

University of Mumbai



No. AAMS(UG)/ 56 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/111 of 2016-17 dated 25th October, 2016 relating to the revised syllabus as per the CBCS for F.Y.B.Sc. (Forensic Science) (Sem I & II).

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. 6.2 (R) have been accepted by the Academic Council at its meeting held on 17th May, 2022 vide item No. 6.10 (R) and that in accordance therewith, the revised syllabus of **F.Y.B.Sc. (Forensic Science) (Sem I & II) (CBCS)** has been brought into force with effect from the academic year 2022-23. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032

28th June, 2022

To

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

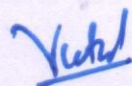
A.C/6.10(R)/17/05/2022

No. AAMS(UG)/ 56 -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 F.Y.B. Sc.
(Forensic Science)
Sem – I & II
(Choice Based Credit System)**

(With effect from the academic year 2022-23)

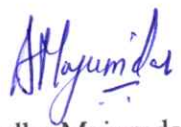
UNIVERSITY OF MUMBAI



Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course O. _____	F.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 2022-23

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 first-year syllabus are designed to get the students acquainted with the knowledge, laws and principles of basic sciences like biology, physics, chemistry and psychology in order to lay down foundations for its application in the field of Forensic Science in successive years.

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)

F. Y. B. Sc. (Forensic Science) (Semester I) Credits

To be implemented from Academic Year 2022-2023

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 101	Forensic Science-I	4		60		50		100		2		2
USFS 102	Chemical Science - I	4		60		50		100		2		2
USFS 103	Physical Science -I	4		60		50		100		2		2
USFS 104	Biological Science - I	4		60		50		100		2		2
USFS 105	Psychology - I	4		60		50		100		2		2
USFS 106	Computer Science - I	4		60		50		100		2		2
USFS 107	Law - I	4		60		50		100		2		2
USFS 1P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 1P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 1P3	Psychology and Computer Science Practical		6		90		72		100		2	2
Total	--	28	18	420	270	350	216	700	300	14	6	20

F. Y. B. Sc. (Forensic Science) (Semester II) Credits

To be implemented from Academic Year 2022-2023

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 201	Forensic Science – II	4		60		50		100		2		2
USFS 202	Chemical Science –II	4		60		50		100		2		2
USFS 203	Physical Science –II	4		60		50		100		2		2
USFS 204	Biological Science – II	4		60		50		100		2		2
USFS 205	Psychology – II	4		60		50		100		2		2
USFS 206	Computer Science – II	4		60		50		100		2		2
USFS 207	Law –II	4		60		50		100		2		2
USFS 2P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 2P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 2P3	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 I - Theory

Course Code	Title	Credits
USFS 101	Forensic Science – I	2
Course Overview: The course covers the basics of Forensic Science with his History, Principles, Crime Scene processing details, Introduction to various evidence and Forensic Science Scenario in India.		
Course Objectives: <ul style="list-style-type: none">• To understand the foundation, principles, history and development of Forensic Science• To learn various steps and procedures involved in crime scene processing• To learn the Forensic Science Laboratory set up In India and various related Indian and International agencies and organizations• To introduce various kinds of evidence and their value and admissibility in Court of law.		
Course Outcome: <ul style="list-style-type: none">• Apply the principles of Forensic Science in investigation• Perform crime scene processing procedures• Understand the working and functioning of Forensic Science Laboratories in India and other related agencies• Classify and evaluate various types of evidence encountered.		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Fundamentals of Forensic Science Definition, Nature, and Scope Laws and principles of Forensic Branches and fields of Forensic Science Historical Development of Forensic: India and Global	15
Unit II	Crime Scene Processing Types and classification of Crime Scene Crime scene response, and role of first responding officer Documentation of crime scene Searching techniques Collection and preservation Crime scene photography Component of Crime scene management Chain of custody	15
Unit III	Forensic Science in India	

	<p>Forensic Science in India (Organogram)</p> <p>Development of Forensic Science Laboratories in India (Central and State)</p> <p>Forensic Science Laboratory: Organization and Services</p> <p>Various Investigation agencies and Organizations (NIA, CBI, Interpol)</p> <p>Forensic Science Expert: Education, Training and ethical responsibilities</p>	
Unit IV	<p>Forensic evidence</p> <p>Evidence: Definition, nature and levels</p> <p>Classification of evidences and its uses</p> <p>Evidentiary value of various evidences</p> <p>Admissibility and Interpretation of evidences in Criminal Justice System</p>	15

Text books and Additional References:

1. Saferstein, R. (2018). Criminalistics: An Introduction to Forensic Science, 12th Edition.
2. Fisher, B. A., Tilstone, W. J., Woytowicz, C. (2009). Introduction to Criminalistics: The Foundation of Forensic Science. United Kingdom: Elsevier Science.
3. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma
4. Stuart H. James., Jon J. Nordby, Suzanne Bell. Forensic Science: An Introduction to Scientific and Investigative Techniques: Fourth Edition (2014)
5. Introduction to Forensic Science in Crime Investigation. (2011). India: Selective & Scientific Books. R. Krishnamurthy
6. Max M. Houck, Jay A. Siegel (2015) Fundamentals of Forensic Science; Third edition
7. Police Investigation - Powers, Tactics and Techniques(2014) V. Sithannan
8. Howard A. Harris, Henry C. Lee (2019) Introduction to Forensic Science and Criminalistics, Second Edition
9. William J. Tilstone, Kathleen A. Savage, Leigh A. Clark (2006) Forensic Science; An Encyclopedia of History, Methods, and Techniques
10. Introduction to Criminal Investigation. (2018). United Kingdom: Taylor & Francis.
11. Nabar, B. S. (2005). Forensic Science in Crime Investigation. India: Asia Law House.
12. Nanda, B. B., Tewari, R. K. (2001). Forensic Science in India: A Vision for the Twenty-first Century. India: Select Publishers.
13. Crime Scene Management: Scene Specific Methods. (2016). Germany: Wiley.
14. Fisher, D. R., Fisher, B. A. J. (2012). Techniques of Crime Scene Investigation, Eighth Edition. United Kingdom: Taylor & Francis.
15. Crime Scene to Court: The Essentials of Forensic Science. (2020). United Kingdom: Royal Society of Chemistry.

Course Code	Title	Credits
USFS 102	Chemical Science –I	2
<p>Prerequisites for the course: Introductory concepts in chemistry like equivalent weight, dilution, physical constants, hybridizations, and Modern periodic table..</p> <p>Course Objectives: Introduction to basic concepts of general chemistry that has widespread applications in forensic chemistry.</p> <p>Course Outcome: To understand the basic chemistry of the solution, structure and bonding, surface chemistry and s, p and d blocks elements.</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Mole concept and methods of expressing concentration Introduction, mole, equivalent weight, milliequivalents, normality, molarity, molality, percentage, mole fraction, ppm, ppb, etc.; Preparation of solutions with all types of concentrations, stock solution and serial dilution; Solvents, polarity index of commonly used solvents, miscibility of various solvents, tuning the polarity by mixing various solvents.</p> <p>Colligative Properties of Solutions Colligative Properties and types of properties, Elevation in boiling point, Relative lowering of vapour pressure, Raoult's law and Henry's law, Depression of freezing point, Osmosis and osmotic pressure, Problems based on all colligative properties</p>	15
Unit II	<p>Structure and Bonding Introduction, hybridization, nature of chemical bonding, polarization, hydrogen bonding, Van der Waals forces; Introduction, Postulates, Applications and Limitation of Valence Band Theory, Valence Shell Electron Pair Repulsion Theory.</p> <p>Theories of Chemical Bonding Introduction, Postulates, Applications and Limitation of Molecular Orbital Theory and Crystal Field Theory; Molecular Orbital diagrams of a few homonuclear and heteronuclear diatomic molecules.</p>	15
Unit III	<p>Surface Chemistry and Catalysis A. Adsorption: Introduction, types, adsorption isotherms, factors affecting adsorption and applications of adsorption. B. Catalysis: Introduction, homogeneous and heterogeneous catalysis, action of Promoters and Inhibitors, enzyme catalysis, autocatalysis; Significance of Catalysis in Forensic Science.</p> <p>Errors in Chemical Analysis</p>	15

	Introduction, Random and Systematic errors, Accuracy, Precision, Uncertainty, Absolute & Relative errors, Mean, Median, Average and Standard deviations, Significant figures. Related Numerical problems.	
Unit IV	<p>Chemistry of s & p – block elements Physical and chemical properties, Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states, Magnetic properties, Complex formation, etc.; Toxicity and Forensic Significance of some metals and their compounds.</p> <p>Chemistry of elements of first transition series Characteristic properties of the elements of first transition series with reference to their: Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states, Magnetic properties, Color, Complex formation tendency and catalytic activity; Coordination Compounds, Some Toxic metals and their Forensic Significance.</p>	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., 9thEd, 2014

Course Code	Title	Credits
USFS 103	Physical Science –I	2
	<p>Course Outcomes: - At the completion of this course the candidate can: Know and understand</p> <ul style="list-style-type: none"> • The basic fundamentals of Light and optics . • The various phenomenon like Interference and diffraction Polarization • The basic principle of laser and its application in holography • About the various aspects of optical fiber and fiber optics communication 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Optics-Reflection, Refraction and Dispersion of light:</p> <p>Laws of reflection, Real and virtual image, Laws of refraction, Physical significance of refractive index, Refraction through number of media, Total internal reflection, Dispersion and dispersive power, Deviation without dispersion and dispersion without deviation, Fermat's principle, Refraction through thin and thick lenses, Combination of two thin lenses(including derivation for focal length and cardinal point), Magnification- lateral, longitudinal and angular, Focal length of a lens immersed in a liquid.</p>	15
Unit II	<p>Interference and Aberration:</p> <p>Interference: Introduction, Conditions for interference of light, Interference in thin film, Newton's ring, Wedge- shaped film, Determination of refractive index of a liquid, Applications of interference- interference filters, thickness of thin film coating, anti-reflecting coating.</p> <p>Aberration: Achromatic and chromatic aberration, Types of Achromatic aberration and their reduction- Spherical aberration, Coma, Astigmatism, Curvature of field, Distortion, Types of chromatic aberration- achromatism (lenses in contact and separated by finite distance).</p>	15
Unit III	<p>Polarization and Diffraction:</p> <p>Polarization: Introduction, Polarization of light waves, Types of polarization, Plane of polarization, Brewster's law, Law of Malus, Production of polarized light, Laurent's half shade polarimeter, Biquartz polarimeter, Polarizer and analyzer.</p> <p>Diffraction: Introduction to Fresnel and Fraunhofer's of diffraction, Difference between interference and diffraction, Plane diffraction grating. Resolving power: Rayleigh's criterion of resolution, resolving</p>	15

	power of grating and microscope, Huygen's and Ramden's eye pieces and their comparison.	
Unit IV	<p>Lasers and Fiber Optics:</p> <p>Lasers: Introduction, Spontaneous and stimulated emission, Interaction of light with matter and quantum processes, Population inversion, Pumping system, Production of laser, Types of lasers- The Ruby laser, gas laser, semiconductor laser, Uses of laser, Properties of laser.</p> <p>Holography: Principle, Recording of a hologram, Applications of holography.</p> <p>Fiber optics: Introduction, Principle, structure and classification of optical fiber, Numerical aperture, Fiber optic communication system, Losses in optical fiber, Applications of optical fiber.</p>	15

Text books and Additional References:

1. A text book of Optics, Multicoloured Revised Edition 2014, Subramanyam, Brij Lal, Avadhanulu, S. Chand and Co. Pvt. Ltd, ISBN 2611
2. Engineering Physics Seventh Enlarged, Revised Edition 2004, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd.
3. Optics – Ajoy Ghatak (3rd Ed) Mc. Graw Hill Co.
4. Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication.
5. Principles of Optics – B. K. Mathur and T. P. Pandya (3rd Ed.) 1981, McGraw Hill International.
6. Fundamentals of Optics – Khanna and Gulati (1994), S. Chand.
7. Optics – C. L. Arora, S. Cand and Co. Ltd (2001)
8. Fundamentals of Physics-Resnik, Halliday and Walker, John Wiley Publication.
9. Fundamentals of Optics – Jenkins and White. (4th Ed) McGraw Hill International.
10. Fibre Optics – Kaiser, McGraw Hill
11. Lasers: Theory and Applications; Thyagrajan
12. Introduction to Lasers; , Avadhanulu , Heman

Course Code	Title	Credits
USFS 104	Biological Science– I	2
	<p>Course Overview: The course covers evolution of life and the biochemistry of molecules, and classical genetics.</p> <p>Course Objectives:</p> <ul style="list-style-type: none"> • To understand origin and evolution of life. • To familiarize the students with biomolecules of importance. <p>To understand the principles of inheritance.</p> <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understanding of the different levels of organization of the biological world • Understanding Beer-Lambert's law and using it for colorimetry Separation and qualitative identification of different bio-molecules from biological samples • Familiarization with the structure of nuclear material and its role in inheritance 	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Evolution :</p> <p>The science of biology; definition and characteristics of life, levels of organization in the biological world.</p> <p>Origin of life: a brief history of the earth, the geological timescale in brief, Oparine- Haldane experiment, Miller-Urey experiment.</p> <p>Theories of evolution: Lamarckism, Darwinism, mutation theory, Neo- Darwinism.</p>	15
Unit II	<p>Biochemistry-I</p> <p>Amino acids: definition, structure and classification, reactions of amino acids, isoelectric point.</p> <p>Proteins: the structure of proteins-primary, secondary, super secondary, tertiary, and quaternary.</p> <p>Enzymes: definition, types, mechanism of action (Lock and key and induced fit model). Michaelis-Menten equation, enzyme inhibition, allosteric enzymes, Isozymes, polymeric enzymes, polymorphic enzymes. Coenzyme and Cofactors.</p> <p>Vitamins: significance, deficiencies</p>	15
Unit III	<p>Biochemistry-II</p> <p>Carbohydrates: Definition, Classification and stereochemistry: isomerism and optical activity. Reactions of aldehydes and ketone groups, importance of carbohydrates.</p>	15

	Carbohydrate metabolism: Glycolysis, Kreb's Cycle and oxidative phosphorylation, Pentose phosphate pathway, Gluconeogenesis, Glyoxylate cycle. Oils and Fats: definition, properties, classification, and nomenclature. Significance of saturated and unsaturated fatty acids and essential fatty acids	
Unit IV	Classical Genetics : Mendel's laws of inheritance, Population Genetics: Hardy-Weinberg equation, non-Mendelian inheritance. Genetic material: Griffith's experiment, Avery-Macleod-McCarty experiment, Hershey-Chase experiment, Meselson-Stahl experiment. Structure of DNA: X-ray crystallography, Chargaff's rule, Watson-Crick's double-helical model, forms of DNA. RNA as genetic material, Types of RNA	15

Text books and Additional References:

1. A text book of Optics, Multicoloured Revised Edition 2014, Subramanyam, Brij Lal, Avadhanulu, S. Chand and Co. Pvt. Ltd, ISBN 2611
2. Engineering Physics Seventh Enlarged, Revised Edition 2004, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd.
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4. Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication.
5. Principles of Optics – B. K. Mathur and T. P. Pandya (3rd Ed.) 1981, McGraw Hill International.
6. Fundamentals of Optics – Khanna and Gulati (1994), S. Chand.
7. Optics – C. L. Arora, S. Cand and Co. Ltd (2001)
8. Fundamentals of Physics-Resnik, Halliday and Walker, John Wiley Publication.
9. Fundamentals of Optics – Jenkins and White. (4th Ed) McGraw Hill International.
10. Fibre Optics – Kaiser, McGraw Hill
11. Lasers: Theory and Applications; Thyagrajan
12. Introduction to Lasers; , Avadhanulu , Heman

Course Code	Title	Credits
USFS 105	Psychology – I	2
<p>Course Objectives:</p> <ul style="list-style-type: none"> • A learner studies in semester-I about the introduction to the science of psychology, related branches, application of these branches in various social, personal contexts. • Further, learner understands the biological perspective of human behavior. • Learner also understands the different perspectives of human behavior that makes individual differences. • It also helps the learner to understand nature of intelligence and its application in daily life. <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Identify- Learner identifies basic elements of psychology. Also he can understand human behavior based on biological process • Describe- Based on various schools of psychology branches a learner gets the holistic perspective of human behavioral aspects. • Differentiate- Learner gets the basic understanding of human different and based on it he learns how to deal with individual differences. • Analyze- Learner analysis the different aspect of human behaviors. • Review- Learner reviews various methodologies and perspectives which are research oriented in nature. 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>The Science of Psychology</p> <ul style="list-style-type: none"> • science of Psychology: Definition, Goals Of Psychology • History of Psychology: Development of Psychology, History of Psychology In India • Modern Perspectives in Psychology: Psycho-Dynamic, Behaviorist, Humanistic, Cognitive, Bio-Psychological, Socio- Cultural, Evolutionary • Types of Psychology Professions: Psychiatrist, Psychologist, Counselor • Research Methods In Psychology: Interview, Observation, Case-Study, Survey 	15

	<ul style="list-style-type: none"> • Ethics In Psychology: APA Code of Conduct for Psychologists 	
Unit II	<p>The Biology of mind</p> <ul style="list-style-type: none"> • neurons: Structure, Neural Impulses, Building The Network • Neurotransmitter- Types, Functions • Nervous system: Central Nervous System, Peripheral Nervous System • Human Brain: Structure , Function, Hemispheres, Significance • Endocrine System: Pituitary, Thyroid And Other Glands • Genetic Influences nn Behavior- Genes And Chromosomes 	15
Unit III	<p>Consciousness And Perception</p> <ul style="list-style-type: none"> • Consciousness: Definition and states of consciousness • Sleep: Stages of Sleep, Rem and Non-Rem Sleep • Altered States of Consciousness: Hypnosis And Drugs • Sensation- Definition, Sensory-Limits, Adaptation, Psychophysics, • Perception- Definition, Gestalt Principles • Perception-Perceptual Organization And Grouping Of Stimuli In Perceptual Organization, • Depth Perception • Errors in Perception- Illusion, Hallucination, Individual Factors In Perception. 	15
Unit IV	<p>Cognition And Intelligence</p> <ul style="list-style-type: none"> • Cognition- Definition, Concepts- Simple & Complex • Concept Formation, Natural Concepts • Intelligence- Definition, History, Cognitive Components • Measures of Intelligence • Theories of Intelligence-Contemporary and Modern • Emotional Intelligence- Nature And Components • Individual Differences- Mental Retardation & Giftedness • Normal Probability Curve Heredity Vs. Environment • Psychological Testing- Testing & Assessment, Types of Tests, Characteristics of A Good Psychological Test. 	15

Text books and Additional References:

- 1 Psychology, Sixth Edition, Henry G. Holt, Rinehart and Winston, 2004
- 2 Psychology in action, Fifth edition, Huffman, Mark and Judith Vernoy, John Wiley and Sons, 2000
- 3 Cognitive psychology, Galotti and Wadsworth, Sage Learning, 2004
- 4 Social psychology, Baron, Pearson Education, 2010
- 5 Introduction to Psychology, (1986) Morgan C.T., King R.A., Weisz J.R., Schopler J., McGraw- Hill Book Co.
- 6 Principles of General Psychology, 3rd ed. Kimble G.A., Garnezy, , New York
- 7 Psychology, Sixth Edition, Henry G. H. Holt, Rinehart and Winston, 2004
- 8 Psychology In Action, Fifth Edition, Huffman, Mark And Judith Vernoy,

- John Willey And Sons,2000
- 9 Cognitive Psychology, Galotti and Wadsworth, Sage Learning, 2004
 - 10 Social Psychology, Baron, Pearson Education, 2010
 - 11 Psychology, Sixth Edition, Benjamin B. Lahey, Tata McGraw-Hill Edition, 1998
 - 12 Cognitive Psychology Mind and Brain', Edward E. Smith, Stephen M. Kosslyn, New Delhi, Pearson Education
 - 13 Invitation to Psychology, Parameswaran, E.G., Beena C. Tata McGraw-Hill, New Delhi
 - 14 Manashatra-Ek Parichay, (2004), Dr. Padhye V.S. Aurangabad; Renuka Prakashan
 - 15 Psychology-An Introduction, Thakkar P., Dr. Ambekar A

Course Code	Title	Credits
USFS 106	Computer Science – I	2
	<p>Course Objectives: To study fundamentals of computers, various types of software and hardware devices, operating system ,file systems , computer network and internet related technology.</p> <p>Course Outcomes: Student can able to describe about the fundamentals of computers, various types of software and hardware devices, operating system ,file systems , computer network and internet related technology</p>	
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Computer Fundamentals: Basic Organization of Computer System, Computer Hardware and Software</p> <p>Input/output Devices: Input/output Devices, Input/output Interface, Asynchronous Data Transfer, Modes of Data Transfer.</p> <p>Computer Memory: Primary Memory (RAM, SRAM, DRAM, ROM, EPROM), Secondary Memory (Magnetic Floppy, Hard Disk, RAID), Optical Memory (CDROM, WORM) Concept of Virtual Memory, Concept of Cache and their need, Memory hierarchy.</p> <p>Types of Software's: Application software, System Software, firmware</p> <p>Types of Computers: Micro Computer, Mini Computer, Super Computer, Mainframe Computer.</p>	15
Unit II	<p>Introduction to Operating System: Understanding Computer Operating Systems, Understanding the Role of the, Operating System, Types of Operating Systems, Multitasking, Multiprogramming, Distributed OS, Multiprocessing, Multithreading, Network OS, Proprietary and Open-Source Operating Systems,</p> <p>An Overview of Commonly Used Operating Systems : Windows, Linux, Mobile OS.</p>	15
Unit III	<p>File Systems: Introduction to File Systems, Types of File System, FAT12 FAT16, FAT32,NTFS, Ext, Ext2, Ext3, Ext4, HFS, UFS, Other File Systems, File System Managements.</p> <p>Number System: Types of Number Systems: Binary, Decimal, Octal, Hexadecimal, Conversion of Number System. Binary Arithmetic's. Basic Logic Gates</p>	15
Unit IV	<p>Computer Networks and Internet: Introduction to Networking, Network topologies, types of transmission Media, Types of Networks, Network Architecture (Client Server and Peer to Peer), Networking Devices (Switches, hub, bridge, Router, Modem etc.),</p>	15

	Reference Models: Protocols, OSI Reference Model, TCP/IP Model Internet: History of Internet, World Wide Web (URL, HTTP, HTTPS, FTP etc.), Web Browsers, E-mails, Instant Messaging System, Search Engines, types of internet connection (dial-up, broadband, 3G, 4G, Wi-Fi, leased line etc.)	
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Text books and Additional References:

1. Computer Fundamentals by Pradeep K. Sinha & Priti Sinha
2. Computer Fundamentals by Larry Long
3. Computer System Architecture, M. Morris Mano, PHI Publications
4. Computer Organization and Architecture Designing for Performance, Eight Edition, William Stallings, Pearson Publication

Course Code	Title	Credits
USFS 107	Law – I	2
<p>Course Objectives:</p> <ul style="list-style-type: none"> • 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. <p>Course Outcomes:</p> <ul style="list-style-type: none"> • 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	<p>Introduction to crime, causes and kinds :</p> <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>	15
Unit II	<p>Criminology : Concept and Schools/Theories</p> <p>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	Penology : Punishments, Prison Reforms and Correctional	15

	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	
Unit IV	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	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 I – Practical

Course Code	Title	Credits
USFS 1P1	Forensic Science and Chemical Science Practical	2
Practical No.	Title of the Practical	No. of Practical
Forensic Science Practical		
1	Handling of Crime Scene Forensic Kits	1
2	Introduction to Lab and Safety Protocols in Forensic Science Laboratory	1
3	Forensic Photography of various types of crime scene.	1
4	Protection and Recording of Crime Scene by Different Methods of Barricade (Indoor and Outdoor)	1
5	Searching of Evidence on Scene of Crime: A. Evidence search using traditional method of searching B. Evidence searching using light sources and other technology	2
6	Sketching of Crime Scene: A. Rough Sketch of Indoor/Outdoor Crime Scene B. Final Sketch of Indoor/Outdoor Crime Scene	2
7	Videography of Crime Scene: A. Full Scene Videography B. Evidential Videography	1
8	Packaging and Chain of custody of various evidences	1
9	To conduct mock 'Crime Scene Investigation'	1
10	Discussion of a Case in a Forum	1
Chemical Science Practical		
1	Introduction to Forensic Chemistry lab apparatus and instruments, Laboratory safety rules, MSDS.	1
2	Identification of commonly used organic solvents/ acids/ bases by physicochemical properties (smell, density, pH, refractive index, viscosity, boiling point, etc.)	1
3	To determine the relative viscosity of given liquid by using Ostwald's Viscometer.	1
4	To determine surface tension of the given liquid by using stalagmometer.	1
5	Analysis of single organic compound	04
6	To determine the strength of the given acid conductometrically using standard alkali solution.	1
7	To determine strength of given acid/base.	1
8	To determine the density of given alcoholic liquid.	1
9	To standardize KMnO ₄ solution and find strength of the given	1

	oxalic acid solution.	
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

Course Code	Title	Credits
USFS 1P2	Physical Science and Biological Science Practical	2
Practical No.	Title of the Practical	No. of Practical's
Physical Science Practical		
1	Standard operation procedure for Vernier caliper, micrometer screw and travelling microscope.	1
2	Determine the combined focal length of given lens system.	1
3	Determine the angle of prism using spectrometer.	1
4	Determine the refractive index of material of prism using spectrometer.	1
5	Determine the magnification of given microscopes.	1
6	Determine the resolving power of microscope.	1
7	Determine the radius of capillary using travelling microscope.	1
8	Determine the radius of curvature of plano convex lens by Newton's Rings.	1
9	Determine the thickness of thin foil using air wedge	1
10	Measure the divergence of given laser.	1
11	Determine the wavelength of light using plane transmission gratings.	1
12	Determine the numerical aperture of optical fibre	1
13	Determine the numerical aperture of optical fibre.	1
Biological Science Practical		
1	Introduction to instrument and Glassware of the laboratory	1
2	To Study the calibration of laboratory equipment	1
3	To study laboratory safety practices	1
4	Beer-Lamberts Law (Validation)	1
5	Qualitative analysis of sugar, proteins, lipids	1
6	Qualitative analysis of Proteins	1
7	Qualitative analysis of Lipids	1
8	Qualitative analysis of nucleic acids	1
9	Determination of pH of any fluid and iso-electric point of protein	1
10	Determination of saponification value and rancidity of fats	1
11	Determination of GOD /POD activity in serum/plasma	1

12	Separation of amino acids and Protein or sugar using paper Chromatography techniques (Radial/Ascending)	1
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Course Code	Title	Credits
USFS 1P3	Psychology and Computer Science Practical	2
Practical No.	Title of the Practical	No. of Practical
Psychology Practical		
1	Introduction To Psychology Practical's	2
2	Objective Personality Test: Locus Of Control Test	3
3	Projective Personality Test: House, Tree, Person Test	3
4	Anxiety Test	1
5	Muller- Lyer (Perception) Experiment	1
6	Emotional Intelligence Test	1
7	Type A/B Behavior Pattern	1
8	Frustration Test	1
9	Depth Perception	1
10	Projective Personality Test: Sentence Completion Test	1
Computer Science Practical		
1	Hands-on on Computer hardware	1
2	Study of various commands in windows and Linux	1
3	Installation of Virtual Box	1
4	Installation of OS/ Windows	1
5	Installation of OS/ Linux	1
6	To create and run Live operating system	1
7	Disk partitioning	1
8	To configure network devices -1 (computer)	1
9	To configure network devices -2 (Wi-Fi router)	1
10	To configure network devices -3 (virtual OS)	1
11	Advanced Google search	1

F. Y. B. Sc. (Forensic Science) (Semester II) Credits

To be implemented from Academic Year 2022-2023

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 201	Forensic Science – II	4		60		50		100		2		2
USFS 202	Chemical Science –II	4		60		50		100		2		2
USFS 203	Physical Science –II	4		60		50		100		2		2
USFS 204	Biological Science – II	4		60		50		100		2		2
USFS 205	Psychology – II	4		60		50		100		2		2
USFS 206	Computer Science – II	4		60		50		100		2		2
USFS 207	Law –II	4		60		50		100		2		2
USFS 2P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 2P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 2P3	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 II– Theory

Course Code	Title	Credits
USFS 201	Forensic Science – II	2
<p>Course Overview: The course covers nature of crime and its statistics, physical evidence, impression evidence, and agencies involved in crime detection and prevention</p> <p>Course Objectives:</p> <ul style="list-style-type: none">• To understand the nature of crime, its types, crime statistics and conviction rate in the nation and factors that influence the conviction rates• To learn the types and importance of various physical evidence in investigation and their collection and preservation techniques• To learn the types and role of impression evidence and their significance• To learn the working of various agencies and organisations in India and their role in record keeping, crime detection and prevention <p>Course Outcome:</p> <ul style="list-style-type: none">• Classify crimes, measure the occurrence of different types of crimes, and assess the role of various factors affecting conviction rates• Classify and evaluate physical evidence and perform their collection and preservation• Classify and evaluate impression evidence and perform their collection and preservation• Understand the importance, working and role of various agencies and organizations in India and their role in record keeping, crime detection and prevention		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Crime, Crime Statistics and Conviction 1. Crime: Nature and dynamics 2. Crime Typologies 3. Crime statistics and related agencies 4. Conviction and conviction rate Factors affecting conviction rates	15
Unit II	Physical evidences 1. Physical evidence: Nature, scope and forensic significance 2. Classification of physical evidence 3. Trace evidence: Nature and types Physical evidence process: Searching, recognition, collection,	15

	preservation, packaging, and handling	
Unit III	Impression Evidences <ol style="list-style-type: none"> 1. Introduction to Impression Evidence 2. Gait Pattern Analysis 3. Tyre and Skid Marks 4. Tool Marks 5. Lip Prints and Ear Print 6. Bite Marks 	15
Unit IV	Agencies of Crime detection and Prevention <ol style="list-style-type: none"> 1. Law enforcement and policing in India 2. Investigating agencies and Authorities in India 3. Custodial Crimes, Interview & Interrogation techniques 4. Police, Magistrate, Coroner, and other investigations 5. Structure, role, and functions: CID, CBI, IB, RAW, NCRB, BPR&D, DFS, DFSS, and NICFS. 	15

Text books and Additional References:

1. Saferstein, R. (2018). Criminalistics: An Introduction to Forensic Science, 12th Edition.
2. Fisher, B. A., Tilstone, W. J., Woytowicz, C. (2009). Introduction to Criminalistics: The Foundation of Forensic Science. United Kingdom: Elsevier Science.
3. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma
4. Stuart H. James., Jon J. Nordby, Suzanne Bell. Forensic Science: An Introduction to Scientific and Investigative Techniques: Fourth Edition (2014)
5. Introduction to Forensic Science in Crime Investigation By Dr.(Mrs.) Rukmani Krishnamurthy
6. Howard A. Harris, Henry C. Lee (2019) Introduction to Forensic Science and Criminalistics, Second Edition
7. William J. Tilstone, Kathleen A. Savage, Leigh A. Clark (2006) Forensic Science; An Encyclopedia of History, Methods, and Techniques
8. Henry C. Lee, Howard A. Harris (2000) Physical Evidence in Forensic Science
9. Sandeep Bhalla; Crime Investigation in India. (n.d.). (n.p.): lawmystery.in.
10. Lacaze, K. (2021). Impression Evidence: Identifying Fingerprints, Bite Marks, and Tire Treads. United States: MASON CREST PUBL.
11. Bodziak, W. J. (2008). Tire Tread and Tire Track Evidence: Recovery and Forensic Examination. Ukraine: Taylor & Francis.
12. Bodziak, W. J. (2017). Footwear Impression Evidence: Detection, Recovery and Examination, SECOND EDITION. United States: Taylor & Francis.
13. Birch, I., Birch, M., Nirenberg, M., Vernon, W. (2020). Forensic Gait Analysis: Principles and Practice. United States: Taylor & Francis.
14. Crime Scene Management: Scene Specific Methods. (2016). Germany: Wiley.
15. Crime Scene to Court: The Essentials of Forensic Science. (2020). United Kingdom: Royal Society of Chemistry.

Course Code	Title	Credits
USFS 202	Chemical Science – II	2
<p>Prerequisites for the course : Basic concepts of spectroscopy, electromagnetic radiation, adsorption and partition phenomenon, functional groups</p> <p>Course Objectives: Introduction to basic concepts of the forensic chemistry and toxicology</p> <p>Course Outcome: To understand the basic chemistry of the Forensic Toxicology, Molecular spectroscopy, electronic spectroscopy, Chromatography, Petroleum products and Food adulteration</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Basics of Toxicology Introduction, History of toxicology, Definition of poison, Classification of poisons, characteristics and mode of action of poisons, types of poisoning; Fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes. Toxicological exhibits; Significance of toxicological findings.</p> <p>Pesticides and Insecticides Nature, classification, composition, uses and significance in forensic science.</p>	15
Unit II	<p>Electromagnetic spectrum and Electronic spectroscopy</p> <ol style="list-style-type: none"> 1. Electromagnetic radiation, relation between energy, wavelength, frequency, wave number; Absorption, emission, fluorescence, phosphorescence, Jablonski Diagram, Introduction to Molecular and atomic spectroscopy 2. Absorption laws (Beer Lambert law), molar absorptivity, Types of electronic transitions, UV-visible spectroscopy (Principle, theory and instrumentation and applications), Effect of conjugation, Concept of chromophores and auxochromes, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts; Quantitative analysis by calibration curve, Woodward-Fieser rules to calculate lambda max for diene and enone systems; Related Numerical problems. 	15
Unit III	<p>Chromatography Classification of chromatography, adsorption and partition chromatography, other methods of classification of chromatography, Principle, theory, stationary phases, mobile phases, retardation factor and applications of Paper Chromatography, Column chromatography, Thin</p>	15

	Layer Chromatography, etc; Forensic significance of these chromatographic techniques.	
Unit IV	<p>Food Adulteration Definition of food and food adulteration, food additives and food adulterants, Relevant sections of Prevention of Food Adulteration Act, Detection of common adulterants used in food products by physical and chemical methods; Related case studies and forensic significance.</p> <p>Petroleum products Definition, classification, distillation and fractionation of petroleum; Flash point, aniline point, ignition point, etc. Commercial uses of different petroleum fractions, nature and purpose of dyes used in petroleum products; adulteration of petroleum products.</p>	15

Text books and Additional References:

1. S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
2. Y.R. Sharma, Elementary Organic Spectroscopy, Revised Ed, S. Chand Publishing, ISBN 9788121928847, 1980
3. Chromatography: Concepts and Contrasts, Second Edition. By James M. Miller ISBN 0-471-47207-7, 2005, John Wiley & Sons, Inc.
4. Detect Adulteration with Rapid Test (DART) Book_FSSAI
5. Kinghorn: Introduction to Petrochemicals Sukumar Maiti
6. D.W.Waples : Geochemistry in Petroleum Exploratio
7. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence& Toxicology, M.M. Tripathi Publication (2001)
8. J.M. Miller, Chromatography: Concepts and Contrasts, 2nd Ed, Wiley Publications, ISBN 978-0-470-53025-2, 2009.

Course Code	Title	Credits
USFS 203	Physical Science – II	2
<p>Course Outcome:</p> <p>At the completion of this course the candidate can: Know and understand</p> <ul style="list-style-type: none"> • Basic Laws of motion and forces Physical properties of vibrating systems and fluid dynamics • ,Basics of Nuclear composition and Radioactivity, and basic fundamental • Basics thermodynamics and heat engines • Basics of forensic photography 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Mechanics and Fluid dynamics:</p> <p>Mechanics: Interpretation and applications of Newton’s laws of motion, Conservative and non-conservative forces, Pseudo forces, Speed and velocity, Acceleration: equation of uniformly accelerated motion, speed time graph, equation of motion for freely falling bodies, distance covered by the body in nth second, Collision, Coefficient of restitution, M.I. of flywheel, Bending of beam, Bending of moment of beam, Cantilever loaded at the free end, Cantilever supported at its ends and loaded in the middle, Determination of Y by bending of beam,</p> <p>Fluid Dynamics: Streamline and turbulent flow, Viscosity and coefficient of viscosity, Temperature dependence of viscosity, Stoke’s law and terminal velocity, Determination of coefficient of viscosity by falling sphere method and Poiseulli’s method.</p>	15
Unit II	<p>Introductory Nuclear Physics:</p> <p>Review of nuclear composition, Nuclear properties, Atomic mass unit, Binding energy and mass defect, Nuclear reactions (Fission and Fusion), Distinguish between fission and fusion, Atom bomb or nuclear bomb: Principle ,construction and explosion method, Nuclear reactor, Radioactivity: Nature of nuclear radiation, characteristics properties of radioactive radiations, Laws of radioactive disintegration, Half life period, Mean life of radioactive elements, Measurement of rate of decay, Isotopes and Isobars, Carbon dating.</p>	15
Unit III	Thermodynamics:	15

	<p>First law of thermodynamics, Determination of j by Joule's method, Second law of thermodynamics, Thermodynamic process(reversible and irreversible), Cycles, Heat engine, Thermal efficiency of heat engines, Carnot's cycle and Carnot's engine, Efficiency of Carnot's cycle, Otto cycle, Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamic, Entropy, Two stroke and four stroke engine principle and their comparison, Types of engines: Petrol, Diesel and CNG</p>	
Unit IV	<p>Forensic Photography</p> <p>Introduction, 35 mm Film / Digital SLR camera, Digital Versus Film, Lenses, Lens filters and Attachments, Tripod and Other Camera Supports, Identification Markers, Electronic and Strobe Flashes, Cable Release, Lens Attachments, Hard Cases, Soft Cases and Backpacks, Basic Exposure: Proper Exposure Triangle, Shutter Speed and Motion Control, Reciprocal Exposure, ISO number, Exposure Index, Focus and Depth of Field and Lenses, Crime Scene Photography.</p>	15

Text books and Additional References:

1. Engineering Physics Seventh Enlarged Revised Edition 2004
M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd.
2. Engineering Physics R.K. Gaur and S.L. Gupta, Dhanpat Rai Publication
3. Advanced Crime Scene Photography Christopher D. Duncan, 2010, CRC Press
4. Crime Scene Photography, 2010, Elsevier, Edward M. Robinson,
5. Perspective of modern Physics by Arthur Beiser
6. Atomic and nuclear Physics by Gupta and Ghosh, 2nd Edition
7. Introduction to Atomic and Nuclear Physics by H. Semat and Albrought
8. Modern Physics by H.E. White New York, NY : McGraw-Hill, 1934
9. Heat, Thermodynamics and Statistical Physics; Singhal, Agrawal
10. Heat and Thermodynamics; Brijlal, Subramanyam

Course code	Title	Credits
USFS 204	Biological Science – II	2
<p>Course Overview: The course covers Cell biology, Microscopy, as well classification, morphology and anatomy of plants</p> <p>Course Objectives:</p> <ul style="list-style-type: none"> • To understand the structure of prokaryotic and eukaryotic cells • To acquaint the students with the different types of microscopes. • To understand the classification of plants. • To understand the morphology and anatomy of different plant parts <p>Course Outcomes: Familiarization with the use of microscopes and different staining techniques Microscopic examination of prokaryotic and eukaryotic cells Examination of different plant parts such as pollen, fibres, stem, root, etc.</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Biology of Cell Ultrastructure of the prokaryotic and eukaryotic cell, Cell Theory Plasma membrane: chemical composition, fluid-mosaic model, functions of the plasma membrane, transport across the membrane. Composition of cytoplasm, Cell organelles: Nucleus, ER, Golgi apparatus, Ribosomes, Mitochondria, Chloroplasts, Lysosomes, peroxisomes Cytoskeleton: Microfilaments, Intermediate filaments and Microtubules, Cell cycle – Overview</p>	
Unit II	<p>Microscopy Microscopy: Parts of the microscope, compound microscope, Numerical aperture, Resolving power. Principles and applications of Dark-field, Phase contrast, Fluorescence microscopy, Electron microscopy, polarisation microscope, stereo microscope. Simple and differential staining of Bacteria and Fungi.</p>	15
Unit III	<p>Classification system Principles of taxonomy general scheme, Systematics- Linnean hierarchy, Binomial nomenclature. Plant diversity: salient features and morphological characteristics of algae (diatoms), fungi, gymnosperms and angiosperms up to class level, Hutchinson system, Bentham and Hooker system of classification, classification of animal kingdom up to class level. Carl Woese</p>	15

	16SrRNA classification.	
Unit IV	Morphology and anatomy Morphology and Anatomy of root stem leaf and flower in monocots and dicots. Plant tissues: Ground tissues: parenchyma, chlorenchyma, collenchyma, and sclerenchyma. Vascular tissues: xylem, phloem. Secretory tissues: lactiferous, glandular. Secondary growth in plants. Growth rings and their role in age estimation of plants. (dendrochronology), Palynology: structure of pollen grains, isolation, and identification. Pollination, Introduction to plant fibers (Cotton, Jute, and Hemp)	15

Text books and Additional References:

1. Origin of species-Charles Darwin
2. Evolution: the modern synthesis-Julian Huxley
3. Biology: Raven, Johnson, Singer
4. Evolution: Donald Prothero
5. Biology: Taylor
6. Biochemistry: Berg, Tymoczko, Stryer
7. Lehninger Principles of Biochemistry: Nelson and Cox.
8. Molecular cell biology: Lodish, Berk, Zipursky, Matsudaira, Baltimore, Darnell.
9. Biochemistry: Voet and Voet
10. Instant Notes in Biochemistry: Hames, B. D.
11. Principles and techniques of biochemistry and molecular biology: Wilson and Walker.
12. Textbook of Biochemistry with clinical correlations: Thomas M. Devlin
13. Genetics: Principles and analysis: Hartl and Jones
14. Principles of genetics: Snustad and Simmons
15. Concepts of genetics: Klug and Cummins
16. Genetics: from genes to genomes: Hartwell, Hood, Goldberg, Reynolds, Silver
17. Genetics: a conceptual approach: Benjamin Pierce
18. Genetics: analysis and principles: Robert Brooker
19. Textbook of Plant taxonomy: Manoj Kumar Singh
20. A textbook of botany: Singh, Pande and Jain
21. An introduction to microscopy: Suzanne Bell and Keith Morris
22. Molecular biology of the cell: Alberts, Bray, Lewis, Raff, Roberts, Watson
23. Cell biology: Gerald Carp
24. The cell: a molecular approach: Cooper

Course Code	Title	Credits
USFS 205	Psychology – II	2
<p>Course Objectives:</p> <ul style="list-style-type: none"> • Learner Understand the importance of human memory formation and its process also how human learning gets shaped up. • It explains different aspects of motion in one’s life and goal oriented behavior along with the nature of human emotions • It describes how humans are different in various aspect of life as personality has various dimensions to it. • Learner understands the process of thinking and its application to the problem solving in different situations <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Identify- Learner identify the processes of memory functions and emotion, also human basic needs, motivations and personality of human beings. • Describe- The learner learns various the process of memory through models which enable him the conceptually understand its broader utility. • Differentiate- The learner can describe different types of personality and its developmental factors or the responsible factors behind human behaviour. • Analyze-The learner can analyze different personality traits through various psychological tests. • Review- The study of emotions, memory, personality, biological aspect makes a learner the basic cognitive elements of human psychology. 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Learning and memory</p> <ol style="list-style-type: none"> 1. Learning: Definition, Principles of Conditioning: Classical and Operant Conditioning, Observational Learning and Models Cognitive Learning Theory- Tolman’s Latent Learning 2. Basic Processes of Memory-Encoding, Storage, Retrieval 3. Stages of Memory: Working Memory, STM and LTM 4. Types of Memory: Declarative, Procedural, Semantic, Episodic, Explicit and Implicit Memory 5. Models of Memory: LOP, PDP, Information Processing Approach 6. Forgetting- Curve and Causes, Retrieval Cues 	15
Unit II	<p>Motivation and Emotion</p> <ol style="list-style-type: none"> 1. Motivation: Definition, Primary & Psychological Motives 2. Yerkes-Dodson Law, n’aff, n’ach, n’power 	15

	<ol style="list-style-type: none"> 3. Theories of Motivation- Instinct, Drive- Reduction, Arousal, Incentive, Humanistic 4. Frustration and Conflict (Types) 5. Emotion-Description, Elements of Emotion, Role of Learning & Culture in Emotions 6. Theories of Emotion- James-Lange, Cannon-Bard, Schachter-Singer 	
Unit III	Personality <ol style="list-style-type: none"> 1. Personality- Definition, Concepts of Temperament, Character 2. Approaches/Theories of Personality- Contemporary and Modern- Psychodynamic Theory, Humanistic Theory, Cognitive-Behavioral and Social Learning Theory, Trait Theories, Big Five Factor Model 3. Assessment of Personality- Interviews, Observational Methods, Projective and Objective Tests 	15
Unit IV	Attention And Thinking <ol style="list-style-type: none"> 1. Attention- Definition, Influencing Factors 2. Characteristics and Types of Attention 3. Thinking-Mental Images, Concepts, Prototypes, Problem Solving and Decision Making, Problems with Problem Solving 4. Creative Problem Solving- Convergent & Divergent Thinking 5. Strategies to Problem Solving 6. Language- Definition, Generative Properties Language and Thought 	15

Text books and Additional References:

1. Psychology, Sixth Edition, Henry G. Holt, Norton and Company, 2004
2. Psychology in Action, Fifth Edition, Huffman, Mark and Judith Vernoy, John Wiley and Sons, 2000
3. Cognitive Psychology, Galotti and Wadsworth, Sage Learning, 2004
4. Social Psychology, Baron, Pearson Education, 2010
5. Introduction to Psychology, (1986) Morgan C.T., King R.A., Weisz J.R., Schopler J., McGraw-Hill Book Co.
6. Principles of General Psychology, 3rd ed. Kimble G.A., Garnezy, New York
7. Psychology, Sixth Edition, Henry G. H. Holt, Norton and Company, 2004
8. Psychology In Action, Fifth Edition, Huffman, Mark and Judith Vernoy, John Wiley and Sons, 2000
9. Cognitive Psychology, Galotti and Wadsworth, Sage Learning, 2004
10. Social Psychology, Baron, Pearson Education, 2010
11. Psychology, Sixth Edition, Benjamin B. Lahey, Tata McGraw-Hill Edition, 1998
12. Cognitive Psychology Mind and Brain', Edward E. Smith, Stephen M. Kosslyn, New Delhi, Pearson Education
13. Invitation to Psychology, Parameswaran, E.G., Beena C. Tata McGraw-Hill, New Delhi
14. Manashatra-Ek Parichay, (2004), Dr. Padhye V.S. Aurangabad; Renuka Prakashan

Course Code	Title	Credits
USFS 206	Computer Science – II	2
<p>Course Objective To introduce the concepts of Procedure Oriented Programming and the various programming constructs of C programming</p> <p>Course Outcome</p> <ul style="list-style-type: none"> • Interpret the concepts of Variables, Constant, Operators and various types of expressions • Apply the concept of Decision making statements and looping constructs for solving basic programs • Use the concepts of files and pointers inside a C program • Develop programs incorporating all the C language constructs • Test the correctness of the programs and identify logical and syntax error 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p>Introduction to C programming: Problem Solving using Computers: Algorithms and Flowcharts History, Structure of a C program, Functions as building blocks, Tokens Keywords, Identifiers, Variables, Constants, Types of Data types Operators and Expressions Operator types (arithmetic, relational, logical, assignment, bitwise, conditional, other operators), precedence and associativity rules. Input output functions, Control structure: Branching (if, if else, switch), Looping (for, do-while, while)</p>	15
Unit II	<p>Functions & Pointers: What is a function, Advantages of Functions, Standard library functions, User defined functions: Declaration, definition, function call, parameter passing (by value), return keyword, Scope of variables, storage classes, Recursion, An Introduction to Pointers, Pointer Notation, Call by Reference.</p>	15
Unit III	<p>Arrays: Array declaration, initialization, Types – one, two and multidimensional, Passing arrays to functions. String: What are Strings, More about Strings, Pointers and Strings, Standard Library String Functions: stolen (), stripy (), stricta (), strum () Two-Dimensional Array of Characters, Array of Pointers to</p>	15

	Strings	
Unit IV	Structures: Why Use Structures, declaring a Structure, Accessing Structure Elements, How Structure Elements are Stored File handling: Data Organization, File Operations, opening a File, reading from a File, Trouble in Opening a File, Closing the File, Counting Characters, Tabs, Spaces, A File-copy Program, Writing to a File, File Opening Modes, String (line) I/O in Files	15

Text books and Additional References:

1. Let Us C, Fifth edition Yashavant P. Kanetkar.
2. Programing in ANSI C , E- Balagurusamy

Course Code	Title	Credits
USFS 207	Law –II	2
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To develop knowledge and understanding of the Indian system of criminal justice from systematic approach. • To understand the various components of the criminal justice system and how they relate and interact with another. • Describe the history, evolution and present structure of the criminal justice system. <p>Course Outcomes:</p> <ul style="list-style-type: none"> • Develop the knowledge regarding the historical development of police system, organization, structure and functions of police. • Explain the salient features of the Indian judicial system, its functions, structure and powers of the court. • Explain the police investigation procedures in forensic field. • Explain the prosecuting agencies involved in forensic domain 		
Unit No.	Contents of Unit	No. of Lectures
Unit I	Introduction to Criminal Justice System History and evolution of the criminal justice system Overview of Indian Criminal Justice System Wings of Criminal Justice System Structure and functions of Criminal Justice System Fundamental Principles of Criminal Justice System	15
Unit II	Investigation Agencies in India Police: History, Structure and Functions Accountability of Police towards Law Enforcement Agencies and Society Role of Investigating Officer in crime investigation Other Specialized Agencies in India:	15

	CBI, CID, RAW, ED, NCB etc. Police Reforms in India International Investigation Agencies: FBI, INTERPOL etc	
Unit III	Police investigation Procedures Methods of investigation – information, Interrogation and Instrumentation. Recording of FIR, Case Diary , Station House Diary Examination of Witnesses and suspects, Filing Charge Sheet. Brief Overview of Police Act of 1861 and Model Police Act, 2006 National Police Commission Recommendations (NPC), 1979.	15
Unit IV	Organization of Courts and Prosecuting Agencies Organization of prosecuting agencies for prosecuting criminal Inquisitorial and Accusatory System in India, Role and duties of prosecutor The Directorate of Prosecution Special Public Prosecutor Public Prosecutor Hierarchy of criminal courts and their jurisdiction Role of the court in correctional programmes in India	15

Text books and Additional References:

1. Takwani Criminal Procedure Code, Third Edition, C.K. Thakkar and M.C.Thakkar, Lexis Nexis, 2013
2. Principles of The Law of Evidence, Twentieth Edition, Dr. Avatar Singh, Central Law Publication, 2013
3. The Constitutional Law of India, Fifth Edition, Dr. J.N.Pandey, Central Law Publication, 2013
4. The Indian Penal Code, Fifth Edition, K.D. Gaur, Universal Law Publication, New Delhi, 2013
5. The Indian Penal Code/Ratanlal and Dhirajlal
6. Criminal Manual (Criminal Major Acts), Justice M.R.Malik, Professional Books Publishers, 2014
7. Indian Evidence Act, Batuklal
8. Indian Constitution, P.M.Bakshi
9. Criminal Procedure Code, Ratanlal Dheerajlal

B.Sc. (FORENSIC SCIENCE)

Semester II– Practical

Course Code	Title	Credits
USFS 2P1	Forensic Science and Chemical Science Practical	2
Practical No.	Title of the Practical	No. of Practicals
Forensic Science Practical		
1	Understanding the Basic Component of Crime Scene Investigation and Management, Safety and Security Protocol	1
2	Protection and Recording of Crime Scene by Different Methods of Barricade (Indoor and Outdoor)	2
3	Photography at Scene of Crime: A. Crime Scene Photography (Bird Eye View, Angular Photography and Close-Up Photography) B. Evidence Photography with and without Light Sources	2
4	Videography of Crime Scene: A. Full Scene Videography B. Evidential Videography	2
5	Sketching of Crime Scene: A. Rough Sketch of Indoor/Outdoor Crime Scene B. Final Sketch of Indoor/Outdoor Crime Scene	2
6	Searching of Evidence on Scene of Crime: A. Evidence Search using Traditional Method of Searching B. Evidence searching using Light Sources and Modern Technology	2
7	Dealing with Physical Evidence on the Scene of Crime A. Collection of Evidence at Scene of Crime (Physical, Chemical, Biological, Document, Fingerprint, Ballistics, etc.) B. Preservation of Evidences According to their	3

	Nature/Stability/ Reactivity C. Packaging, Sealing and Forwarding of Physical Evidence to the Forensic Laboratory	
Chemical Science Practical		
1	To determine relative viscosity of given organic liquids by viscometer (Four liquids)	1
2	To determine critical solution temperature of phenol water system	1
3	To determine the rate constant (or to study kinetics) of acid catalysed ester hydrolysis	1
4	To determine the rate constant of base catalyzed ester hydrolysis	1
5	Partition coefficient of iodine between water and carbon tetrachloride	1
6	To compare the relative strength of HCl and H ₂ SO ₄ by studying the kinetics of Inversion of cane sugar using Polarimeter	1
7	To determine the molecular weight of a high polymer by using solutions of different concentrations	1
8	To study the effect of addition of salt on critical solution temperature of phenol water system	1
9	To determine the transport number of cation by moving boundary method	1
10	To prepare standard 0.2 M Na ₂ HPO ₄ and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the Pka value of these and unknown solutions by Potentiometry	1
11	To determine Pka value of given monobasic acid by Potentiometric titration	1
12	To determine the formal redox potential of Fe ²⁺ / Fe ³⁺ system Potentiometrically	1
13	To determine the amount of Cl ⁻ and Br ⁻ from the given halide mixture by titrating with silver nitrate solution by Potentiometry	1
14	To determine Pka value of given weak acid by pH-metric titration with strong base	1
15	To determine the dissociation constant of oxalic acid by pH-metric titration with strong base	1
16	To determine pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find the dissociation of acetic acid by pH-metry	1
17	To determine the cell constant of the given cell using 0.01 M KCl solution and hence determine dissociation constant of a given monobasic weak acid by Conductometry	1
18	To estimate the amount of lead present in given solution of lead nitrate by Conductometric titration with sodium sulphate	1
19	To investigate the Conductometric titration of any one of the following a) Strong acid against strong base b) Strong acid against weak base c) Strong base against weak acid d) Weak acid against weak base	1

Course Code	Title	Credits
USFS 2P2	Physical Science and Biological Science Practical	2
Practical No.	Title of the Practical	No. of Practical's
Physical Science Practical		
1	Sample calculations of radioactive dating to determine time of death.	1
2	35 mm Film SLR Camera A. Understanding Parts, Functions and Operation. B. Understanding the concepts: Exposure, ISO, Shutter Speed, F-Stops, Depth of Field, and Focus.	1
3	35 mm digital SLR Camera A. Understanding Parts, Functions and Operation. B. Understanding Close Up/Mid-Range/Overall Photographs.	1
4	Evidence photography by Digital camera.	1
5	MI of flywheel	1
6	Sample calculations- application of collision theory to accidental cases.	1
7	Sample calculations- velocity of freely falling bodies in air and ponds.	1
8	Y by bending.	1
9	Determination of coefficient of viscosity by Poiseulli's method.	1
10	Demonstration of terminal velocity and coefficient of viscosity by falling sphere.	1
11	Ultrasonic interferometer	1
12	Sound intensity measurement	1
Biological Science Practical		
1	Extraction of bacterial amylase/ yeast invertase and determination of its activity.	1
2	Separation and identification of amino acids by paper chromatography.	1
3	Separation and identification of lipids by thin layer chromatography.	1

4	Study of Beer-Lambert's law using colorimeter.	1
5	Quantitative estimation of proteins by Biuret/ Folin-Ciocalteu method using standard bovine serum albumin.	1
6	Quantitative estimation of glucose by Dinitrosalicylic acid method.	1
7	Protein fractionation by dialysis/ salting out. (Demonstration)	1
8	Estimation of total protein content by Kjeldahl method (Demonstration)	1
9	Analysis of transverse and longitudinal sections of stems.	1
10	Microscopic identification of pollen grains.	1
11	Microscopic identification of spores.	1
12	Microscopic examination of different plant fibres.	1
13	Examination of different macroscopic and microscopic features of wood.	1
14	Microscopic examination of different animal hair types.	1
15	Study of life-cycle of blowfly on chicken liver.	1
16	Isolation and identification of diatoms from fresh and marine water sources.	1
17	Study of different feather types.	1
18	Extraction of plant oils using Soxhlet apparatus (Demonstration)	1
19	Field Visit to BNHS to study wildlife flora and fauna	-

Course Code	Title	Credits
USFS 2P3	Psychology and Computer Science Practical	2
Practical No.	Title of the Practical	No. of Practicals
Psychology Practical		
1	Recall- Recognition	
2	Serial Learning	
3	Retroactive and Proactive Inhibition- Memory/ Interference in Memory- Retroactive Inhibition	
4	Objective Personality Test: Big Five Personality Traits Test	
5	Attention: Measurement of Span of Attention Using Tachistoscope	
6	Memory For Pleasant and Unpleasant stimuli	
7	Maze Learning	
8	Free and Controlled Association Test	
9	Facial Expression	
10	Effect of Meaning fullness on memory	
Computer Science Practical		
1	C Programming for Basic program	1
2	C programming for Variable and Mathematical Operations	1
3	C programming for simple Condition	1
4	C programming for Compound condition	1
5	C programming for Loop (For, While, do- while)	1
6	C programming on array	1
7	C programming on Functions	1
8	C programming on File handing and pointer	1