



**BANGALORE UNIVERSITY**

Jnanabharati, Bengaluru-560056

Syllabus for

**B.Sc. FORENSIC SCIENCE (UG)**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

Framed According to the National Educational Policy (NEP 2020)

**V & VI SEMESTERS**

[To be implemented from the academic year 2023-24]

## **Proceedings of the meeting of BOS in B. Sc Forensic Science Bangalore University, Bengaluru.**

### **Reference:**

1. Constitution of BOS U.O dated 27.08. 2021
2. U.O. BU/Aca-2/NEP/Syllabus-setting/2023-24 dated 10.08.2023

Adverting to above, the drafted syllabus prepared by Higher Educational Council (HEC), Government of Karnataka (GOK) pertaining to B. Sc Forensic Science was circulated by online mode to all the members of BOS, for scrutiny and approval.

A formal meeting of the Board of Studies in Forensic Science was held on Monday the **28<sup>th</sup> August, 2023** at Department of Zoology from 11.00 am- 5.00 pm, Bangalore University, Bangalore to scrutinize the drafted syllabus pertaining to B.Sc. Forensic Science in accordance with NEP-2020.

**AGENDA 1:** Approval of syllabus for B. Sc in Forensic Science of 5<sup>th</sup> & 6<sup>th</sup> semesters under NEP-2020.

**Resolution:** The proposed syllabi for BSc in Forensic Science both theory and practical as well as the scheme of the examination for V and VI semesters were scrutinized thoroughly, finalized with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.

**AGENDA 2:** Approval of panel of examiners for B. Sc in Forensic Science for the year 2023-24.

**Resolution:** The given panel of examiners for UG in Forensic Science for the year 2023-24 is scrutinized with appropriate inclusion(s) and deletion(s) of examiners and finally approved.

The meeting concluded with the chairman thanking all the members for the cooperation.

Following BOS members attended the meeting

- |  |                   |
|--|-------------------|
| 1. Dr. P. MAHABOOB BASHA Chairperson –Professor of Zoology, BUB BOS.               | Chairman.         |
| 2. Dr. M. DAVID, Professor of Zoology Karnatak University, Dharwad.                | Member – External |
| 3. Dr. SALMA KHANUM. Asso. Prof., Dept. of Psychology Maharanis Cluster University | Member – External |
| 4. Dr. SURESH KUMAR. Asso. Prof., Dept. of Botany Maharanis Cluster University     | Member – External |
| 5. Dr. S. RAMAKRISHNA, Professor, Dept. Zoology, BUB.                              | Member – Internal |
| 6. Dr. B.P. HARINI, Professor, Dept. Zoology, BUB.                                 | Member – Internal |
| 7. Dr. D. USHA ANANDI, Professor, Dept. of Zoology, BUB.                           | Member – Internal |
| 8. Dr. T. SRIPATHY, Professor, Dept. of Electronic Science, BUB.                   | Member – Internal |
| 9. Dr. V. SUDESH, Professor Dept. Law, University Law College, BUB.                | Member – Internal |
| 10. Dr. ERRAIAH, Professor, Dept. Physics, BUB.                                    | Member – Internal |
| 11. Dr. KRISHNA MURTHY, Professor, Dept. Chemistry, BUB.                           | Member – Internal |
| 12. Dr. GAYATRI, Asst. Professor in Zoology, BGS Science Academy, Chikkaballapura  | Member – Internal |
| 13. Dr. MADHUSUDHAN, Principal & Dean, BGS Science Academy, Chikkaballapura.       | Member – External |
| 14. Dr. SREENIVASA MOORTHY KM Asso, Professor, Dept. of BT, BUB-                   | Member – External |
| 15. Dr. RAJU, Asso, Professor Karnatak Open University, Mysore-                    | Member – External |

**(P. MAHABOOB BASHA),  
Chairman- BOS in Forensic Science**

# PROGRAMME MATRIX: B.SC FORENSIC SCIENCE

## CURRICULAM MODEL ADOPTED: C4a (SINGLE MAJOR) WITH PRACTICALS

Programme Matrix: Bachelor of Science - Forensic Science

V Semester													
Course Type	Programme Major Code		Course Title	Total Hours	Hrs./Week	Credit Structure			Credits	Pre-requisite (*) / Concurrent Course	Max Marks		
	Programme Code	Course Code				L	T	P			FA	SA	Total
DSC			Forensic Toxicology	60	4	4	-	-	4		40	60	100
DSC			Forensic Toxicology Practical	60	4	-	-	4	2		25	25	50
DSC			Forensic Physics	60	4	4	-	-	4		40	60	100
DSC			Forensic Physics Practical	60	4	-	-	4	2		25	25	50
DSC			Forensic Computing and Cyber Crime	60	4	4	-	-	4		40	60	100
Any one to be opted	DSE		Forensic Engineering	45	3	3	-	-	3		45	30	75
	DSE		Sports Toxicology	45	3	3	-	-	3		45	30	75
VOC			Entrepreneurship in Forensic Science	45	3	3	-	-	3		45	30	75
SEC			Skill Enhancement Course: Skill Based - Cyber Security	30	2	2	-	-	2	-	20	30	50
					<b>31</b>				<b>27</b>		<b>325</b>	<b>350</b>	<b>675</b>

Programme Matrix: Bachelor of Science - Forensic Science

VI Semester													
Course Type	Programme Major Code		Course Title	Total Hours	Hrs./Week	Credit Structure			Credits	Pre-requisite (*) / Concurrent Course	Max Marks		
	Programme Code	Course Code				L	T	P			FA	SA	Total
DSC			Forensic Serology	60	4	4	-	-	4		40	60	100
DSC			Forensic Serology Practical	60	4	-	-	4	2		25	25	50
DSC			Digital Forensics	60	4	4	-	-	4		40	60	100
DSC			Digital Forensics Practical	60	4	-	-	4	2		25	25	50
DSC			Forensic Medicine	60	4	4	-	-	4		40	60	100
Any one to be opted	DSE		Forensic Audio and Speaker Identification	45	3	3	-	-	3		45	30	75
	DSE		Microbial Forensics	45	3	3	-	-	3		45	30	75
VOC			Economic Offences	45	3	3	-	-	3		45	30	75
Any one to be opted	SEC		Skill Enhancement Course: Skill Based - General Aptitude	30	2	2	-	-	2	-	20	30	50
	SEC		Internship	30	2	2	-	-	2	-	20	30	50
					<b>28</b>				<b>24</b>		<b>280</b>	<b>320</b>	<b>600</b>

## THEORY PAPER: FORENSIC TOXICOLOGY

### Course Description

Program Name	<b>B.Sc.</b>	<b>V Semester</b>	
Course Title	<b>FORENSIC TOXICOLOGY (Theory)</b>		
Course Code:	<b>DSC-FS-T501</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Articulation Matrix: Mapping of Course Outcomes (COs)

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Course Out comes(COs)/(POs)	<b>T501</b>							
I Core competency	X							
II Critical thinking	X							
III Analytical reasoning	X							
IV Research skills	X							
V Team work	X							

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

CO1. Familiarize the student with the most frequently encountered substances in forensic toxicology and drug-related casework.

CO2. Develop an understanding of the uses, effects and pharmacology and toxicology of drugs.

CO3. Acquire knowledge on forensic identification of illicit liquors. The classification and characteristics of the narcotics, drugs and psychotropic substances.

## FORENSIC TOXICOLOGY

Credits: 4

Hours: 60

Content	Hours
<b>Unit 1: Introduction to Toxicology</b> Introduction, scope and branches of toxicology; Exposure: routes of administration: enteral and parenteral; Types of toxicity; Lethal dose 50 and effective dose 50; Dose-response relationship; Synergism; Introduction to pharmacokinetics; Absorption: Fluid mosaic model, passive diffusion, active transport, factors affecting absorption; Distribution: volume of distribution, factors affecting distribution, bioavailability of drugs; Metabolism and excretion of poisons.	10
<b>Unit 2: Poisons</b> Types of poisoning: accidental, suicidal and homicidal; Classification based on: physico-chemical properties, mode of action; Corrosives: acids and alkalis; Irritants: Inorganic, organic: plant, animal and mechanical; Systemics: neurotics, cardiac, asphyxiants; Miscellaneous poisons; Sample collection and preservation of toxicological exhibits (viscera, blood, urine) in fatal and survival cases of poisoning; Antidotes: classification, mechanism of action; Medico legal aspects	14
<b>Unit 3: Analysis of Poisons</b> Extraction: distillation, acid digestion, wet digestion, micro-extraction, ammonium sulphate method, stas-otto method; Analysis and estimation of poisons: spot tests, chromatographic, electrophoretic techniques, spectrophotometric and instrumental methods; Interpretation of toxicological findings; Field testing in toxicological work; Relevant sections of Indian Penal Code	12
<b>Unit 4: Narcotic and Psychoactive Drugs</b> Introduction to narcotic substances and psychoactive drugs: definition, drug use, drug misuse, drug abuse, dependence and withdrawals, addiction and tolerance; Classification of drugs; Designer drugs and date drugs; Differentiation between natural and synthetic drugs; Relevant sections of Narcotics and Psychotropic Substances (NDPS) act.	10
<b>Unit 5: Analysis of Narcotic and Psychoactive Drugs</b> Clandestine drug laboratories; Collection and preservation of drug evidence; Testing of narcotics; drugs and psychotropic substances; Isolation techniques for purifying narcotics; drugs and psychotropic substances: thin layer chromatography; gas-liquid chromatography and high-performance liquid chromatography; Presumptive and screening tests for narcotics; drugs and psychotropic substances; Microcrystalline testing of drugs of abuse. Analysis of narcotics; drugs and psychotropic substances in breastmilk; saliva; urine; hair and ante mortem blood; Drugs and driving; Dope tests. Analysis of narcotics; drugs and psychotropic substances in postmortem blood; Postmortem changes affecting the analysis of narcotics; drugs and psychotropic substances.	14

**Pedagogy:** .....

<b>Formative Assessment for Theory</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

**References**

1. Parikh, C. K. (2007). *Parikh's Textbook of Medical Jurisprudence & Toxicology: For Classrooms & Courtrooms*.
2. Modi, J. P. (2013). *Text-Book of Medical Jurisprudence and Toxicology: Medical Jurisprudence and Toxicology for India*. Butterworth-Heinemann.
3. Reddy, K. S. N., & Murty, O. P. (2014). *The Essentials of Forensic Medicine and Toxicology*. Macmillan Publishers.
4. Tripathi, K. (2019). *Pharmacological Classification of Drugs with Doses and Preparations*. Macmillan Publishers.
5. Biswas, G., Prahlow, J. A., & Aggrawal, A. (2022). *Review of Forensic Medicine and Toxicology: Including Clinical and Pathological Aspects* (2nd ed.). Jaypee Brothers Medical Pub.

## FORENSIC TOXICOLOGY PRACTICAL

**Credits: 2**

**Hours:60**

Course Title	FORENSIC TOXICOLOGY (Practical)	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P502</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Pre-requisite(s):**

**Course Outcomes(COs):**

At the end of the course the student should be able to:

1. Develop an understanding of the uses, effects and pharmacology and toxicology of drugs.
2. Acquire knowledge on forensic identification of illicit liquors. The classification and characteristics of the narcotics, drugs and psychotropic substances.

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)**

Course Out comes(COs)		P502						
I Core competency		X						
II Critical thinking		X						
III Analytical reasoning		X						
IV Research skills		X						
V Team work		X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Content
1. Qualitative analysis of metallic poisons.
2. Extraction and qualitative analysis of common plant poisons.
3. Qualitative analysis of ethanol from biological sample.
4. Quantitative estimation of ethyl alcohol in blood samples.
5. Qualitative analysis of organo-chlorides and organo-phosphates pesticides using spot and color tests.
6. Extraction and identification of pesticides using thin-layer chromatography from a simulated case with report writing.
7. Quantitative analysis of over-the-counter drugs using UV-Vis Spectrophotometry.
8. Qualitative analysis of barbiturates.
9. Separation of carbolic acid, phenol and glycol drugs by Thin Layer Chromatography.
10. Qualitative analysis of drug of abuse.
11. Visit to Cyber Economic Narcotics (CEN) Police station (Optional)

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

**References**

1. Parikh, C. K. (2007). *Parikh's Textbook of Medical Jurisprudence & Toxicology: For Classrooms & Courtrooms*.
2. Modi, J. P. (2013). *Text-Book of Medical Jurisprudence and Toxicology: Medical Jurisprudence and Toxicology for India*. Butterworth-Heinemann.
3. Reddy, K. S. N., & Murty, O. P. (2014). *The Essentials of Forensic Medicine and Toxicology*. Macmillan Publishers.
4. Tripathi, K. (2019). *Pharmacological Classification of Drugs with Doses and Preparations*. Macmillan Publishers.
5. Biswas, G., Prahlow, J. A., & Aggrawal, A. (2022). *Review of Forensic Medicine and Toxicology: Including Clinical and Pathological Aspects* (2nd ed.). Jaypee Brothers Medical Pub.



## Course Description

Program Name	<b>B.Sc.</b>	<b>V Semester</b>	
Course Title	<b>FORENSIC PHYSICS (Theory)</b>		
Course Code:	<b>DSC-FS-T503</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)/(POs)			<b>T503</b>					
I Core competency			X					
II Critical thinking			X					
III Analytical reasoning			X					
IV Research skills			X					
V Team work			X					

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

CO1. Understand various Forensic Applications in Trace Analysis which includes analysis of glass soil and fiber samples

CO2. Understand Various aspects of road accidents

CO3. Understand Various marks that are left behind on site which are helpful as evidence as well as helpful in creating the picture of accident

## FORENSIC PHYSICS

Credits: 4

Hours: 60

Content	Hours
<b>Unit 1: Glass Evidence</b> Glass: types of glass and their composition; Forensic significance; Types of glass fracture: radial, concentric, cone, thermal; Determination of direction of impact: rib marks, hackle marks, 3R rule; Sequence of impact; Examination of glass: physical matching, color and fluorescence, edge thickness and radius of curvature, density, refractive index and instrumental analysis.	13
<b>Unit 2: Soil Evidence</b> Soil: types of soil, composition and color of soil; Forensic significance; Examination of soil: macroscopic and microscopic, particle size distribution, turbidity, density gradient analysis, chemical-analysis and instrumental analysis.	10
<b>Unit 3: Paint Evidence.</b> Types of paint and their composition; Forensic significance; Examination of paints: macroscopic and microscopic, physical matching, solubility test, micro-chemical analysis, instrumental analysis.	10
<b>Unit4: Fiber evidence</b> Classification: natural, synthetic and semi-synthetic; Forensic significance; Optical properties of fibres: fluorescence, refractive index, birefringence; Identification, comparison and examination of fibre evidence: microscopic, floatation, burning, solubility, dye analysis and instrumental analysis.	12
<b>Unit 5: Tyre and Tool mark evidence</b> Tyre: types, parts and characteristics; Forensic significance; Tyre impressions: types, collection and preservation; Skid marks: types and analysis. Tool marks: types and characteristics; Forensic significance; Collection and preservation; Class and individual characteristics and forensic examination. Serial numbers: Forensic significance; Methods of obliteration of serial numbers; Restoration of erased marks: chemical etching, electrolytic, ultrasonic cavitation and magnetic particle method.	15

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-15)

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

## References

1. Robertson, J., Roux, C., & Wiggins, K. G. (2017). *Forensic examination of Fibres*. (3rd ed.). Taylor and Francis.
2. Houck, M. M., & Siegel, J. A. (2015). *Fundamentals of Forensic Science*. Academic Press.
3. Langford, A., Dean, J., & Reed, R. (2005). *Practical skills in forensic science*. Pearson.
4. Nabar, B. S. (2005). *Forensic science in crime investigation*. Asia Law House.
5. Palmer, R. (2010). *The Forensic Examination of Fibres*. 10.1201/EBK1439826584-c1.
6. Saferstein, R., & Hall, A. B. (2020). *Forensic science handbook*. CRC Press.
7. Siegel, J. A., Saukko, P. J., & Houck, M. M. (2013). *Encyclopedia of Forensic Sciences*. Academic Press.
8. Baldwin, D., Birkett, J., Facey, O., & Rabey, G. (2013). *The forensic examination and interpretation of Tool Marks*. Wiley Blackwell.
9. Freckelton, I. R. (2021). *Forensic analysis: Scientific and medical techniques and evidence under the microscope*. IntechOpen.
10. Houck, M. M. (2009). *Trace evidence*. Facts on File.

Course Title	<b>FORENSIC PHYSICS (Practical)</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P504</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Pre-requisite(s):**

**Course Outcomes(COs):**

At the end of the course the student should be able to:

1. Understand various Forensic Applications in Trace Analysis which includes analysis of impact of glass fractures, refractive index of glass evidence, Examination of soil evidence, paint evidence,
2. Understand Micro-chemical testing of soil/paint evidence.
3. Understand Fibre evidence using microscopy, burning and floatation test
4. Understand Comparison of tyre mark evidence

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)**

Course Out comes(COs)				<b>P504</b>				
I Core competency				X				
II Critical thinking				X				
III Analytical reasoning				X				
IV Research skills				X				
V Team work				X				

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

**FORENSIC PHYSICS PRACTICAL**

**Credits: 2**

**Hours: 60**

<b>Content</b>
1. Physical matching and determination of side of impact of glass fractures.
2. Demonstration of estimation of refractive index of glass evidence.
3. Examination of soil evidence using Munsell's color chart.
4. Determination of density of soil evidence.
5. Microscopic examination of paint evidence.
6. Micro-chemical testing of soil/paint evidence.
7. Examination of fiber evidence using microscopy, burning and floatation test
8. Comparison of tyre mark evidence
9. Lifting of tool marks by casting method.
10. Demonstration of examination of tool marks using a comparison microscope.

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

### References

1. Robertson, J., Roux, C., & Wiggins, K. G. (2017). Forensic examination of Fibres. (3rd ed.). Taylor and Francis.
2. Houck, M. M., & Siegel, J. A. (2015). Fundamentals of Forensic Science. Academic Press.
3. Langford, A., Dean, J., & Reed, R. (2005). Practical skills in forensic science. Pearson.
4. Nabar, B. S. (2005). Forensic science in crime investigation. Asia Law House.
5. Palmer, Ray. (2010). The Forensic Examination of Fibres. 10.1201/EBK1439826584-c1.
6. Saferstein, R., & Hall, A. B. (2020). Forensic science handbook. CRC Press.
7. Siegel, J. A., Saukko, P. J., & Houck, M. M. (2013). Encyclopedia of Forensic Sciences. Academic Press.

## Course Description

Program Name	<b>B.Sc.</b>	<b>V Semester</b>	
Course Title	<b>FORENSIC COMPUTING AND CYBER CRIME (Theory)</b>		
Course Code:	<b>DSC-FS- T505</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

**Course Articulation Matrix: Mapping of Course Outcomes (COs)**

**Course Articulation Matrix: Mapping of Course Outcomes (COs)**

Course Out comes(COs)/(POs)					<b>T505</b>			
I Core competency					X			
II Critical thinking					X			
III Analytical reasoning					X			
IV Research skills					X			
V Team work					X			

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

CO1. Learn the processes of computer forensics, including topics within digital forensics and computer crimes.

CO2. Acquire knowledge how digital evidence plays in criminal and civil investigations and incident response

CO3. Identify, gather evidences and preserve the proof of a law-breaking

## FORENSIC COMPUTING AND CYBER CRIME

Credits: 4

Hours: 60

Content	Hours
<p><b>Unit 1: Basics of Computers</b>                      Components of computer: input and output devices, central processing unit, memory hierarchy, types of memory, storage devices, system software, application software, types of operating system; Number systems: binary, hexadecimal; Introduction to computer languages.</p>	10
<p><b>Unit 2: Storage</b>                      Historical development of hard disk: Hard disk drive and Solid-state drive; Physical construction, Cylinder Head Sector and Logical Block Addressing; Encoding methods and formats; Methods of storing data.</p>	10
<p><b>Unit 3: Networking</b>                      Introduction to network: Local area network, wide area network and metropolitan area network; Network devices; Overview of Open System Interconnection (OSI) and Transmission Control Protocol/Internet Protocol models (TCP/IP); Introduction to cloud computing;</p>	10
<p><b>Unit 4: Cyber and Computer Crimes</b>                      Definition and types of cyber-crimes: Internal and External Attacks; Introduction to internet crimes: hacking and cracking, computer stalking, credit card and ATM frauds, phishing, identity theft, data theft, steganography; Crimes related to social media: cyberbullying, cyber stalking, cyber defamation; Types of computer crimes: cyber pornography, computer terrorism, hate speech, Malicious codes; Crimes related to intellectual property rights; software piracy; Emerging digital crimes.</p>	15
<p><b>Unit 5: Cyber Law</b>                      Measures to prevent cyber-crime; Information Technology Act, 2000 (43A, 65, 66, 66A to 66F, 67, 67A, 67B, 70, 70A, 70B); Controller, Certifying Authority and Cyber Appellate Tribunal; Amendments to Indian Penal Code; Section 45A of Indian Evidence Act; National Cyber Security Policy 2013, Information Technology Rules, Digital Personal Data Protection Bill, 2022; Roles of nodal agencies: State Cyber Cell, Cyber Security Division (MeitY), Indian Computer Emergency Response Team; National Institute of Standards and Technology cybersecurity framework. (Amendments in Criminal Law due to IT Act).</p>	15

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

## References

1. Joshi, R. (2006). *Introduction to computers*. Gyan Publishing House.
2. Venkatachalam, S. (1996). *Introduction to computers*. Pitambar Publishing House.
3. P.K. Singh. (2015). *Basics of Computer*. V.K. Publications
4. Miller, M. (2016). *Computer basics: Windows®*. (10<sup>th</sup> ed.). Que.
5. Joshi, R. C. (2005). *Operating systems: A simplified methodological approach*. Dreamltech Press.
6. Odom, W. (2004). *Computer Networking first-step*. Macmillan Computer Pub.
7. Bagad, V. S., & Dhotre, I. A. (2010). *Data Communication and Networking*. Technical Publications.
8. Beasley, J. S., & Nilkaew, P. (2012). *Networking essentials*. Pearson Education.
9. Gerdes, L. I. (2009). *Cyber crime*. Greenhaven Press.
10. Moore, R. (2015). *Cybercrime: Investigating high-technology computer crime*. Routledge Taylor & Francis Group.
11. J., M. J. A., & Menendez, D. (2008). *Cyber forensics: A Field Manual for collecting, examining, and preserving evidence of computer crimes*. Auerbach Publications.
12. Casey, E. (2004). *Digital Evidence and Computer Crime: Forensic Science, Computers and the internet*. Academic.



Course Title	<b>FORENSIC COMPUTING AND CYBER CRIME PRACTICAL</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P506</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Pre-requisite(s):**

**Course Outcomes(COs):**

At the end of the course the student should be able to:

1. To learn about various types of computer system used in the cybercrime
2. To know about computer forensic tool.
3. Learn the demonstration of booting procedure (using Windows/Linux), Examination of parts of hard disk drive.
4. Learn the Demonstration of email phishing attack and its preventive measures

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)**

Course Out comes(COs)/(POs)					<b>P506</b>			
I Core competency					X			
II Critical thinking					X			
III Analytical reasoning					X			
IV Research skills					X			
V Team work					X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

**FORENSIC COMPUTING AND CYBER CRIME PRACTICAL**

**Credits: 2**

**Hours: 60**

<b>Content</b>
1. Safety practices in cyberspace.
2. Identification of the internal and external components of a computersystem.
3. Demonstration of booting procedure (using Windows/Linux).
4. Examination of parts of hard disk drive.
5. Detection of steganography.
6. Setting up of a local area network.
7. Analysis of network packets using Wireshark.
8. Demonstration of email phishing attack and its preventive measures
9. Preparing checklist for reporting cyber-crime online
10. Analysis of a case study pertaining to S . 66 of Information Technology Act.
11. Visit to Cyber Crime Centre, Economic & Narcotics Police station.

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

### References

1. Joshi, R. (2006). *Introduction to computers*. Gyan Publishing House.
2. Venkatachalam, S. (1996). *Introduction to computers*. Pitambar Publishing House.
3. P.K. Singh. (2015). *Basics of Computer*. V.K. Publications
4. Miller, M. (2016). *Computer basics: (10<sup>th</sup> ed.)*. Que.
5. Joshi, R. C. (2005). *Operating systems: A simplified methodological approach*. Dreamltech Press.
6. Odom, W. (2004). *Computer Networking first-step*. Macmillan Computer Pub.
7. Bagad, V. S., & Dhotre, I. A. (2010). *Data Communication and Networking*. Technical Publications.
8. Beasley, J. S., & Nilkaew, P. (2012). *Networking essentials*. Pearson Education.
9. Gerdes, L. I. (2009). *Cyber crime*. Greenhaven Press.
10. Moore, R. (2015). *Cybercrime: Investigating high-technology computer crime*. Routledge Taylor & Francis Group.
11. J., M. J. A., & Menendez, D. (2008). *Cyber forensics: A Field Manual for collecting, examining, and preserving evidence of computer crimes*. Auerbach Publications.
12. Casey, E. (2004). *Digital Evidence and Computer Crime: Forensic Science, Computers and the internet*. Academic.

## Course Description

Program Name	<b>B.Sc.</b>	<b>V Semester</b>	
Course Title	<b>FORENSIC ENGINEERING (Theory)</b>		
Course Code:	<b>DSE-FS-T507</b>	No. of Credits	<b>3</b>
Contact hours	<b>45 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>30</b>	Summative Assessment Marks	<b>45</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)/(POs)						<b>T507</b>		
I Core competency						X		
II Critical thinking						X		
III Analytical reasoning						X		
IV Research skills						X		
V Team work						X		

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:  
 CO1. The purpose of a forensic engineering investigation is to locate cause or causes of failure with a view to improve performance or life of a component, or to assist a court in determining the facts of an accident.

CO2. Build up a conceptual understanding of criminal justice system, rules of evidence collection, legal system, critical thinking and analysis in a stepwise fashion that builds through the sequence of courses.

## FORENSIC ENGINEERING

Credits: 3

Hours: 45

Content	Hours
<b>Unit 1: Introduction to Forensic Engineering</b> Definition of forensic engineering; Investigation pyramid; Role of mechanical, electrical, electronics and computer engineers in forensic science; Applications of animations, simulations and digital imaging in solving crime cases.	10
<b>Unit 2: Electrical System failure</b> Electrical system failure: household materials such as cables, wires, switchboards, Miniature Circuit Breakers (MCBs), substation equipment, lift and motors used in industries, insulation failures, improper layout of appliance fitting according to safety criterion; Forensic examination of electrical appliance failures.	10
<b>Unit 3: Investigation of Structural failures</b> Structural failures, static loads, dynamic loads, building collapse, bridge collapse; causes of structural collapse, analysis of Bitumen and road material; Sampling and examination of: concrete, mortar, bricks, reinforcement steel; Investigation and observation of collapsed structures and causes of failure; Building code of construction applicable at the time of construction and Indian standards.	15
<b>Unit 4: Accident Investigations and Reconstruction</b> Motor vehicle accident; Pre-crash movement, post-crash movement, collision model, tachograph charts, principles of chart analysis, accuracy of speed record; Tyre slip effects; Use of PC Crash software; Use of reconstruction in accident investigation; Falling fatalities: investigation and reconstruction; Mass disaster investigation.	10

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

### References

1. Randall K. Noon, R. K. (2000). Forensic Engineering Investigation. CRC Press.

2. Ratay, R. (2009). Forensic Structural Engineering Handbook. (2nd ed.). McGraw Hill.
3. Day, R. (2011). Forensic Geotechnical and Foundation Engineering. (2nd ed.) McGraw Hill.
4. Petty, S. E. (2013). Forensic Engineering: Damage assessments for Residential and Commercial Structures. (1st ed.). CRC Press.
5. Carper, K. L. (1998). Forensic Engineering. (2nd ed.).
6. Frank, H., & Frank, D. (2012): Forensic Engineering Fundamentals. CRC Press. (1st ed.).



## SPORTS TOXICOLOGY

Credits: 3

Hours: 45

Content	Hours
<b>Unit 1: Fundamentals of Nutrition and Physical fitness</b> Introduction to Nutrition: Definition; Nutrients; Food; Classification of nutrients; Role of nutrients. Carbohydrates, Dietary Fibre, Protein and Micronutrients; Water and Electrolytes; Functional tests: Cardiorespiratory and muscular assessment; Type of measurement and protocol for evaluation and interpretation of performance; Aerobic Power or VO <sub>2</sub> max; Fitness assessment: Types of exercise, Components of physical fitness and its evaluation in health and performance; Activity Recording: Self-reporting of activities vs. Direct monitoring of activities.	13
<b>Unit 2: Doping control and Supplement testing</b> World anti-doping agency and National Anti-doping agency (NADA), Formation, History and Standards; List of prohibited substances and Drugs; Analytical procedures and testing of samples from athletes; Drug abuse and athletic performance; Regulations on Dietary supplements: FSSAI and NADA; Laws governing Anti-doping in sports; The National Anti-Doping Act, 2022; Athlete passport: regulation and uses; Therapeutic exemptions.	13
<b>Unit 3: Pre-Analytical Techniques</b> Requirements of a Drugs Control Centre (DSC); Doping control form; Chain of custody form; Sample collection: Shortlisting of candidate, role of chaperone, collection of blood sample; collection of urine sample; collection of special samples. Preservation of collected samples; Transport of collected samples.	10
<b>Unit 4: Analytical and Post Analytical Phase</b> Laboratory analysis of samples: Preliminary tests, instrumental tests. Accreditation in Anti-doping labs; Report format; Post-report protocols; Rights of an athlete; Anti-doping appeal panel; Anti-doping Administration and Management System (ADAMS) initiative; Consequences of adverse report	09

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

**References**

1. Swapan Kumar Dey, A Textbook of Sports & Exercise Physiology, Jaypee Publishers.
2. Landry GL, Kokotaio PK. Drug screening in athletic settings. *Curr Probl Pediatr* 1994;24:344–59.
3. Newton, David E., Contemporary world issues, Steroids and doping in sports: a reference handbook, Santa Barbara, California : ABC-CLIO, [2014].

## Course Description

Program Name	<b>B.Sc.</b>	<b>V Semester</b>	
Course Title	<b>ENTREPRENEURSHIP IN FORENSIC SCIENCE (Theory)</b>		
Course Code:	<b>VOC-TS-P509</b>	No. of Credits	<b>3</b>
Contact hours	<b>45 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>30</b>	Summative Assessment Marks	<b>45</b>

Course Out comes(COs)								<b>P509</b>
I Core competency								X
II Critical thinking								X
III Analytical reasoning								X
IV Research skills								X
V Team work								X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Articulation Matrix: Mapping of Course Outcomes (COs)**

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

- CO1. Understand Why forensic experts need to develop entrepreneurial skills.
- CO2. Understand How business skills can make forensic experts a better decision maker
- CO3. Understand What changes can they bring to the way forensic services are delivered to the clients



## ENTREPRENEURSHIP IN FORENSIC SCIENCE

Credits: 3

Hours: 45

Content	Hours
<p><b>Unit 1: Introduction to Entrepreneurship</b>                      Entrepreneurship: concept and evolution, types of entrepreneurs; Core elements of entrepreneurship; Factors affecting entrepreneurship development; Attribute of entrepreneur; skill gap analysis; Innovation: meaning and types; Methods of protecting innovation: branding, trademarks, copyrights and registered design protection.</p>	11
<p><b>Unit 2: The World of Business</b>                      Methods and process of generating ideas; Assessing opportunities; Form of business organization: sole proprietorship, partnership, corporations, Limited Liability company; E- business: meaning, features, e-commerce and e-markets, e-business models: B2B, B2C and C2C, digital commerce, mobile commerce, emergence of e-governance in India, e-business applications.</p>	12
<p><b>Unit 3: Becoming an Entrepreneur</b>                      Characteristics for being an entrepreneur in forensic science; Leadership: meaning, definition, difference between leaders and managers; Types and styles of Leaders: primal leadership, resonant leadership, narcissist leaders, situational leadership, leadership traits, emotional intelligence vs. intelligence quotient; Legal and regulatory aspects; Role of government organizations and schemes.</p>	12
<p><b>Unit 4: Establishing a Forensic Startup</b>                      Need for a forensic startup; Essential features of business plan, types of business plan, pitfalls to be avoided in preparation of business plan; Concept of crowdfunding, Steps to establish forensic startup; Physical and human resources; Forensic firms; Training and certification firms; Private practices; Forensic vendors; Private Laboratories; Licensing; ISO:IEC certification. Quality and Accreditation; NABL guidelines;</p>	10

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

### References

1. Ramachandran, K. (2008). *Entrepreneurship Development*. Mc Graw Hill.
2. Katz, J. (2021). *Entrepreneurship Small Business*. (6<sup>th</sup> ed.). Mc Graw Hill.
3. Byrd, M. J., & Megginson, L. (2012). *Small Business Management an Entrepreneur's Guidebook*. (7th ed.). McGrawHill.
4. Fayolle, A. (2007). *Entrepreneurship and new value creation*. Cambridge University Press.

5. Hougaard, S. (2005). *The business idea*. Berlin, Springer.
6. Lowe, R., & Mariott, S. (2006). *Enterprise: Entrepreneurship & Innovation*. Burlington, Butterworth Heinemann.
7. Dana, L. P. (2013). *World Encyclopedia of Entrepreneurship*. Edward Elgar.
8. Kumar, A. S. (2003). *Entrepreneurship Development*. New Age International (P) Ltd. Publishers
9. Mellor, R. (2009). *Entrepreneurship for Everyone: A Student Textbook*. Sage Publication Ltd.
10. Blundel, R., & Lockett, N. (2011). *Exploring Entrepreneurship: Practices and Perspective*. Oxford University Press.
11. Gupta, C. B. (1992). *Entrepreneurial Development: Text and Cases*. Entrepreneurship Sultan Chand & Sons.

## VI<sup>TH</sup> SEMESTER SYLLABUS

### Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>FORENSIC SEROLOGY (Theory)</b>		
Course Code:	<b>DSC-FS-T601</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Articulation Matrix: Mapping of Course Outcomes (COs)

#### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)	T601									
I Core competency	X									
II Critical thinking	X									
III Analytical reasoning	X									
IV Research skills	X									
V Team work	X									

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

CO1. Understand the general concepts and definitions used in Forensic serology

CO2. Understand the role of Forensic biologists in crime scene investigation

### FORENSIC SEROLOGY

Credits: 4

Hours: 60

Content	Hours
<b>Unit 1: Immunology</b> Introduction to the immune system; Types of immunity: Innate, adaptive, comparative; Cells of the immune system; Organs of the immune system; Cell mediated immunity and humoral immunity, complement system, antigens, epitopes, haptens, adjuvants, antibody structure, types of immunoglobulins; Antigen-antibody interactions; Agglutination, precipitation and flocculation; Monoclonal and polyclonal antibodies, anti-globulins; Species of origin using precipitin assays and immuno chromatographic assays.	15
<b>Unit 2: ABO Blood Grouping System</b> History, biochemistry and genetics of ABO; Bombay and Para Bombay blood groups; Blood group typing: forward and reverse; ABO blood grouping using Lattes crust method, absorption elution method and mixed agglutination method using blood stains; Secretor and non- secretor status; ABO blood grouping from saliva and semen using absorption inhibition methods; Population frequencies of ABO blood group; Blood transfusion, transfusion reactions, maternal-fetal blood incompatibility, compatibility chart for whole blood, red cell, plasma and platelets.	15
<b>Unit 3: Rh Blood Grouping System</b> History, biochemistry and genetics of Rh blood system; Rh Blood group typing; Population frequencies of Rh blood group; Blood transfusion, transfusion reactions, maternal-fetal blood incompatibility, compatibility chart for whole blood, red cell, plasma and platelets.	10
<b>Unit 4: HLA and other Blood Groups</b> History, biochemistry and genetics of MNS, Kell, Duffy, Diego, Lewis, Lutheran, P1PK system; Forensic significance of other blood groups; Introduction to HLA, HLA types, DNA typing of HLA; Forensic Significance of HLA.	10
<b>Unit 5: Serogenetic Markers</b> Red cell enzymes: genetics, polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA and their forensic significance; Isoelectric focusing: principle and technique; Serum proteins: genetics, polymorphism and typing of: Hp, Tf, Bf, C3, Gc, Pi and their forensic significance; Serum proteins typing results interpretation and troubleshooting.	10

**Pedagogy:** .....

<b>Formative Assessment for Theory</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

**References**

1. Kuby, J. (2013) Immunology. W.H. Freeman and Company, New York.; 7th ed. New York : W.H. Freeman,.
2. Tobe, S. S. *Forensic Serology*. Elsevier.
3. Sharma, B. R. (2006). *Scientific Criminal Investigation*. Universal Law Publishing CoLtd.
4. Narayanamoorthi, V. *Forensic Serology And DNA Profiling: For BE/B.TECH/BCA/MCA/ME/M.TECH/Diploma/B.Sc/M.Sc/BBA/MBA/Competitive Exams & Knowledge Seekers*.
5. Houck, M. M. (2015). *Forensic Biology (Advanced Forensic Science Series)* (1st ed.)AP.
6. Hunt, S. M. *Investigation of Serological Evidence: A Manual for Field Investigators*. Charles C Thomas Pub Ltd.
7. Gunn, A. (2019). *Essential Forensic Biology*. Wiley.
8. Author, U. *Forensic Serology (Forensic Science Case Studies)*.
9. Gaensslen, R. E. & National Institute of Justice (U.S.). (1983). *Sourcebook in Forensic Serology, Immunology, and Biochemistry: Unit IX, Translation of Selected Contributions to the Original Literature of Medicolegal Examinations of Blood and Body Fluids*. U.S. Department of Justice, National Institute of Justice.
10. Houck, M. M. (2015). *Forensic Biology (Advanced Forensic Science Series)* (1st ed.). Academic Press.
11. Li, R. (2008). *Forensic Biology: Identification and DNA Analysis of Biological Evidence*. Taylor & Francis.

Course Title	<b>FORENSIC SEROLOGY PRACTICAL</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P602</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>
<b>Course Pre-requisite(s):</b>			
<b>Course Outcomes(COs):</b>			
<p>At the end of the course the student should be able to:</p> <ol style="list-style-type: none"> <li>1. Examine the biological evidence with laboratory handling procedures.</li> <li>2. Understand the role of Forensic biologists in crime scene investigation</li> <li>3. Apply the skills to carry-out serological tests.</li> <li>4. Experiment the science of bloodstain pattern analysis</li> </ol>			
<b>Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)</b>			
<b>Course Out comes(COs)</b>		<b>P602</b>	
I Core competency		X	
II Critical thinking		X	
III Analytical reasoning		X	
IV Research skills		X	
V Team work		X	
<p>Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.</p>			

### FORENSIC SEROLOGY PRACTICAL

**Credits: 2**

**Hours: 60**

<b>Content</b>
1. Estimation of antisera titer.
2. Determination of species origin using Ouchterlony double diffusion method.
3. Determination of species origin using Ring Precipitation Test.
4. ABO and Rh blood grouping using fresh blood.
5. MNS blood grouping using fresh blood.
6. Determination of ABO blood group from fresh bloodstain using Lattescrust method.
7. Determination of ABO blood group from dried bloodstain using absorption-elution method.
8. Determination of secretor status from saliva using absorption-inhibition method.
9. Interpretation of red cell typing results.
10. Interpretation of serum typing results.

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

### References

1. Tobe, S. S. *Forensic Serology*. Elsevier.
2. Sharma, B. R. (2006). *Scientific Criminal Investigation*. Universal Law Publishing CoLtd.
3. Tripathi, A., & Dwivedi, A. K. (2012). *Forensic serology and blood examination*.

### Selective & Scientific Books

4. Mozayani, A., & Noziglia, C. (2011). *The forensic Laboratory handbook: Procedures and Practices*. Springer.
5. Langford, A., & Dean, J., et al. (2019). *Practical Skills in Forensic Science*. Pearson.
6. Kindt, T. J., Osborne, B. A., & Goldsby, R. A. (2006). *Kuby Immunology*. (6th ed.). WH Freeman and company.
7. Pawar, C.B. *Cell biology*. Himalayan Books.

## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>DIGITAL FORENSICS (Theory)</b>		
Course Code:	<b>DSC-FS-T603</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)	T603							
I Core competency	X							
II Critical thinking	X							
III Analytical reasoning	X							
IV Research skills	X							
V Team work	X							

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

After the successful completion of the course, the student will be able to:

- CO1. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- CO2. To understand how to examine digital evidences such as the data acquisition, identification analysis.
- CO3. Examine the Volatile and Non-volatile Digital Evidence

## DIGITAL FORENSICS

Credits: 4

Hours: 60

Content	Hours
<p><b>Unit 1 : Introduction to Digital Forensics</b>                      Introduction to digital, computer/cyber forensics; History of computer forensics. Need for digital forensics; Principles of computer forensics; Locard’s principle of exchange in digital forensics; Prerequisites for setting up digital forensic lab and global standards; Law enforcement investigations and corporate investigations. Following the legal process; Establishing company policies; Lab preparation; Preparing for a forensic operation; Rapid/onsite response; Role of an investigator.</p>	12
<p><b>Unit 2: Incident Response Management</b>                      Cyber forensic steps-securing the scene, planning, documentation, assess, seizure, analyze, report; Incident response and handling process: identification, incident recording, initial response, communicating the incident, containment, formulating a response strategy, incident classification, incident investigation, data collection, forensic analysis, evidence protection; Notify external agencies; Review and update of response policies; Computer Incident Response Team (CIRT).</p>	12
<p><b>Unit 3: Computer Forensic Investigation</b>                      Preparation required prior to seizure; Protocol to be followed at the scene of occurrence; First responder rule and Cardinal rules; Collection, seizure and preservation of exhibits; Hashing; Encryption and decryption methods; Tools and techniques: write blockers, data recovery and vulnerability assessment; Encase, Forensic Tool Kit, Autopsy.</p>	12
<p><b>Unit 4: Volatile and Non-Volatile data</b>                      Seizure of volatile and non-volatile memory; Collection of data from Random Access Memory (RAM); Creating bit stream image of the suspect storage device; Disk cloning; Searching of information from the image; Extraction of information: restoration of deleted files, password cracking, slack space; Memory data recovery tools and procedures; Importance of log analysis; Report Preparation.</p>	14
<p><b>Unit 5: Mobile Forensics</b>                      Mobile phone basics; types of mobile devices and their components: Android and iOS; Crimes using mobile phones: phone phreaking, call tampering, fake hotspots, and wireless hack walkthrough; SIM card crimes; Securing, preserving and documenting evidence; Tools used in mobile forensics; Challenges in mobile forensics.</p>	110

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>



## References

1. Easttom, W. C. (2016). *Computer security fundamentals*. Pearson Education India.
2. Easttom, C. (2014). *CCFP Certified Cyber Forensics Professional All-in-One Exam Guide*. McGraw- Hill Education Group.
3. Philipp, A., Cowen, D., & Davis, C. (2016). *Hacking exposed computer forensics*. McGraw-Hill, Inc.
4. Brenner, S. W. (2010). *Cybercrime: criminal threats from cyberspace*. ABC-CLIO.
5. Nelson, B., Phillips, A., & Steuart, C. (2010). *Guide to computer forensics and investigations*. Boston: Thomson Course Technology

Course Title	<b>DIGITAL FORENSICS PRACTICAL</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P604</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Pre-requisite(s):**

**Course Outcomes(COs):**

At the end of the course the student should be able to:

1. Illustrate the cyber-crime investigation procedures.
2. Apply the cyber-crime techniques to data acquisition and evidence collection.
3. Analyzing the digital evidences and arriving at conclusions

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)**

Course Out comes(COs)		P604						
I Core competency		X						
II Critical thinking		X						
III Analytical reasoning		X						
IV Research skills		X						
V Team work		X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

**DIGITAL FORENSICS PRACTICAL**

**Credits: 2**

**Hours: 60**

<b>Content</b>
1. Identification, seizure and preservation of digital evidence from crimescene.
2. Imaging of hard disk/pen drive using Forensic Tool Kit.
3. Identification and decryption of encrypted files from a forensic image.
4. Identification and recovery of hidden files from a forensic image.
5. Identification and recovery of deleted files from a forensic image.
6. Searching of information from a forensic image using a simulated case.
7. Detection of deletions; obliterations and modifications of files using Hash Calc.
8. Tracing of the IP address of the sender of e-mails.
9. Demonstration of analysis of mobile phones.
10. Analysis of a simulated case of cyber-crime.

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

### **References**

1. Easttom, W. C. (2016). *Computer security fundamentals*. Pearson Education India.
2. Easttom, C. (2014). *CCFP Certified Cyber Forensics Professional All-in-One Exam Guide*. McGraw- Hill Education Group.
3. Philipp, A., Cowen, D., & Davis, C. (2016). *Hacking exposed computer forensics*. McGraw-Hill, Inc.
4. McGraw-Hill, Inc.
5. Brenner, S. W. (2010). *Cybercrime: criminal threats from cyberspace*. ABC-CLIO.
6. Nelson, B., Phillips, A., & Steuart, C. (2010). *Guide to computer forensics and investigations*. Boston: Thomson Course Technology.

## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>FORENSIC BALLISTICS (Theory)</b>		
Course Code:	<b>DSC-FS-T605</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)			<b>T605</b>					
I Core competency			X					
II Critical thinking			X					
III Analytical reasoning			X					
IV Research skills			X					
V Team work			X					

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

- CO1. To understand about the knowledge of different firearms, ammunitions, and projectile.
- CO2. To analyse and detect gunshot residue, gunshot powder, class and. individual characteristics of firearms and ammunitions.
- CO3. Identify the range of fire using modern methods and also different wounds caused by firearms.

## FORENSIC BALLISTICS

**Credits: 4**

**Hours: 60**

Content	Hours
<p><b>Unit 1: Introduction to Firearms and Ammunitions</b>                      History and development of firearms: match lock, wheel lock, flintlock and percussion cap; Parts of a firearm; Rifling and calibre; Classification of firearms based on: bore, barrel length, loading, action mechanism, handling and use; Operation of weapons: handgun, shotgun, rifle, machine gun; Country made firearms; Ammunition: definition and constructional features; Composition and types of: primers, propellants, projectiles, cartridge case.</p>	15
<p><b>Unit 2: Internal Ballistics</b>                      Internal Ballistics: concept; ignition of propellant; Neutral, degressive and progressive powders; Various factors affecting internal ballistics: lock time, ignition time, barrel time, erosion, corrosion, barrel fouling and gas cutting;</p>	10
<p><b>Unit 3: External Ballistics</b>                      Concept; Vacuum and air trajectory; Factors affecting external ballistics: air resistance, base drag, drop, drift, yaw, shape of projectile; ballistics coefficient and limiting velocity; Ballistics Data Acquisition System (BDAS).</p>	10
<p><b>Unit 4: Terminal Ballistics</b>                      Concept; Effect of projectile on hitting the target: shock wave, laceration and cavitation; Factors affecting terminal ballistics: bullet shape, striking velocity, limiting velocity, striking angle, instability of bullet, intermediate targets, nature of target, range and ricochet; Stopping power; Estimation of range: burning, scorching, blackening, tattooing, shots dispersion;; Identification and nature of firearm injuries; Entry and exit wound.</p>	12
<p><b>Unit 5: Ballistic Evidence</b>                      Ballistic evidence: Types, collection and packaging; Collection of test bullet and cartridge cases; Marks on fired bullets and cartridge cases: rifling marks, headstamp markings, firing pin marks, breech face marks, chamber marks, extractor and ejector marks, Identification of Class and individual characteristics; Matching and identification of bullets, pellets and wads, cartridge cases; Integrated Ballistic Identification System (IBIS); Mechanism of formation of gunshot residues (GSR); Methods of collection and analysis of GSR from shooter's hands, clothing and targets; Reconstruction of shooting scene; Arms Act 1959, Arms Rule 2016.</p>	13

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

## References

1. Wallace, J. S. (2008). Chemical analysis of firearms, ammunition, and gunshot residue. CRC Press.
2. Heard, B. J. (2013). Forensic ballistics in court: interpretation and presentation of firearms evidence. John Wiley & Sons.
3. Massaro, P. P. (2015). Understanding ballistics. Iola: Gun Digest.
4. Warlow, T. (2016). *Firearms, the law, and forensic ballistics*. CRC Press.
5. Cleckner, R. M. (2016). *Long range shooting handbook*. Nashville, TN: North Shadow.
6. Sharma, B. R. (2017). *Firearms in criminal investigation & trials*. Universal LawPublishing.

Course Title	<b>FORENSIC BALLISTICS PRACTICAL</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-FS-P606</b>	Contact Hours	<b>60</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Pre-requisite(s):**

**Course Outcomes(COs):**

At the end of the course the student should be able to:

1. Differentiate between Internal, External and Terminal Ballistics and its significance in forensic examination.
2. Acquire knowledge on the classification, characteristics and working mechanism of firearms

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)**

Course Out comes(CO s)				P606				
I Core competency				X				
II Critical thinking				X				
III Analytical reasoning				X				
IV Research skills				X				
V Team work				X				

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

**FORENSIC BALLISTICS PRACTICAL**

**Credits: 2**

**Hours: 60**

<b>Content</b>
1. Identification of the parts of a firearm.
2. Study of firing and action mechanism of firearms with the aid of diagrams.
3. Identification of parts of an ammunition
4. Collection, preservation, and packaging of firearm evidence:
5. firearm/bullet/cartridge cases
6. Collection of test bullets.
7. Examination of fired bullet and cartridge cases under stereo microscope.
8. Demonstration of comparison of fired bullets and cartridge cases under Comparison Microscope.
9. Estimation of range of firing with the aid of wound diagrams.
10. Collection of Gunshot residue from suspected shooter.
11. Identification of gunshot residue from firearm.
12. Visit to FSL (Ballistics division)/ City Armed Reserve (CAR) Police station (optional)

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
<b>Total</b>	<b>25 Marks</b>

### **References**

1. Wallace, J. S. (2008). *Chemical analysis of firearms, ammunition, and gunshot residue*. CRC Press.
2. Heard, B. J. (2013). *Forensic ballistics in court: interpretation and presentation of firearms evidence*.
3. Sharma, B. R. (2017). *Firearms in criminal investigation & trials*. Universal Law Publishing.



## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>FORENSIC MEDICINE</b>		
Course Code:	<b>DSC-FS-T607</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)				<b>T607</b>				
I Core competency				X				
II Critical thinking				X				
III Analytical reasoning				X				
IV Research skills				X				
V Team work				X				

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

### Course Pre-requisite(s):

Course Articulation Matrix: Mapping of Course Outcomes (COs)

After the successful completion of the course, the student will be able to:

- CO1. Identify and describe the medico legal aspects of death especially unnatural deaths (Accidental, Suicidal and Homicidal)
- CO2. Illustrate the role of Medico legal expert in examining (autopsy) the corpses with respect to changes in body after the death; injury pattern; determination of ante mortem and postmortem in nature and in cases of unnatural deaths and sexual offenses
- CO3. Examine the different evidential points by applying the modern methods, concepts and techniques of medical sciences which further helps in reconstruction of Scene of Crime (SOC).
- CO4 To differentiate and identify various types of injuries

## FORENSIC MEDICINE

Credits: 4

Hours: 60

Content	Hours
<p><b>Unit 1: Introduction to Forensic Medicine</b>                      History of Forensic Medicine, Definition of Forensic Medicine, Medical Jurisprudence, Medical Code of India (M.C.I), Court procedures: summons, warrant; Definition of witness, types of witnesses; Definition of inquest, types of inquest; Court evidence: Oral, Documentary, Medical evidence, recording of evidence, conduct of doctor in witness box; Medical certification and medico-legal reports including dying declaration, Medico-legal expert's deposition.</p>	12
<p><b>Unit 2: Medicolegal Aspects of Death</b>                      Death: Definition, types, brain-death. Natural and Unnatural death, Sudden death: suspended animation moment of death; Modes of death: Coma, Syncope and Asphyxia, Manner of death, Determination of time since death using Forensic Entomology; Medico legal aspect of Death, causes of death in asphyxia, starvation, electrocution and accidents deaths; Medico legal aspects of drowning: Diatom test, Gessler test, Chemical tests in drowning; Definition of infanticide, foeticide and stillbirth; Signs of intrauterine death; Collection and preservation of foetus; Signs of live birth, viability of foetus, age determination of foetus, demonstration of ossification centres, precipitate labour, Haase's rule, Hydrostatic test, maceration, Sudden infants' death syndrome.</p>	15
<p><b>Unit 3: Post Mortem Examination</b>                      Definition of post-mortem examination, types. Legal requirements to conduct autopsy, post-mortem artefacts, preservation of viscera, examination of mutilated bodies or fragments, bundle of bones and exhumation; Post-mortem changes: Immediate early &amp; late changes; algor mortis, lividity, pallor mortis, rigor mortis, cadaveric spasm, putrefaction, adipocere, mummification; Establishing identity of living persons: Corpus Delicti, decay, bite marks; FDI, bones ossification centers, medico legal aspects of age; Identification of unidentified dead persons.</p>	11
<p><b>Unit 4: Introduction to Injuries</b>                      Definition of injury, classification of injury, differences between ante-mortem and post-mortem injuries, estimation of age of different types of injuries. Classification of injuries; Mechanical injuries or wounds: Definition, classification of mechanical injuries, description of blunt force, sharp force and firearm injuries, simple and grievous hurt causes of death by mechanical injuries; Medico-legal aspects of injuries, Vehicular injuries: Primary and Secondary impact, Secondary injuries, crush syndrome, railway spine, reconstruction of scene of crime; Blast injuries; Burn injuries; Rule of 9; Dupetries degrees; Injuries due to cold; Immersion, Non immersion &amp; hypothermic</p>	12

<p><b>Unit 5: Medico legal Aspects of Injuries</b>  Medico legal aspects in cases of burns and scalds. Medico-legal aspects in case of identifying injuries by torture; Introduction to sexual offences, rape, adultery, unnatural sexual offence, sodomy; Examination of accused and victim, preservation and dispatch of evidences in case of sexual offences; IPC sections pertaining to injuries.</p>	10
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**Pedagogy:** .....

<b>Formative Assessment for Theory</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>

**References**

1. Pillay, V.V. (2010). *Text book of Forensic Medicine and Toxicology*. (15<sup>th</sup> ed), Paras Medical Publishing, Hyderabad.
2. Basu, R. (2011). *Fundamentals of Forensic Medicine and Toxicology*. Publishers-Books and Allie (P) Ltd, Kolkata.
3. Guharaj, P.V. (2003). *Forensic Medicine*. (2<sup>nd</sup> ed.). The Orient Blackswan.
4. Saukko, P., & Knight, P. (2016). *Forensic Pathology*. CRC Press.
5. Iscan, M. Y. *Human Skeleton in Forensic Medicine*. Charles C Thomas Pub Ltd. U.S.A.

## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>FORENSIC AUDIO AND SPEAKER IDENTIFICATION</b>		
Course Code:	<b>DSE-FS-T608</b>	No. of Credits	<b>3</b>
Contact hours	<b>45 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>30</b>	Summative Assessment Marks	<b>45</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)						T608		
I Core competency						X		
II Critical thinking						X		
III Analytical reasoning						X		
IV Research skills						X		
V Team work						X		

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

### Articulation Matrix: Mapping of Course Outcomes (COs)

After the successful completion of the course, the student will be able to:

- CO1. Identify and describe different audio technology including different types of circuits, recording and playback devices and multiple video technologies
- CO2. Apply scientific methodology in the investigation of cases where forensic analysis of audio and video evidence is required
- CO3. Articulate the fundamentals of voice, the physics behind the production of sound, forensic linguistics and phonetics.

## FORENSIC AUDIO AND SPEAKER IDENTIFICATION

Credits: 3

Hours: 45

Content	Hours
<b>Unit 1: Introduction to Audio</b> Basic Electric Circuits: Inductor-Resistor (LR), Capacitor-Resistor (CR), Inductor-Capacitor-Resistor (LCR) circuits, conventional filters and digital filters (high pass filters, low pass filters); Noise Characteristics: properties of noise, acoustic characteristics of environments-diffraction, reverberation and diffusion; Recording Formats: analog and digital.	10
<b>Unit 2: Digital Audio Analysis</b> Audio level measurement: voltage, decibels, frequency, audio line levels, range, spectrum; audio acquisition, restoration and enhancement; Audio authentication and types of alterations; Audio Analysis: Auditory, Spectrographic and Automatic methods; Evidence handling procedures, Recovery, Software used and admissibility of audio evidence in court	12
<b>Unit 3: Production of Speech</b> Speech sound: basic factors, components of speech sounds; Speech anatomy; Organs of Speech: respiratory, phonatory and articulatory, Mechanism of speech production: vibration of vocal folds and acoustic properties of vocal tract; Forensic phonetics: speech articulators: active/passive, articulation- manner and place of articulation, phonemes, sound of speech: vowel, consonant and glides, IPA (The International Phonetic Association).	12
<b>Unit 4: Speaker Identification</b> Identification and verification; Forensic significance; Components of speaker recognition; Approaches to Speaker recognition system of auditory analysis, spectrographic approach/voice print identification, automatic approach: Gaussian Mixture Models, long term averaging, vector quantization, hidden Markov models, neuralnetworks; Admissibility of evidence based on Speaker Identification report in court	11

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

### References

1. Rose, P. (2002). *Forensic Speaker Identification*. London: Taylor & Francis.
2. M, B. G. (2011). *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*. (2 ed.). John Wiley & Sons.
3. IPA. (2015). *International Phonetic Association*.
4. Coulthard, M. (2016). *An Introduction to Forensic Linguistics: Language in Evidence*. Taylor & Francis.

## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>MICROBIAL FORENSICS</b>		
Course Code:	<b>DSE-FS-T609</b>	No. of Credits	<b>3</b>
Contact hours	<b>45 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>30</b>	Summative Assessment Marks	<b>45</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)							T609	
I Core competency							X	
II Critical thinking							X	
III Analytical reasoning							X	
IV Research skills							X	
V Team work							X	

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

After the successful completion of the course, the student will be able to:

CO1. Understand what evidence is collected, its safe methods of collection and preservation to employ, how the evidence is analyzed, what the significance of a result is, and what is supportive in identifying a perpetrator for prosecution.

CO2. Understand the growth and control of microbes as well as different bacteriological techniques involved in microbiology.

### MICROBIAL FORENSICS

**Credits: 3**

**Hours: 45**

Content	Hours
<b>Unit 1 : Introduction to Microbiology</b> Basics of Microbiology; History of microbiology; Broad classification of microorganisms: bacteria, fungi, virus, algae, protozoa; Concepts of Pure culture techniques; Media: composition, preparation and inoculation.	12
<b>Unit 2: Forensic Microbiology</b> History related to forensic microbiology; Major incidents of microbial forensics; Classification of microorganisms involved in bio crimes: Anthrax, Influenza, Fungal and viral pathogens; Collection, Preservation and identification of specific microorganisms used in bio crimes.	10

<b>Unit 3: Bioterrorism</b> Introduction: Historical cases related to bioterrorism; Different modes of terrorism using pathogenic microorganisms; Safety precautions taken during collection & preservation of samples; Forensic aspects of biological toxins.	10
<b>Unit 4: Methods of Analysis</b> Sampling of microbial forensic investigations, toxin analysis using Microbial Culturing; Staining methods for identification; Design of genomic signatures for pathogen identification and characterization; inferential validation and evidence interpretation.	13

**Pedagogy:** .....

<b>Formative Assessment for Theory</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

### References

1. Budowle, B., Schutzer, S. E., Einseln, A., Kelley, L. C., Walsh, A. C., Smith, J. A., & Campos, J. (2003). *Building microbial forensics as a response to bioterrorism*. *Science*. Vol. 301, Issue 5641, pp. 1852-1853. doi: 10.1126/science.1090083.
2. Gunasekaran, P. (2007). *Laboratory manual in microbiology*. New Age International.
3. Hester, R. E., & Harrison, R. M. (2008). *Environmental Forensics*. RSC Publishing.
4. Budowle, B., & Williamson, P. C. (2011). *Microbial forensics*. John Wiley & Sons, Ltd.
5. Breeze, R. G., Budowle, B., & Schutzer, S. E. (2011). *Microbial forensics*. Burlington, MA: Elsevier Academic Press.
6. Cliff, J. B., Kreuzer, H. W., Ehrhardt, C. J., & Wunschel, D. S. (2011). *Chemical and physical signatures for microbial forensics*. Springer Science & Business Media.
7. Cano, R. J., Toranzos, G.A. (2017). *Environmental Microbial Forensics*. ASM Press.

## Course Description

Program Name	<b>B.Sc.</b>	<b>VI Semester</b>	
Course Title	<b>ECONOMIC OFFENCES</b>		
Course Code:	<b>VOC-FS-T610</b>	No. of Credits	<b>3</b>
Contact hours	<b>45 Hours</b>	Duration of SEA/Exam	<b>2.5 hours</b>
Formative Assessment Marks	<b>30</b>	Summative Assessment Marks	<b>45</b>

### Course Articulation Matrix: Mapping of Course Outcomes (COs)

Course Out comes(COs)	3	4	5	6	7	8	9	Fs610
I Core competency								X
II Critical thinking								X
III Analytical reasoning								X
IV Research skills								X
V Team work								X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

**Course Pre-requisite(s):** outcome.

**Course Out comes (COs):** After the successful completion of the course, the student will be able to:

**CO1.** Understand Basic Economic and financial terminology.

**CO2.** Understand Economic crimes in India are linked to several other crimes and Economic crimes often have a bearing on national security.

**CO3.** Understand Types of common Economic offences and their consequences and Steps involved in mitigating Economic crimes.

<b>Content</b>	<b>Hours</b>
<b>Unit 1: Taxonomy of Economic Offences</b> Concept of economic offenses; Fundamentals of economics in economic offenses; Tax evasion; Excise duty evasion; Fraudulent bankruptcy; Whitecollar crime; Economic exclusion; Black money; Corruption and bribery; Money laundering and hawala transactions.	11
<b>Unit 2: Frauds in various Sectors</b> Insurance fraud; Corporate fraud; Bank fraud; Credit card fraud; Stock market fraud; Ponzi scheme; Pyramid scheme; Illicit trafficking in: contraband goods, arms, explosives, human organs and antique objects; Racketeering in employment and travel documents.	12



<p><b>Unit 3: Investigation and Prevention</b> Introduction to forensic accounting and forensic auditing; Violation of intellectual property rights; Legislations to deal with different forms of economic offenses: Reserve Bank of India (RBI) Act, 1934; Securities and Exchange Board of India (SEBI) Act, 1992, Prevention of Money Laundering (PML) Act, Foreign Exchange Management Act (FEMA), Foreign Contribution Regulation (FCRA) Act; Competition Commission of India.</p>	10
<p><b>Unit 4: Enforcement Agencies Preventing Economic Offences</b> Measures adopted by: Lokpal and Lokayukta; Central Vigilance Commission; Economic Offences Wing of Central Bureau of Investigation(CBI); Central Economic Intelligence Bureau; Directorate of Enforcement; Narcotic Control Bureau; Directorate General of Revenue Intelligence; INTERPOL.</p>	12

**Course Articulation Matrix: Mapping of Course Outcomes (COs)**

**Pedagogy:** .....

Formative Assessment for Theory	
Assessment Occasion/type	Marks
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>30 Marks</b>

**References**

1. Green, S. P. (2006). *Lying, cheating and stealing: a moral theory of white-collar crime*. Oxford University Press; Oxford.
2. Pasco, G. A. (2012). *Criminal Financial Investigations: The Use of Forensic Accounting Techniques and Indirect Methods of Proof*. (2<sup>nd</sup> ed.). CRC Press.
3. Pickett, K. H., & Pickett, J. M. (2002). *Financial Crime Investigation and Control*. John Wiley and Sons.
4. John Wiley and Sons.
5. Pontell, H. N. (2007). *International Handbook of White-Collar and Corporate Crime*. Springer.
6. Springer.
7. Indian Audit and Accounts department. (2007). *Audit of fraud; Fraud Detection and Forensic Audit*.