Gyanmanjari
Innovative University

Subject: Forensic Biology and Serology – MSCFS12508

Type of course: Major

Prerequisite: Basic knowledge of biology, biochemistry, and chemistry, along with foundational lab skills and an understanding of forensic science principles.

Rationale: Forensic Biology and Serology play a crucial role in criminal investigations by analyzing biological evidence, such as blood, saliva, and DNA, to identify individuals and reconstruct events, ensuring justice through scientific accuracy.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weight age
1	**Unit 1: Forensic Importance of Body fluids** Common body fluids. Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood. Determination of blood groups. Antigens and antibodies. Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins. Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination. Composition, functions and forensic	15	25

	significance of saliva, sweat, milk and urine. Tests for their identifications.		
2	**Unit-2 : Serology and Immunology** Cell structure and functions. Structure and function of carbohydrates, fats and proteins, serum proteins, haemoglobin and its variants, haptoglobins, HLA, polymorphic enzymes, blood groups-history, biochemistry and genetics of ABO, Rh, Mn and other systems, Methods of ABO blood grouping from fresh blood and biological stains, body fluids, determination of secretor status, polymorphic enzyme typing, serogenetic markers, determination of origin of species, immunology, immune response, antigens, haptens and antibodies, function and rising of antisera, lectins.Bloodstains investigations: Blood pattern analysis, ageing of bloodstains, difference between human and animal bloodstains, spectroscopic analysis.	15	25
3	**Unit- 3 Genetic Marker Analysis** Cellular antigens. ABO blood groups. Extracellular proteins and intracellular enzymes. Significance of genetic marker typing data. Sexual assault investigations.	15	25
4.	**Unit 3: Bloodstain Pattern Analysis** Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.	15	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Body Fluids Identification Chart** Students create a comparative chart of common body fluids, noting their composition, functions, and forensic significance and then upload it on GMIU web Portal.	10
2.	**Immune Response Flowchart** Students design a flowchart depicting the stages of the immune response, including the roles of antigens, haptens, antibodies, and immune cells and upload it on GMIU web Portal.	10
3.	**Genetic Marker Case Evaluation** Provide a hypothetical case involving sexual assault evidence, including	10

	genetic marker data (e.g., ABO blood groups, intracellular enzyme profiles). Students analyze the data and write a report identifying potential suspects and student need to make a report on their observation and upload it on GMIU web Portal.	
4.	**Bloodstain Pattern Sketching Exercise** Faculty will provide descriptions of bloodstain patterns (e.g., impact, cast-off, projected). Students will sketch these patterns and label key characteristics such as directionality, angle of impact, and area of origin and then upload it on GMIU web Portal.	10
5.	**Case Study Analysis** Faculty will provide students with hypothetical crime scene scenarios involving bloodstains or semen evidence. They write step-by-step methods for collection, preservation, and forensic characterization and upload it on GMIU web Portal.	10
Total		50

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weight age	25%	30%	30%	10%	5%	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Evaluate the forensic importance of semen, including spermatozoa analysis and individualization techniques.
CO2	Apply techniques for ABO blood grouping, secretor status determination, and species identification.

| CO3 | Examine extracellular proteins and intracellular enzymes as genetic markers in forensic cases. |
| CO4 | Investigate blood trails and their significance in crime scene analysis. |

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).
[2] G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
[3] R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
[4] T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).