistry of fire, fire triangle, Classes of fire and their extinguishers, fire behaviour. Location of point of ignition. Searching the fire scene. Collection and preservation of arson evidence; Related case studies.</p> <p>Explosives Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves; Related case studies.</p>	15
Unit III	<p>Flame Photometry and Atomic Absorption Spectroscopy Principle, theory, instrumentation & applications of flame photometry. Flame test and its forensic applications. Principle, theory, instrumentation, sample introduction, nebulizers and burners system, Non-flame methods of atomization, radiation sources, monochromators, detectors, interferences encountered, qualitative and quantitative analysis; Forensic significance of AAS.</p> <p>Vibrational Spectroscopy Principle, theory, types of vibrations, Instrumentation, Working, Applications, Limitations of IR and Raman Spectroscopy. Interpretation of IR and Raman spectra</p>	15
Unit IV	<p>Advanced Chromatographic Techniques Principle, Instrumentation, working, applications and limitations of HPTLC, HPLC and GC; Plate theory and Rate theory of chromatographic separation, Sample introduction, Columns, Detectors, qualitative and quantitative analysis; Introduction to hyphenated techniques like GC-MS, GC-MS, LC-MS and other tandem techniques. A brief introduction to ion chromatography.</p>	15

Text books and Additional References:

1. Kenyon Evans-Nguyen, Katherine Hutches - Forensic Analysis of Fire Debris and Explosives; Springer Publications, ISBN 978-3-030- 25834-4, 2019
2. Eric Stauffer, Julia Dolan, Reta Newman – Fire Debris Analysis; Elsevier Publications, ISBN: 978-0-12-663971-1, 2008
3. Alexander Beveridge. Forensic Investigation of Explosives, CRC Press, 2nd edition, 2011
4. J. Akhavan. The Chemistry of explosives, RSC Publishing, 2015
5. D.A. Skoog, F.J. Holler and T.A. Neman, Harcourt; Principles of Instrumental Analysis; College publishers, Singapore
6. G.D. Christian and J.E. O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston
7. F.W. Fifield and D. Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London.
8. R.P. Bauman, Absorption Spectroscopy, John Wiley, New York

Course Code	Title	Credits
USFS 403	Physical Science – IV	2
Course Outcome :		
At the completion of this course the candidate can: Know and understand		
<ul style="list-style-type: none"> • The fundamental electromagnetic spectrum, Sources of various radiations , Interaction of radiation with matter. • About various transducers and its applications • Various types of automobiles and its components • Fundamentals of speech recognition 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Spectroscopy Basic Concepts of Atomic and Molecular Spectroscopy, Blackbody Radiation, Planck’s Radiation Law, Wave Particle Duality, De Broglie’s Hypothesis, Introduction to Stark Effect, Zeeman Effect, Compton Effect. Electromagnetic Spectrum, Principles of Generation of Radiations, Their Utility and Limitations. Conventional Sources for UV, Visible and Infrared Rays, Sources for X-Rays.	15
Unit II	Transducers: Strain Gauge, Resistance Thermometer, Thermocouple, Thermistors and its Applications, Integrated Circuit Temperature Transducers, Speedometers, Microphone & Loudspeaker. Variable Inductance Transducers, Linear Variable Differential	15

	Transducers and Applications, Uses of LVDT, Capacitive Transducers, Piezo-Electric Transducers, Photo-Electric Transducers, Mechanical Flow Meter.	
Unit III	Introduction to Automobiles: Vehicles manufactured in India, Components of automobile, Chassis, body, chassis frame, general assembly's of chassis and their functions, Various identification numbers, Head lights, Tail lights and Indicators, Types of automobiles, Technical terms- wheel base, thread width, turning radius, ground clearance, variants. Safety standards for cars, Suspension system, Steering system, Brake system and testing of brakes, Tire and rims, Two stroke and four stroke engines and their comparison.	15
Unit IV	Elements of Speech Analysis: Fundamentals of Speech Recognition: Disciplines Involved in Speech Recognition, Paradigm for Speech Recognition, Speech Production and Perception in Human Beings, Speech Production Process, Presenting Speech in the Time and Frequency Domain, Speech Sounds and Features, Approaches to Automatic Speech Recognition (ASR) by Machine (Acoustic-Phonetic, Pattern Recognition, Artificial Intelligence), Neural Networks and their Application and Advantages in Speech Recognition. Signal Processing and Analysis Methods for Speech Recognition- Introductory Idea about Spectral Analysis Model, Linear Predictive Coding Model, Vector Quantization, Auditory based Spectral Analysis Model. Various Voice Identification Software. Collection of Samples and Forensic Importance of Voice Analysis.	15

Text books and Additional References:

1. Modern Physics; Arthur Beiser
2. Atomic Physics; J. B. Rajam
3. The Physics of Speech; D. B. Fry
4. Applied Speech and Audio Processing; Ian Mcloughlin
5. Fundamentals of Speech Recognition; Lawrence Rabiner and Biing- Hwang Juang
6. Modern Spectroscopy; J. Michael Hollas
7. Transducers and Instrumentation; D. V. S. Murty
8. Engineering Physics; R.K.Gaur, S.L.Gupta
9. Applied Speech and Audio Processing; Ian Mcloughlin
10. Fundamentals of Speech Recognition; Lawrence Rabiner and Biing Hwang Jaung
11. Basic of Automobile Engineering By C. P. Nakra.
12. Automobile Engineering Vol- I and II By K. M. Gupta.
13. Automotive Mechanics By Joseph Heitner

Course code	Title	Credits
USFS 404	Biological Science – IV	2
<p>Course Overview: The course covers Molecular genetics, molecular techniques and DNA profiling</p> <p>Course Objectives:</p> <ul style="list-style-type: none"> • To familiarize the students with the concept of chromosome. • To understand the concepts of DNA replication and gene expression • To introduce the various techniques of extraction, isolation and estimation of nucleic acids • To understand the concepts underlying DNA profiling and its interpretation <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understanding of the chromosomal organization of nuclear material in eukaryotes • Understanding the central dogma of molecular biology • Familiarization of the students with extraction and isolation of DNA from various sources • Examination, analysis, evaluation of DNA samples, followed by interpretation of DNA profiling results to aid in legal investigation. 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Molecular genetics –I Chromosome: structure and types. Chromosomal organization:	

	<p>histone octamer, nucleosome solenoid, etc. Heterochromatin and euchromatin region, repetitive and non-repetitive DNA sequences.</p> <p>C-value, C-value paradox and Cot-curve. Chromosomal mapping and karyotyping.</p> <p>DNA replication in prokaryotes and eukaryotes.</p>	
Unit II	<p>Molecular genetics –II</p> <p>Transcription, Genetic code and translation.</p> <p>Chromosomal mutations (Causes, types of mutation)</p> <p>Mutagens, induced mutagenesis, mutation rate, genetic load</p> <p>Gene mutation- Transition, transversion, Frameshift, Point mutation</p>	15
Unit III	<p>Molecular techniques</p> <p>Sources of DNA evidence</p> <p>Extraction of DNA (Conventional and advanced method of DNA extraction)-basic principles, methods of extraction, DNA amplification- PCR, blotting methods, DNA electrophoresis, DNA quantification.</p> <p>Databanks (Human Genome Project)</p>	15
Unit IV	<p>DNA profiling</p> <p>History of DNA fingerprinting</p> <p>Polymorphism in DNA system – DNA markers VNTRs, SNP, Autosomal – STR, Y-STR, Mitochondrial DNA, DNA databases, Techniques of analysis: PCR, Reverse transcriptase PCR, Real-Time PCR, RFLP, RAPD.</p> <p>Forensic Significance of DNA Profiling: - Application in disputed paternity cases, child swapping, Missing person's identity – immigration, veterinary & wildlife and Agriculture cases</p>	15

Text books and Additional References:

1. Microbiology: an introduction: Tortora, Funke, Case
2. Textbook of microbiology: Ananthanarayan and Pannikar
3. Microbiology: Black
4. Clinical microbiology and infectious diseases: John Spicer
5. Perscott's microbiology: Willey, Sherwood and Woolverton
6. Microbiology: Pelczar, Chan and Krieg
7. Microbiological applications: laboratory manual in general microbiology: Brown and Smith
8. Cellular and molecular immunology: Abbas, Lichtman and Pillai
9. Kuby immunology: Goldsby, Kindt, Osborne
10. Roitt's essential immunology: Delvis, Martin, Burton and Roitt
11. An introduction to immunology: C. V. Rao
12. Fundamental immunology: William Paul

Course Code	Title	Credits
USFS 405	Psychology – IV	2
<p>Course objectives-</p> <ul style="list-style-type: none"> -In this learner is oriented to the branch of forensic psychology along with its nature, services and professional ethics -Further learner understands how to assess criminal psychological behavioural aspect -It also describes different social factors influencing criminal behavior -For learner it's also important that, along with criminal tendencies, the nature of victims and victimization should be in consideration as long as the crimes are concern. <p>Course outcome</p> <p>Identify- The learner starts understanding the basic nature of forensic psychology.</p> <p>Describe- The learner studies the nature, services, roles ethics of forensic psychology. Here it also explains to learner, the role of psychology in the field of forensic. The learner also understand the basic nature of criminal behaviour.</p> <p>Differentiate- The learner differentiates crimes based on different psychological aspects</p> <p>Analyze- The learner understand and can differentiate nature of crime, victims and victimizations.</p> <p>Review- Over all learner can understand different kind of criminal tendencies.</p>		

Unit No.	Contents of Unit	No. of Lectures
Unit I	Domains of Psychology 1. Social Psychology –Definition, Introduction 2. Attitude – Formation, Attitude-Behavior Link, Concept of Persuasion 3. Attitude Change, Biased Assimilation, Polarization, Cognitive Dissonance, Stereotyping, Prejudice and Discrimination 4. Attribution-Definition, Correspondent Inference, Non-Common Effects, Sources of Error 5. Aggression- Definition, Theoretical Perspectives, Contemporary & Modern Theories, Determinants-Social, Personal, Situational, Prevention and Control of Aggression	15
Unit II	Biological Perspective Of Psychology 1. Hormones, Biology of Emotions-Fear, Stress, Anxiety & Depression 2. Stress- Definition, Sources, Physical Stress Reactions 3. The General Adaptation Syndrome, Stress & Immune System 4. Factors Influencing the Reactions to Stress 5. Personality and Stress 6. Cognitive Factors in Stress Reactions 7. Stress & Coping- Emotion and Problem Focused Coping 8. Stress Management	15
Unit III	Research Methods in Psychology 1. Introduction to Research Methods in Psychology: Importance, Goals, Need and Types of Research 2. Quantitative Methods: Experimental and Non-Experimental Methods in Psychology, Descriptive Statistics (Mean, Median, Mode, Frequency, Normal-Distribution, Central Tendency, Hypothesis testing, Probability, T-Tests, Chi-Square, Correlation) 3. Qualitative Methods :Methods for Analysis, Textual Methods (Conversationanalysis,Discourseanalysis,Thematicanalysis,Narrativeanalysis),Field Methods (Grounded Theory)	15
Unit IV	Violence 1. Definition, Nature- Self-Directed, Interpersonal, Family & Community And Interpersonal & Collective. 2. Types – Physical, Sexual, Emotional, Psychological, Spiritual, Cultural 3. Domestic Violence- Nature, Types- Reciprocal And Non-Reciprocal- Physical, Sexual, Emotional, Verbal, Economic. 4. Theories of Sexual Offending 5. Working With Sexual Offenders, Sexual Offending 6. Psychological Impacts of Violence and Sexual Offences, Post-Traumatic Stress Disorder, Victimization	15

Text books and Additional References:

1.

Baron.R.A.,Byrne,D.&Bhardwaj.G(2010).SocialPsychology(12thEd).NewDelhi:Pearson

2. Deaux.K &Wrightsmann,L.(2001).Social Psychology. California: Cole Publishing

3. Misra, G. (1990). *Applied Social Psychology*. New Delhi: Sage.
4. Misra, G. (2009). *Psychology in India, Volume 4: Theoretical and Methodological Developments (ICSSR survey of advances in research)*. New Delhi: Pearson.
5. Alcock, J. E., Carment, D. N., Sadava, S. N., Collins, J. E. & Green J. M. (1998). *A text book of Social Psychology*. Scarborough, Canada: Prentice Hall.
6. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). *Social Psychology (7th Ed.)*. Upper Saddle River, NJ: Prentice Hall.
7. Taylor, S. E., Peplau, L. A. & Sears, D. O. (2006). *Social Psychology (12th Ed)*. New Delhi: Pearson
8.

Baumeister, R. F., & Bushman, B. J. (2008). *Social Psychology and Human Nature*. International student edition, Thomson Wadsworth USA.
9. Delamater, J. D., & Myers, D. J. (2007). *Social Psychology (6th edition.)*, Thomson. Wadsworth International student edition, USA
10. Franzoi, S. L. (2003). *Social Psychology (3rd ed.)*. New York McGraw Hill co.
11.

Kenrick, D. T., Newberg, S. L., & Cialdini, R. B. (2007). *Social Psychology: Goals in Interaction (4th ed.)*. Pearson Education Allyn and Bacon, Boston.
12.

Aron, A., Aron, E. N., & Coups, E. J. (2007). *Statistics for Psychology (4th Ed.)*. India: Pearson Education, Prentice Hall.
13. King, B. M. & Minium, E. W. (2007). *Statistical Reasoning in the Behavioral Sciences (5th Ed.)* USA: John Wiley.
14.

Coakes, S. J., Steed, L., & Ong, C. (2009). *SPSS: Analysis Without Anguish Using Version 16.0 for Windows*. Milton, QLD: Wiley Students Edition.
15. Field, A. (2009). *Discovering Statistics using SPSS (3rd Ed)*. New Delhi: Sage
16. Breakwell, G. M., Hammon, S., Fife-Shaw, C., & Smith, J. (2006). *Research methods in Psychology (3rd edition)*. London: Sage.
17.

Haslam, S. A., & McGarty, C. (2003). *Research methods and statistics in psychology*. London: Sage.
18. Aiken, L. R., & Groth-Marnet, G. (2009). *Psychological testing and assessment (12th edition)* New-Delhi: Pearson Education.
19.

Gregory, R. J. (2005). *Psychological testing: History, principles, and applications (5th edition)*. New Delhi: Pearson Education.
20. Howell, D. C. (2010). *Statistical methods for psychology*. Belmont: Wadsworth.
21. Kaplan, R. M., & Saccuzzo, D. P. (2005). *Psychological testing: Principles, applications and issues*. New Delhi: Cengage.
22. Singh, A. K. (2008). *Tests, measurement research methods in behavioral sciences*. Patna: Bharti Bhawan.

Course Code	Title	Credits
USFS 406	Computer Science – IV	2
<p>Course objectives-</p> <ul style="list-style-type: none"> • To introduce the various concealment techniques • To detail about the incident response, biometric and Multimedia <p>Course outcome</p> <ul style="list-style-type: none"> • Illustrate about the concept various Concealment Techniques • Prepare for Incident Handling • Explain the concepts of biometric and multimedia 		

Unit No.	Contents of Unit	No. of Lectures
Unit I	Concealment Techniques: Introduction to cryptography, Types of cryptographic algorithms (Secret key cryptography, public key cryptography, Hash function), Electronic signature, Steganography, Obfuscation, Packing, Reversing the steganographic process, Cloaking techniques(Data hide and seek),Renaming files, manipulating file system, Data hiding on NTFS with alternate data stream	15
Unit II	Incident Response: Introduction to incident response process, Computer security incident, Goals of incident response, Involvement in incident response process, Incident response methodology, formulate a response strategy, Investigation of incident, Preparing for incident response, Overview of pre-incident preparation, Identifying risk after detection of an incident	15
Unit III	Biometrics: Introduction to biometrics, Various types of biometric methods, Characteristics of biometrics, Advantages and disadvantages General Biometric System (Identification and Verification), General architecture comparison of different biometric technologies, difficulties in implementation of biometrics, Applications of biometrics.	15
Unit IV	Multimedia: Introduction to multimedia, Multimedia components (text, graphics, animation, audio, video) Multimedia Applications. Image processing techniques: Digital photography: processing pipeline and sensor characteristics, sensor identification, Anomaly to detection: Statistics of natural images inconsistency in lighting and chromatic aberration, duplication detection. Image and video processing: re-sampling algorithms (rotation scaling) and their identification via linear dependency patterns among adjacent pixels, compression history identification, Super resolution. Document printer / scanner Identification with focus on steganography, water marking, and finger printing algorithms for hiding, recovering, detecting and distorting embedding signals in invariant properties.	15

Text books and Additional References:

- 1 Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGrawHill, 2006.
- 2 Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999. Computer Forensics
- 3 Computer Crime Investigation by John R, Vacca, Firewall Media, New Delhi.
- 4 Computer Forensics and Investigations by Nelson, Phillips Enfinger, Stuart, CENGAGE Learning.
- 5 Cyber Forensic a field manual for collecting ,examining and preserving evidence of computer crimes by Albert J. Menendez
- 6 Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition,

- 2001.
- 7 Skoudis. E., Perlman. R. Counter Hack: “A Step-by-Step Guide to Computer Attacks and Effective Defenses”, .Prentice Hall Professional Technical Reference. 2001.
 - 8 Norbert Zaenglein, “Disk Detective: Secret You Must Know to Recover Information From a Computer”, Paladin Press, 2000.
 - 9 Real Digital Forensics by Keith j.Jones, Richard Bejtllich,Curtis W.Rose ,AddisonWesley Pearson Education
 - 10 Forensic Compiling,A Tractitioneris Guide by Tony Sammes and Brain Jenkinson,Springer International edition.
 - 11 Computer Evidence Collection & Presentation by Chrostopher L.T. Brown, Firewall Media.
 - 12 Homeland Security ,Techniques& Technologies by Jesus Mena,Firewall Media.
 - 13 Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M.Slade ,TMH 2005
 - 14 Windows Forensics by chad Steel,Wiley India Edition.
 - 15 Pattern Recognition by Theodoridus
 - 16 Biometrics by Anil jain and salil prabhakar
 - 17 Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Prentice-Hall, Inc.Upper Saddle River, NJ, USA, 2006
 - 18 Alan Bovik, Handbook of Image and Video Processing, Academic Press, USA, 2000
 - 19 Husrev Taha Sencar and Nasir Memon, Digital Image Forensics: There is More to a Picture than Meets the Eye, Springer Science and Business Media, New York, 2013
 - 20 Anthony T.S. Ho and Shujun Li, Handbook of digital forensics of multimedia data and devices, John Wiley & Sons, Ltd., UK, 2015.
 - 21 Hany Farid, Photo Forensics, The MIT Press, Cambridge, First Edition, 2016
 - 22 Philip Rose, Forensic Speaker Identification, CRC Press, 2002

Course Code	Title	Credits
USFS 407	Law –IV	2

Course objectives-

1. This Course objective is to encourage the students to appreciate the underlying principles of law of evidence.
2. Developing the capabilities to understand and apply the general principles of relevancy and admissibility in forensic evidences.
3. Technically furnish the students to be able to read the legal text and apply the same in real forensic cases.
4. To analyse certain areas of evidence critically so as to instil the spirit of questioning and law reforms.

Course outcome		
<ol style="list-style-type: none"> 1. To Design and implement a plan for establishing each legal element of a given forensic case to the required standard of proof with admissible evidence; 2. To analyse and define the concept and general nature of evidence, and illustrate the different types of evidence and court procedures relating to evidence. 3. Analyse the rule relating to relevance of evidence and admissibility of evidence before the court as a Forensic Expert. 4. Evaluate the rules relating to admissibility of Evidence in court. 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Introduction to Law of Evidence Meaning and Kinds of Evidence Applicability and Definitions under Indian Evidence Act 1872 Admission Confession Statements By Persons Who Cannot Be Called As Witnesses/Dying Declaration Expert Opinion and its admissibility in courts Character Evidence in court	15
Unit II	Oral and Documentary Evidence Admissibility of Oral evidence Primary evidence and Secondary evidence Proof of documents by primary evidence Cases in which secondary evidence relating to documents may be given Special provisions as to evidence relating to electronic record Admissibility of electronic records Rules as to notice to produce Proof of signature and handwriting of Proof as to electronic signature Public documents and Private documents Certified copies of public documents Proof of documents by production of certified copies. Proof of other official documents.	15
Unit III	Burden of Proof Definition of Burden Of Proof On Whom Burden Of Proof Lies Burden Of Proof As To Particular Fact Burden Of Proving Fact To Be Proved To Make Evidence Admissible Burden Of Proving That Case Of Accused Comes Within Exceptions Burden of proving fact especially within knowledge. Burden of proving death of person known to have been alive within thirty years. Birth during marriage, conclusive proof of legitimacy.	15

	<p>Presumption as to abetment of suicide by a married woman.</p> <p>Presumption as to dowry death.</p> <p>Presumption as to absence of consent in certain prosecution for rape</p>	
Unit IV	<p>Witnesses and Examination of Witnesses</p> <p>Who may testify.</p> <p>Witness unable to communicate verbally. Official communications.</p> <p>Professional communications.</p> <p>Confidential communications with legal advisers. Accomplice.</p> <p>Number of witnesses.</p> <p>Order of production and examination of witnesses. Judge to decide as to admissibility of evidence.</p> <p>Examination-in-chief, Cross-examination, Re-examination.</p> <p>Leading questions- When they must not be asked and When they may be asked. When witness to be compelled to answer.</p> <p>Indecent and scandalous questions Questions intended to insult or annoy</p> <p>Exclusion of evidence to contradict answers to questions testing veracity Impeaching credit of witness.</p> <p>Questions tending to corroborate evidence of relevant fact, admissible</p>	

Text books and Additional References:

1. Forensic science in criminal investigation and trail by B R Sharma.
2. The Constitution of India- P.M. Bakshi
3. The Constitution of India:J.N. Pandey
4. The Indian Penal Code: K.D. Gaur
5. Introduction to Constitution of India- D.D. Basu
6. The Code of Criminal Procedure- RatanlalDhirajlal
7. Criminal Procedure Code – Bare Act
8. Forensic science in criminal investigation and trail by B R Sharma.
9. The Law of Evidence- BatukLal
10. .The Law of Evidence- Ratanlal and Dhirajlal
11. Evidence Act- Bare Act
12. .Information Technology Act- 2000 Bare Act
13. The Criminal Procedure Code: Takwani
14. Criminology and Penology:N.V. Paranjape

B.Sc. (FORENSIC SCIENCE)

Semester IV– Practical

Course Code	Title	Credits
USFS 4P1	Forensic Science and Chemical Science Practical	2
Practical No.	Title of the Practical	No. of Practicals
	Forensic Science Practical	

1	To Perform Preliminary Examination of Document	1
2	Collection, Handling and Preservation of Documents	1
3	Examination and Identification of General and Individual Characteristics of Handwriting	1
4	To study natural variation of handwriting	1
5	Examination of paper	1
6	Examination of altered documents	1
7	Identification of Indented writing.	1
8	Identification of Secret writing.	1
9	Identification of typewritten documents.	1
10	Identification of printed documents.	1
11	To examine various rubber stamps, seal impressions and postal cancellation stamps	1
12	Detection of forgeries including traced and simulated Forgery.	1
13	Examination of ink by TLC method.	1
14	Examination of Security Features of Currency Notes and passport	1
15	Examination of security features of bank cheques	1
16	To re-evaluate (proficiency testing) a sample as per NABL guidelines.	1
Chemical Science Practical		
1	Estimation of strength of sodium thiosulfate by iodometry using starch indicator.	1
2	Estimation of Ca ²⁺ and Mg ²⁺ from milk powder.	1
3	Talcum powder analysis.	1
4	Potentiometric Titration – 02	2
5	Estimation of H ₂ O ₂ in given Samples (ointments).	1
6	Colorimetry: To determine the amount of Iron present in an Iron tablet, Fefol, using SCN ⁻ as complexing agent	1
7	To verify Lambert-Beers law using KMNO ₄ solution. (colorimetrically)	1
8	Estimation of Aspirin from a given tablet.	1
9	Double titration using two indicators (methyl orange and phenolphthalein).	1
10	To prepare acetanilide from aniline and purify by column chromatography.	1
11	Nitration of phenol and separation of products by column chromatography.	1
12	Industry/Laboratory Visit	1

Course Code	Title	Credits
USFS 4P2	Physical Science and Biological Science Practical	2
Practical	Title of the Practical	No. of

No.		Practical's
Physical Science Practical		
1	Study of absorption coefficient of given Sample	1
2	Study of transmission coefficient of given Sample	1
3	Study of Segregation of Speech Sample	1
4	Study of Thermistor/ Thermocouple Characteristics.	1
5	To determine the Planck's constant using filters	1
6	Measurement of displacement using LVDT	1
7	Gravimetric Analysis (Density Measurement of Given Sample)	1
8	Voice recording and analysis by repetitive hearing.	1
9	Wheel base and thread width measurement of various vehicles.	1
10	Comparative study of technical specifications of various vehicles	1
11	Examination of automobile chassis.	1
12	Examination of braking system.	1
13	Examination two and four stroke engines.	1
14	I-V characteristics and efficiency of Solar cell.	1
Biological Science Practical		
1	Organic extraction and isolation of DNA from blood	1
2	Extraction and isolation of DNA from plant sources	1
3	Extraction of DNA using silica column	1
4	Quantification of DNA	1
5	Quantification of RNA	1
6	Restriction digestion of DNA	1
7	PCR amplification of DNA	1
8	DNA fingerprinting in individual identification, paternity testing	1
9	Visit to autopsy center at mortuary, Forensic Science Laboratory, Pathology Laboratory, Veterinary Center, Biodiversity and wildlife Center	1

Course Code	Title	Credits
USFS 4P3	Psychology and Computer Science Practical	2
Psychology Practical		
Practical No.	Title of the Practical	No. of Practicals
1	State Trait Anxiety Inventory For Children/Adult	3
2	Aggression Test	3
3	Medico Psychological Questionnaire-J. Bharatraj	3

4	Indian Adaptation of Bell's Adjustment Inventory	1
5	Pass-A-Long Intelligence Test	1
6	Life Satisfaction Scale	1
7	Observation and Testimony	1
8	Achievement Motivation Test(N Ach) Scale By Deo- Mohan { DMAMS}	1
9	Immediate Memory Span Experiment	1
10	Practical Based on Qualitative Research Method (Survey, Interview, Observation, Projective/Semi-Projective Test)	1
Computer Science Practical		
1	Study of cryptography	1
2	Study of digital certificate of website	1
3	Comparing data to find the changes with hashing algorithm	1
4	Data recovery with various tools	1
5	Acquiring data from live system	1
6	Windows logs analysis	1
7	Windows registry analysis	1
8	Configuring firewall	1
9	Configuring IDS	1
10	Steganography (hiding and retrieving data)	1