PROGRAM CURRICULUM

(Applicable for the batches admitted from A.Y. 2025-26)

B.Sc. Forensic Science

for

B.Sc. Three Year Degree Program

ADITYA
UNIVERSITY

Aditya Nagar, ADB Road, Surampalem - 533 437

ADITYA UNIVERSITY

Vision

- To be a globally recognized university through excellence in Education, Innovation and Sustainable growth.

Mission

Deliver collaborative education to prepare students for global challenges through

- Transformative learning
- Vibrant research ecosystem
- Sustainable and inclusive community

DEPARTMENT OF FORENSIC SCIENCE

Vision

- To be a leading center of forensic science education and research, advancing justice through scientific excellence, innovation, and interdisciplinary collaboration.

Mission

- **M1:** Transformative, hands-on forensic education fostering critical thinking, ethics and rigor.
- **M2**: Interdisciplinary research ecosystem supporting justice and global challenges.
- **M3**: Sustainable and inclusive community of globally competent professionals.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

Graduates of the Program will

PEO1: Career Success and Leadership

Graduates will establish successful careers and demonstrate professional competence and leadership in their respective domains of forensic science, cyber security, digital forensics, and related fields.

PEO2: Higher Studies, Research, and Entrepreneurship

Graduates will pursue higher studies, research opportunities, or entrepreneurial pathways to contribute to advancements in their chosen discipline and allied areas.

PEO3: Lifelong Learning and Ethical Responsibility

Graduates will engage in lifelong learning, adapt to emerging global challenges, and uphold ethical responsibility in their professional and personal endeavors.

PROGRAMME SPECIFIC OUTCOMES (PSO)

After successful completion of the program, the graduates will be able to

PSO1: Scientific and Technical Skills

Apply knowledge from physical, biological, computational, and digital sciences to examine forensic or digital evidence. Use appropriate laboratory and digital tools and follow proper investigative protocols.

PSO2: Ethics and Professional Practice

Conduct forensic or digital investigations with integrity. Follow ethical standards and legal rules and ensure accurate handling and documentation of evidence for judicial or professional use.

PROGRAMME OUTCOMES (PO)

After successful completion of the program, the graduates will be able to

PO1: Integrated Forensic and Digital Competence

Apply foundational and advanced concepts from life sciences, physical sciences, computer sciences, and legal studies to investigate, analyze, and interpret physical, biological, and digital evidence in crime investigations.

PO2: Evidence Collection and Scene Management

Demonstrate proficiency in identifying, securing, documenting, and managing both physical and digital crime scenes, ensuring the integrity, continuity, and admissibility of collected evidence.

PO3: Analytical and Instrumental Proficiency

Operate laboratory instruments and digital forensic tools to accurately examine, process, and interpret chemical, biological, physical, and electronic evidence using validated analytical techniques.

PO4: Multidisciplinary and Technological Insight

Integrate knowledge from forensic pathology, toxicology, cyber forensics, network security, psychology, and data analytics to address complex challenges in modern forensic investigations.

PO5: Legal Awareness and Ethical Responsibility

Exhibit awareness of national laws, cyber regulations, and ethical standards governing forensic practice, maintaining integrity, confidentiality, impartiality, and adherence to justice in all professional actions.

PO6: Technical Documentation and Forensic Reporting

Develop competence in preparing comprehensive laboratory records, forensic reports, and digital documentation that meet scientific and legal standards, ensuring clarity, accuracy, and traceability.

PO7: Courtroom and Professional Communication Skills

Demonstrate the ability to present technical findings effectively in judicial proceedings and communicate professionally with law enforcement, legal experts, and multidisciplinary teams.

PO8: Evidence-Based and Critical Decision-Making

Employ scientific reasoning, statistical analysis, and critical thinking to evaluate data, validate findings, and make informed decisions in forensic and digital investigations.

PO9: Innovation, Research, and Lifelong Learning

Engage in research, innovation, and continuous learning to stay updated with evolving forensic methodologies, analytical technologies, cybersecurity threats, and global standards.

PO10: Collaboration, Leadership, and Professionalism

Work effectively as part of multidisciplinary forensic and investigative teams, demonstrating leadership, accountability, adaptability, and professionalism in diverse work environments.

PO11: Societal Impact and Public Awareness

Communicate forensic and cybersecurity knowledge responsibly to promote public awareness, contribute to crime prevention, and support the ethical use of science and technology in justice delivery.

Department of Forensic Science

B.Sc. (Forensic Science) Program Curriculum – 2025-26

(Applicable for the students submitted from the A.Y. 2025-26)

UG Programs Offered

- B.Sc. in Forensic Science
- B.Sc. Cyber Security and Digital Forensics

Minor Streams offered in B.Sc. Forensic Science

- Minor Stream in Physics
- Minor Stream in Chemistry
- Minor Stream in Botany
- Minor Stream in Zoology
- Minor Stream in Mathematics
- Minor Stream in Cyber Forensics

Credit Division Category-wise

Sr. No.	Broad Category of Course	UGC	Credits
1	Major Core Courses (MCC)	60	60
2	Minor Stream Courses (MSC)	24	24
3	Multidisciplinary Courses (MDC)	9	6
4	Ability Enhancement Courses (AEC)	8	10
5	Skill Enhancement Courses (SEC)	9	8
6	Value Added Courses (VAC)	6-8	6
7	Summer Internships (SI)	2-4	2
8	Project (PROJ)	-	4
9	Mandatory Courses (MC)	-	-
Total Credits to be earned for B.Sc. Degree		**120**	**120**

FC- Fundamental Courses
IC- Integrated Courses
AC- Advanced Courses

B.Sc. Forensic Science
Major Core Courses (MCC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS26	I	Fundamentals of Forensic Science	FC	2		2	4	50	50	100	-
2509FS27		Crime Scene Processing	FC	2		2	4	50	50	100	-
2509FS28		Criminology and Legal System in India	FC	3		1	4	50	50	100	-
2509FS29	II	Questioned Document Examination	FC	2		2	4	50	50	100	FFS
2509FS30		Fingerprint and Impression Evidence	FC	2		2	4	50	50	100	FFS
2509FS31		Instrumentation	FC	3		1	4	50	50	100	-
2509FS49	III	Forensic Toxicology & Pharmacology	IC	2		2	4	50	50	100	-
2509FS50		Forensic Chemistry and Explosives	IC	2		2	4	50	50	100	-
2509FS51		Digital & Cyber Forensics	IC	3		1	4	50	50	100	-
2509FS52	IV	Forensic Biology and Serology	IC	2		2	4	50	50	100	-
2509FS53		Medical, Skeletal & Dental Forensics	IC	2		2	4	50	50	100	-
2509FS54		Forensic Genetics and DNA Fingerprinting	IC	3		1	4	50	50	100	-
2509FS01	V	Forensic Physics and Ballistics	AC	2		2	4	50	50	100	-
2509FS02		Forensic Psychology	AC	3		1	4	50	50	100	-
2509FS03		Multimedia Forensics	AC	2		2	4	50	50	100	-
Total				**35**		**25**	**60**				

Multidisciplinary Courses (MDC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS32	II	Fundamentals of Cyber Security	FC	2			2	50	50	100	-
2509FS04	V	Cyber Law	AC	2			2	50	50	100	-
2509FS05	VI	Cyber Criminology	AC	2			2	50	50	100	-
Total				**6**			**6**				

Ability Enhancement Courses (AEC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS33	I	Essential Cognitive Skills for Graduates	FC			1	1	100		100	-
2509FS34	II	Advanced Cognitive Skills for Graduates	FC			1	1	100		100	ECS
2509FS35	II	Human Values and Professional Ethics	FC	2			2	50	50	100	-
2509FS55	IV	Forensic Report Writing	IC	2			2	50	50	100	-
2509FS0667	V	Intellectual Property Right & Patents	AC	2			2	50	50	100	-
2509FS07	VI	Student Activity Based Learning	AC				2	100		100	-
Total				**6**	**0**	**2**	**10**				

Skill Enhancement Courses (SEC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS36	I	Insurance Forensics and Fraud Investigation	FC	2			2	50	50	100	-
2509FS56	III	IT Skills	IC			2	2	50	50	100	-
2509FS57	IV	Court Testimony	IC	2			2	50	50	100	-
2509FS08	VI	Research Methodology & Scientific Writing	AC	2			2	50	50	100	-
Total				**6**		**2**	**8**				

Value Added Courses (VAC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS58	III	Entrepreneurship Development	IC	2			2	50	50	100	-
2509FS09	V	Environmental Science	AC	2			2	50	50	100	-
2509FS10	VI	Forensic Journalism & Investigative Reporting	AC	2			2	50	50	100	-
Total				**6**			**6**				

Summer Internships (SI)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS12	V	Summer Internship	AC			2	2	100		100	-
Total						**2**	**2**				

Project (PROJ)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS13	VI	Project	AC			4	4	50	50	100	-
	Total					**4**	**4**				

Mandatory Courses (MC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509AC01	I	Constitution of India	FC	2				100	-	100	-
2509AC02	II	Indian Science & Technology	FC	2				100	-	100	-
2509AC03	III	Health & Wellness, Yoga Education, Sports, and Fitness	FC	2				100	-	100	-
2509AC04	IV	Indian History & Culture	FC	2				100	-	100	-
2509AC05	V	Indian Philosophy & Ethics	FC	2				100	-	100	-
		Total		**10**							

Minor Stream: Physics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS37	I	Mathematical Physics	FC	2		2	4	50	50	100	-
2509FS38	II	Mechanics and Properties of Matter	FC	2		2	4	50	50	100	-
2509FS59	III	Waves & Optics	IC	2		2	4	50	50	100	MMP
2509FS60	IV	Electricity and Magnetism	IC	2		2	4	50	50	100	MPM
2509FS14	V	Modern Physics	AC	2		2	4	50	50	100	EM
2509FS15	VI	Applications of Electricity & Electronics	AC	2		2	4	50	50	100	EM
Total				**12**		**12**	**24**				

Minor Stream: Chemistry

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS39	I	Fundamentals of Inorganic and Physical Chemistry	FC	2		2	4	50	50	100	-
2509FS40	II	Fundamentals of Organic and General Chemistry	FC	2		2	4	50	50	100	-
2509FS61	III	Chemistry of Complex Compounds and Physical Chemistry	IC	2		2	4	50	50	100	FI & PC
2509FS62	IV	Chemistry of Organic Compounds	IC	2		2	4	50	50	100	FO & GC
2509FS16	V	Spectroscopy and Structural Identification of Organic Compounds	AC	2		2	4	50	50	100	-
2509FS17	VI	Analytical Chemistry	AC	2		2	4	50	50	100	FI & PC
Total				**12**		**12**	**24**				

Minor Stream: Botany

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS41	I	Non-vascular Plants	FC	2		2	4	50	50	100	-

2509FS42	II	Vascular Plant	FC	2		2	4	50	50	100	NVP
2509FS63	III	Plant Anatomy and Embryology of Angiosperms	IC	2		2	4	50	50	100	VP
2509FS64	IV	Plant Ecology, Biodiversity and Phytogeography	IC	2		2	4	50	50	100	-
2509FS18	V	Cell Biology and Genetics	AC	2		2	4	50	50	100	PA & EA
2509FS19	VI	Plant Physiology and Metabolism	AC	2		2	4	50	50	100	PA & EA
Total				**12**		**12**	**24**				

Minor Stream: Zoology

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS43	I	Principles of Ecology	FC	2		2	4	50	50	100	-
2509FS44	II	Animal Diversity-I Biology of Non-Chordates	FC	2		2	4	50	50	100	PE
2509FS65	III	Animal Diversity-II Biology of Chordates	IC	2		2	4	50	50	100	AD-I
2509FS66	IV	Embryology	IC	2		2	4	50	50	100	AD-II
2509FS20	V	Animal Physiology: Life Sustaining Systems	AC	2		2	4	50	50	100	AD-II
2509FS21	VI	Poultry Management (Poultry Farming)	AC	2		2	4	50	50	100	EMB
Total				**12**		**12**	2				

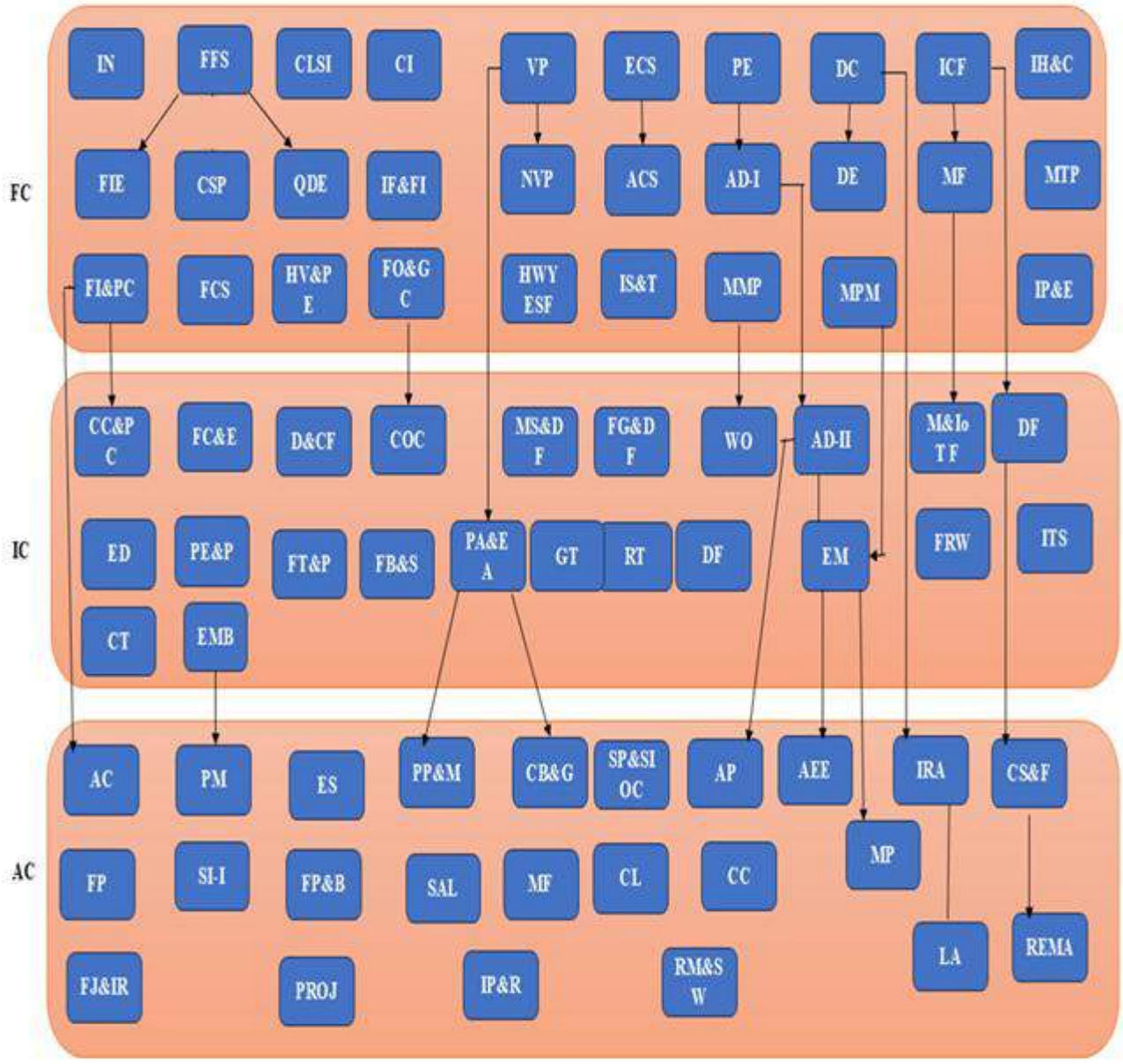
Minor Stream: Mathematics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS45	I	Differential Calculus	FC	2		2	4	50	50	100	-
2509FS46	II	Differential Equations	FC	2		2	4	50	50	100	DC

2509FS67	III	Group Theory	IC	2		2	4	50	50	100	-
2509FS68	IV	Ring Theory	IC	2		2	4	50	50	100	-
2509FS22	V	Introduction to Real Analysis	AC	2		2	4	50	50	100	DE
2509FS23	VI	Linear Algebra	AC	2		2	4	50	50	100	DE
Total				12		12	24				

Minor Stream: Cyber Forensics

Course Code	**Sem**	**Course Name**	**Level**	**L**	**T**	**P**	**C**	**CIE**	**SEE**	**Total**	**Pre-requisite**
2509FS47	I	Introduction to Cyber Forensics	FC	2		2	4	50	50	100	-
2509FS48	II	Mobile Forensics	FC	2		2	4	50	50	100	ICF
2509FS69	III	Digital Forensics	IC	2		2	4	50	50	100	ICF
2509FS11	IV	Multimedia and IoT Forensics	IC	2		2	4	50	50	100	MF
2509FS24	V	Cloud Security and Forensics	AC	2		2	4	50	50	100	DF
2509FS25	VI	Reverse Engineering & Malware Analysis	AC	2		2	4	50	50	100	CS & F
Total				**12**		**12**	**24**				


FC
IC
AC
IN
FFS
CLSI
CI
VP
ECS
PE
DC
ICF
IH&C
FIE
CSP
QDE
IF&FI
NVP
ACS
AD-I
DE
MF
MTP
FI&PC
FCS
HV&PE
FO&GC
HWY ESF
IS&T
MMP
MPM
IP&E
CC&PC
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PE&P
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AEE
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CS&F
FP
SI-I
FP&B
SAL
MF
CL
CC
MP
LA
REMA
FJ&IR
PROJ
IP&R
RM&SW

FFS	Fundamentals of Forensic Science	FT & P	Forensic Toxicology & Pharmacology	FP & B	Forensic Physics and Ballistics
CSP	Crime Scene Processing	FC & E	Forensic Chemistry and Explosives	FP	Forensic Psychology
CLSI	Criminology and Legal System in India	D & CF	Digital & Cyber Forensics	MF	Multimedia Forensics
QDE	Questioned Document Examination	FB & S	Forensic Biology and Serology		
FIE	Fingerprint and Impression Evidence	MS & DF	Medical, Skeletal & Dental Forensics		
IN	Instrumentation	FG & DF	Forensic Genetics and DNA Fingerprinting		
MTP	Mathematical Physics	WO	Waves & Optics	MP	Modern Physics
MPM	Mechanics and Properties of Matter	EM	Electricity and Magnetism	AEE	Applications of Electricity & Electronics
FI & PC	Fundamentals of Inorganic and Physical Chemistry	CC & PC	Chemistry of Complex Compounds and Physical Chemistry	SP & SIOC	Spectroscopy and Structural Identification of Organic Compounds
FO & GC	Fundamentals of Organic and General Chemistry	COC	Chemistry of Organic Compounds	AC	Analytical Chemistry
NVP	Non-vascular Plants	PA & EA	Plant Anatomy and Embryology of Angiosperms	CB & G	Cell Biology and Genetics
VP	Vascular Plant	PE & P	Plant Ecology, Biodiversity and Phytogeography	PP & M	Plant Physiology and Metabolism
PE	Principles of Ecology	AD- II	Animal Diversity-II Biology of Chordates	AP	Animal Physiology: Life Sustaining Systems

AD-I	Animal Diversity-I Biology of Non-Chordates	EMB	Embryology	PM	Poultry Management (Poultry Farming)
DC	Differential Calculus	GT	Group Theory	IRA	Introduction to Real Analysis
DE & PSS	Differential Equations & Problem-Solving Sessions	RT	Ring Theory	LA	Linear Algebra
ICF	Introduction to Cyber Forensics	DF	Digital Forensics	CS & F	Cloud Security and Forensics
MF	Mobile Forensics	M &IoT F	Multimedia and IoT Forensics	REMA	Reverse Engineering & Malware Analysis
FCS	Fundamentals of Cyber Security	FRW	Forensic Report Writing	CL	Cyber Law
ECS	Essential Cognitive Skills for Graduate	IT S	IT Skills	CC	Cyber Criminology
ACS	Advanced Cognitive Skills for Graduate	CT	Court Testimony	IP & R	Intellectual Property Right & Patents
HV & PE	Human Values and Professional Ethics	ED	Entrepreneurship Development	RM & SW	Research Methodology & Scientific Writing
IF & FI	Insurance Forensics and Fraud Investigation			ES	Environmental Science
CI	Constitution of India			FJ & IR	Forensic Journalism & Investigative Reporting
IS & T	Indian Science & Technology			SI	Summer Internship
HWY ESF	Health & Wellness, Yoga Education, Sports, and Fitness			PROJ	Project
IH & C	Indian History & Culture			SABL	Student Activity Based Learning
IP & E	Indian Philosophy & Ethics				

Semester-wise Curriculum

I SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
2509FS26	Fundamentals of Forensic Science	MCC	FC	2		2	4	6
2509FS27	Crime Scene Processing	MCC	FC	2		2	4	6
2509FS28	Criminology and Legal System in India	MCC	FC	3		1	4	5
	Minor Stream Course - 1	MSC	FC	2		2	4	6
2509FS33	Essential Cognitive Skills for Science	AEC	FC			1	1	2
2509FS36	Insurance Forensics and Fraud Investigation	SEC	FC	2			2	2
2509AC01	Constitution of India	MC	FC	2				2
	Total			**13**		**8**	**19**	**29**

II SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
2509FS29	Questioned Document Examination	MCC	FC	2		2	4	6
2509FS30	Fingerprint and Impression Evidence	MCC	FC	2		2	4	6
2509FS31	Instrumentation	MCC	FC	3		1	4	5
	Minor Stream Course - 2	MSC	FC	2		2	4	6
2509FS32	Fundamentals of Cyber Security	MDC	FC	2			2	2
2509FS34	Advanced Cognitive Skills for Science	AEC	FC			1	1	2
2509FS35	Human Values and Professional Ethics	AEC	FC	2			2	2
2509AC02	Indian Science & Technology	MC	FC	2				2
	Total			**15**		**8**	**21**	**31**

III SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
2509FS49	Forensic Toxicology & Pharmacology	MCC	IC	2		2	4	6
2509FS50	Forensic Chemistry and Explosives	MCC	IC	2		2	4	6
2509FS51	Digital & Cyber Forensics	MCC	IC	3		1	4	5
	Minor Stream Course - 3	MSC	IC	2		2	4	6
2509FS56	IT Skills	SEC	IC			2	2	4
2509FS58	Entrepreneurship Development	VAC	IC	2			2	2
2509AC03	Health & Wellness, Yoga Education, Sports, and Fitness	MC	FC	2				2
	Total			**13**		**9**	**20**	**31**

IV SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
2509FS52	Forensic Biology and Serology	MCC	IC	2		2	4	6
2509FS53	Medical, Skeletal & Dental Forensics	MCC	IC	2		2	4	6
2509FS54	Forensic Genetics and DNA Fingerprinting	MCC	IC	3		1	4	5
	Minor Stream Course - 4	MSC	IC	2		2	4	6
2509FS55	Forensic Report Writing	AEC	IC	2			2	2
2509FS57	Court Testimony	SEC	IC	2			2	2
2509AC04	Indian History & Culture	MC	FC	2				2
	Total			**15**		**7**	**20**	**29**

V SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
2509FS01	Forensic Physics and Ballistics	MCC	AC	2		2	4	6
2509FS02	Forensic Psychology	MCC	AC	3		3	4	6
2509FS03	Multimedia Forensics	MCC	AC	2		2	4	5
	Minor Stream Course - 5	MSC	AC	2		2	4	6
2509FS04	Cyber Law	MDC	AC	2			2	2
2509FS06	Intellectual Property Right & Patents	AEC	AC	2			2	2
2509FS09	Environmental Science	VAC	AC	2			2	2
2509FS12	Summer Internship	SI	AC			2	2	2
2509AC05	Indian Philosophy & Ethics	MC	FC	2				2
Total				**17**		**9**	**24**	**33**

VI SEMESTER

Course code	Course Title	Course		Credits				Total Hours
		Category	Level	L	T	P	Total	
	Minor Stream Course - 6	MSC	AC	2		2	4	6
2509FS05	Cyber Criminology	MDC	AC	2			2	2
2509FS08	Research Methodology & Scientific Writing	SEC	AC	2			2	2
2509FS10	Forensic Journalism & Investigative Reporting	VAC	AC	2			2	2
2509FS13	Project	PROJ	AC			4	4	8
2509FS07	Student Activity Based Learning	AEC	AC				2	
Total				**8**		**6**	**16**	**20**

Total Credits: 120

Minor Stream: Physics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS37	I	Mathematical Physics	FC	2		2	4	50	50	100
2509FS38	II	Mechanics and Properties of Matter	FC	2		2	4	50	50	100
2509FS59	III	Waves & Optics	IC	2		2	4	50	50	100
2509FS60	IV	Electricity and Magnetism	IC	2		2	4	50	50	100
2509FS14	V	Modern Physics	AC	2		2	4	50	50	100
2509FS15	VI	Applications of Electricity & Electronics	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

Minor Stream: Chemistry

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS39	I	Fundamentals of Inorganic and Physical Chemistry	FC	2		2	4	50	50	100
2509FS40	II	Fundamentals of Organic and General Chemistry	FC	2		2	4	50	50	100
2509FS61	III	Chemistry of Complex Compounds and Physical Chemistry	IC	2		2	4	50	50	100
2509FS62	IV	Chemistry of Organic Compounds	IC	2		2	4	50	50	100
2509FS16	V	Spectroscopy and Structural Identification of Organic Compounds	AC	2		2	4	50	50	100
2509FS17	VI	Analytical Chemistry	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

Minor Stream: Botany

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS41	I	Non-vascular Plants	FC	2		2	4	50	50	100
2509FS42	II	Vascular Plant	FC	2		2	4	50	50	100
2509FS63	III	Plant Anatomy and Embryology of Angiosperms	IC	2		2	4	50	50	100
2509FS64	IV	Plant Ecology, Biodiversity and Phytogeography	IC	2		2	4	50	50	100
2509FS18	V	Cell Biology and Genetics	AC	2		2	4	50	50	100
2509FS19	VI	Plant Physiology and Metabolism	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

Minor Stream: Zoology

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS43	I	Principles of Ecology	FC	2		2	4	50	50	100
2509FS44	II	Animal Diversity-I Biology of Non-Chordates	FC	2		2	4	50	50	100
2509FS65	III	Animal Diversity-II Biology of Chordates	IC	2		2	4	50	50	100
2509FS66	IV	Embryology	IC	2		2	4	50	50	100
2509FS20	V	Animal Physiology: Life Sustaining Systems	AC	2		2	4	50	50	100
2509FS21	VI	Poultry Management (Poultry Farming)	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

Minor Stream: Mathematics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS45	I	Differential Calculus	FC	2		2	4	50	50	100
2509FS46	II	Differential Equations	FC	2		2	4	50	50	100
2509FS67	III	Group Theory	IC	2		2	4	50	50	100
2509FS68	IV	Ring Theory	IC	2		2	4	50	50	100
2509FS22	V	Introduction to Real Analysis	AC	2		2	4	50	50	100
2509FS23	VI	Linear Algebra	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

Minor Stream: Cyber Forensics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total
2509FS47	I	Introduction to Cyber Forensics	FC	2		2	4	50	50	100
2509FS48	II	Mobile Forensics	FC	2		2	4	50	50	100
2509FS69	III	Digital Forensics	IC	2		2	4	50	50	100
2509FS11	IV	Multimedia and IoT Forensics	IC	2		2	4	50	50	100
2509FS24	V	Cloud Security and Forensics	AC	2		2	4	50	50	100
2509FS25	VI	Reverse Engineering & Malware Analysis	AC	2		2	4	50	50	100
Total				**12**		**12**	**24**			

B.Sc. Forensic Science
Major Core Courses (MCC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS26	I	Fundamentals of Forensic Science	FC	2		2	4	50	50	100	-
2509FS27		Crime Scene Processing	FC	2		2	4	50	50	100	-
2509FS28		Criminology and Legal System in India	FC	3		1	4	50	50	100	-
2509FS29	II	Questioned Document Examination	FC	2		2	4	50	50	100	FFS
2509FS30		Fingerprint and Impression Evidence	FC	2		2	4	50	50	100	FFS
2509FS31		Instrumentation	FC	3		1	4	50	50	100	-
2509FS49	III	Forensic Toxicology & Pharmacology	IC	2		2	4	50	50	100	-
2509FS50		Forensic Chemistry and Explosives	IC	2		2	4	50	50	100	-
2509FS51		Digital & Cyber Forensics	IC	3		1	4	50	50	100	-
2509FS52	IV	Forensic Biology and Serology	IC	2		2	4	50	50	100	-
2509FS53		Medical, Skeletal & Dental Forensics	IC	2		2	4	50	50	100	-
2509FS54		Forensic Genetics and DNA Fingerprinting	IC	3		1	4	50	50	100	-
2509FS01	V	Forensic Physics and Ballistics	AC	2		2	4	50	50	100	-
2509FS02		Forensic Psychology	AC	3		1	4	50	50	100	-
2509FS03		Multimedia Forensics	AC	2		2	4	50	50	100	-
Total				**35**		**25**	**60**				

Fundamentals of Forensic Science

L	T	P	C
2	0	2	4

Course Code: 2509FS26
Semester- I
Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain the principles, scope, and history of forensic science in the legal system.
CO2: Analyze the roles of forensic and law enforcement institutions in crime investigation.
CO3: Classify crimes, criminal behaviors, and ethical standards in forensic practice.
CO4: Demonstrate proper handling and examination of physical, biological, chemical, and digital evidence.
CO5: Evaluate forensic experts' roles in legal proceedings, including testimony and evidence presentation.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	2	3	1	1	2	1	2	2
CO2	2	3	2	2	3	2	2	2	3	2	2
CO3	2	2	1	2	3	1	2	2	2	2	1
CO4	3	3	3	2	2	2	2	3	2	3	1
CO5	2	2	2	1	3	3	3	3	2	2	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Introduction to Forensic Science

Forensic Science - Introduction, Definition, Need, Significance, Scope. History and development of Forensic Science in India and abroad. Specific contribution of scientists in the field of Forensic Science. Principles of forensic science. Domains of Forensic Science - Criminalistics, Forensic Biology, Serology and DNA Fingerprinting, Forensic Chemistry and Toxicology, Forensic Physics and Ballistics, Forensic Fingerprint and Questioned Document Examination, Forensic Medicine and Anthropology, Forensic Odontology and Osteology, Wildlife and Environmental Forensics, Forensic Engineering, Forensic Psychology and Behavioural Science, Digital and Cyber Forensics, and Forensic Accounting.

Practice -To understand the working of Government and Private FSLs.

UNIT – II: Forensic Science Laboratories in India
Introduction to Forensic Laboratories. Organizational Structure of Forensic Laboratories. Types of Government Forensic Laboratories (DFSS, CFSL, SFSL, RFSL, & MFSL), Private Forensic Laboratories and their Functions. Chain of Custody in Forensic Laboratories. Procedures in Forensic Laboratories. Hierarchical Structure & Roles of Personnel in Forensic Laboratories. Laboratory Administration - Routine Laboratory Work, Record Management & Report Handling, Laboratory Resources, Purchase Procedures & Waste Disposal. Laboratory Information Management System (LIMS): Classification and Functions of LIMS. Sub-division of LIMS by Functional Areas. Strategic Design of LIMS for Forensic Labs.

Practice -Forensic Lab Safety: Handling various samples.

UNIT – III: Forensic Laboratory Management, Safety, and Accreditation
Introduction to Laboratory Management - Quality Assurance (QA), Quality Control (QC), Quality Management (QM). Good Laboratory Practices (GLP). Importance of accreditation in forensic laboratories. Forensic Standards and Accreditation - ISO 9000, ISO 14000, and ISO 17000 series standards. ASTM and other forensic relevant standards. Accreditation Boards and NABL Guidelines for Accreditation. Laboratory Safety - Safety Policies, Resources, & Planning. Chemical, Solvent, & Biological Hazards. Emergency Care and Medical Facilities. Workplace Safety in Forensic Laboratories: Fume Cupboards, Exhaust Systems, and Protective Equipment.

Practice -Principles of Forensic Science: Demonstration.

UNIT – IV: Forensic Science and Allied Institutions
National Research Institutions: CDFD, CCMB, DRDO, CSIR-IITR, and NDTL. National Forensic Educational Institutions: Government and Private Institutes and Universities. Law Enforcement Agencies & Investigative Bodies: CBI, NIA, CID, IB, RAW, BPR&D, NCRB, CISF, & NCB. Training & Data Management Institutions: CDTI, Police Academies and Training centres, Clues Team, FPB, & OCTOPUS. International Educational and Research Institutions. Law Enforcement Agencies: FBI, CIA, WADA, DEA, INTERPOL, Europol, Ameripol, & Afripol.

Practice -Comparative Study of National and International Allied Institutes.

UNIT – V: Legal Aspects and Courtroom Testimony
Key Legal Terminologies in Forensic Science – Victim, Suspect, Offender, Accused, Convict, Witnesses and Expert Witnesses. Frye and Daubert Standard. Role of forensic experts in the judicial process, Ethics in forensic practice and expert testimony. Admissibility of evidence in court.

Practice -Case Study Analysis on Wrongfully Excluded Evidence.

Activities:
1. Field visit to various Forensic Organizations.
2. Moot Court Simulation

Textbooks:

1. B. S. Nabar, *Forensic Science in Crime Investigation*, Asia Law House, ISBN: 978-8173461477.
2. R. Saferstein, *Criminalistics: An Introduction to Forensic Science*, Pearson, ISBN: 978-0134477596.

Reference Books:

1. B. R. Sharma, *Forensic Science in Criminal Investigation & Trials*, Universal Law Publishing, ISBN: 978-9350354724.
2. H. J. Walls, *Forensic Science: An Introduction to Scientific Crime Detection*, CBS Publishers, ISBN: 978-8123904054.

Web Links:

1. NPTEL: Forensic Science
2. FBI Forensic Science Resources
3. NIJ Forensic Science
4. https://www.interpol.int/en/Crimes/Forensics
5. https://www.aafs.org/

Crime Scene Processing

Course Code: 2509FS27
Semester- I
Course Outcomes:

L	T	P	C
2	0	2	4

At the end of the course, students will be able to:

CO1: Understand principles, importance, and methods of crime scene processing.
CO2: Demonstrate documentation techniques like photography, sketching, and 3D scanning.
CO3: Identify and use forensic kits for evidence collection.
CO4: Apply proper evidence handling, preservation, and legal procedures.
CO5: Analyze crime scene reconstruction and forensic reporting.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	3	2	2	3	2	2	2	1	1	-
CO2	2	3	2	1	2	3	2	2	1	1	3
CO3	3	3	3	2	2	2	2	3	1	1	-
CO4	3	3	2	2	3	3	3	3	2	1	-
CO5	3	2	2	2	3	3	3	3	2	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	2
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Crime Scene Processing
Definition and Importance of Crime Scene Processing, Types of Crime Scenes, Steps of Crime Scene Investigation - Manpower Management, Logistics Management, Technology Management, and Information Management - Initial Response and Receipt of Information, Safety Procedures, Emergency Care, Securing and Crowd handling at the Scene, Establishing and Securing Crime Scene Boundaries, The Initial Walk-Through, and Search Patterns for Evidence Collection, Number and Labelling of Evidences, Documenting Actions and Observations, Establishing a Command Post and Notifications.

Practice -Processing of general Crime Scene (Homicide & Suicide Case).

UNIT – II: Crime Scene Documentation
Steps and Importance of Crime Scene Documentation, Crime Scene Photography: Types and Techniques, Crime Scene Videography, Crime Scene Sketching: Types and Components of a Crime Scene Sketch, and Crime Scene Note-Taking: Characteristics, Elements, and

Guidelines. Digital Imaging of Crime Scene, 3D Scanning Technique: Types, advantages, applications.

Practice -Processing of Fire & Arson Case.

UNIT – III: Forensic Kits in Crime Scene Investigation
Introduction and Importance of Crime Scene Kits, Types and their components: General Crime Scene skit**,** Crime scene reconstruction kit, Biological Evidence Collection Kits, Fingerprint Development Kits, Impression Evidence Kits, Bullet trajectory kit, Trace Evidence Collection Kits, Toxicology and Drug Testing Kits, Sexual Assault Examination Kits, Gunshot Residue (GSR) Collection Kits, Explosive kit, Arson Investigation Kits, Digital Evidence Collection Kits and other related kits.

Practice -Processing of Vehicular Accident & Structure Failure.

UNIT – IV: Evidence Handling, Preservation, Forwarding
Introduction to Evidence. Physical Evidence: Class vs. Individual Characteristics of Evidence, Role of Physical Evidence in Linking Suspects, Victims, and Crime Scenes. General Guidelines for Evidence Collection, Collection Techniques for Various Types of Evidence: Biological Evidence, Chemical Evidence, Physical Evidence, Digital Evidence, and Trace Evidence, Labeling and Documentation of Evidence, Evidence Preservation Methods, Legal Considerations and Chain of Custody, Forwarding letter to law enforcement agencies. Challenges and Best Practices in Evidence Management.

Practice -Processing of Bomb Blast Scene.

UNIT – V: Crime Scene Reconstruction and Report Writing
Crime Scene Reconstruction: Introduction, Importance, Nature, Principles (Recognition, Identification, Individualization and Reconstruction) and Stages of Crime Scene Reconstruction. Types and Classification of Reconstruction. Pattern Evidence in Reconstruction. Computer Assisted Reconstruction Analysis. Writing a Forensic Report: General guidelines, Importance, Nature, Types, Format, Length, Common Reporting Mistakes, Do’s and Don’ts while preparing the Report and Legal considerations.

Practice -Processing of Digital Crime Scene.

Textbooks:
1. Criminalistics: An Introduction to Forensic Science" by Richard Saferstein
2. Techniques of Crime Scene Investigation" by Barry A.J. Fisher, David R. Fisher, and William J. Tilstone

Reference Books:
1. Crime Scene Investigation: The Forensic Technician’s Field Manual" by Thomas P. Mauriello
2. Crime Scene Investigation and Reconstruction: An Illustrated Manual and Field Guide" by Paul T. Jayaprakash

Web Links:

1. https://nij.ojp.gov/
2. https://www.crime-scene-investigator.net/
3. https://www.justice.gov/forensic-science
4. https://www.nfstc.org/
5. https://www.aafs.org/

Criminology & Legal System in India

Course Code: 2509FS28

L	T	P	C
3	0	1	4

Semester- I

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the structure, functions, and components of the criminal justice system.

CO2: Learn legal frameworks like BNS, BNSS, and BSA in law enforcement and judiciary.

CO3: Recognize roles and powers of law enforcement, courts, and correctional institutions.

CO4: Apply legal principles in investigations, trials, and evidence admissibility.

CO5: Criminology & Punishment – Assess crime theories, punishments, and correctional approaches.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	1	2	3	2	2	2	2	2	2
CO2	2	2	1	1	3	2	2	2	1	2	1
CO3	2	3	1	2	3	2	2	2	2	2	1
CO4	3	3	2	2	3	3	3	3	2	2	1
CO5	2	2	1	3	3	2	2	2	2	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Criminology & Criminal Justice System

Definition and Growth of Criminology in India, Conservative, Liberal & Radical Criminology. Crime & Criminal - Definition, Classification, Theories and Schools of Criminology.

Introduction to the Criminal Justice System – Objectives, Components, Interrelationship between Law, Justice, and Society. Courts and Their Hierarchy - Structure of Courts in India, Special Courts. Introduction to Civil and Criminal Laws. Hierarchy of Police personnel in India - Functions and duties of police. Investigation of crimes and prosecution. Introduction to Penology.

Practice -Case Study on Criminal Psychology and Behaviour

UNIT – II: Legal Framework and Law Enforcement in Criminal Justice

Role and Powers of Law Enforcement Agencies - Powers and Responsibilities of the Police under BNSS. Arrest, Detention, and Questioning Procedures. Classification of Offenses under

Criminal Law - Bailable vs. Non-Bailable Offenses, Cognizable vs. Non-Cognizable Offenses, Compoundable vs. Non-Compoundable Offenses, Felonies vs. Misdemeanors (Serious vs. Minor Crimes). Crimes against Individuals, Property, State, and Economy, Interrogation and Confession Laws - Admissibility of Confessions in Court, Protection against Custodial Violence and Third-Degree Methods, and Rights of Victims and Accused under Legal Provisions.

Practice -Mock Courtroom Trial

UNIT – III: Criminal Laws Governing the Justice System

Criminal Laws Governing the Justice System - Bharatiya Nyaya Sanhita (BNS) - Section 63, 64, 80, 100, 101, 103(1), 110, 138, 170, 173, 293, 294, 295, 309(1)(2)(3), 310(1), 318(4), 332(c), 336(1), and 336(2). Bharatiya Nagarik Suraksha Sanhita (BNSS) - Section 173, 176, 326, 328, 329, 330, 349 and 337. Bharatiya Sakshya Adhiniyam (BSA) - Section 39(1), 40, 41(1), 41(2), 52, 53, 55, 72, 140, 141, 142, and 162.

Practice -Classification of Crimes and Legal Provisions

UNIT – IV: Trial Process, Testimony and Admissibility of Evidence

Trial Process and Adjudication: Stages of a Criminal Trial. Rights of the Accused during Trial. Role of Prosecution and Defense Lawyers. Testimony and Cross-Examination in Court - Examination-in-Chief, Cross-Examination, and Re-Examination. Rules for Witness Testimony and Expert Opinions. Role of Forensic Experts in Court Proceedings. Admissibility of Evidence in Court - BSA (Bharatiya Sakshya Adhiniyam) and Rules of Evidence. Types of Admissible and Inadmissible Evidence. Electronic Evidence and Digital Forensics in Trials.

Practice -To explore victim rights, support services, and their role in criminal justice.

UNIT – V: Punishment, Rehabilitation and Victim Rights

Judicial Sentencing and Discretion. Correctional Measures - Probation and Parole. Structure and Administration of Prisons in India. Correctional Institutions - Prisons and Jails, Juvenile Justice Homes, Open Prisons, Prison Reforms and Human Rights. Victimology - Definition and Typology of Victims, Historical Perspective of Victimology, Theories of Victimology, and Victim-Oriented Services.

Practice -Filing of FIR and Charge Sheet Preparation

Activities:

1. Visit to the Police Station.
2. Visit to the Juvenile Justice Homes.
3. Visit to the Jail.

Textbooks:

1. Criminalistics: An Introduction to Forensic Science" by Richard Saferstein
2. Criminology, Penology and Victimology" by Ahmad Siddique, revised by Sanjay Vashishtha

Reference Books:

1. The Criminal Justice System in India" by H.R. Bhardwaj
2. Criminal Laws in India: A Comprehensive Textbook

Web Links:

1. https://www.indiacode.nic.in/handle/123456789/20099?utm
2. https://globcci.org/wp-content/uploads/2021/07/Criminal-Justice-System-in-India-2013.pdf?utm
3. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S001608/P001744/M027830/ET/1521104098StructureofCriminalJusticeSysteminIndiaEPG%282.pdf?utm_
4. https://www.data.gov.in/ministrydepartment/National%20Crime%20Records%20Bureau%20(NCRB)?utm
5. https://www.mha.gov.in/en/commoncontent/new-criminal-laws?utm

Questioned Document Examination

Course Code: 2509FS29 L T P C
Semester- II 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Develop a fundamental understanding of the scope, significance, and forensic applications of questioned documents and handwriting examination.

CO2: Understand handwriting characteristics, principles of identification, and their role in forensic analysis.

CO3: Learn various methods for the detection, examination, and authentication of questioned documents.

CO4: Gain comprehensive knowledge of security documents, their features, and forensic examination techniques.

CO5: Develop proficiency in using forensic tools, techniques, and technologies for document analysis.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	1	2	1	2	1	2	1	1	2
CO2	3	-	2	2	3	2	-	2	1	2	1
CO3	2	1	2	2	2	2	-	3	2	2	1
CO4	2	1	2	2	2	2	1	2	2	2	1
CO5	2	1	2	1	2	3	1	3	2	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Basic of Documents and Questioned Document

Basics, Definition, Nature and Scope of Document and Questioned Documents. Essentials to Produce Document, Types and Importance of Documents. Type of Cases Encountered, Preliminary Examination, Collection, Handling and Transportation of Document. Problems in Document Handling, Analysis and Forwarding of Documents Seized from Scene of Crime. Examination of Questioned Document, Legal Aspects and Admissibility of Questioned Document Evidence. Role of a Forensic Document Examiner in Criminal and Civil Cases.

Practice -To study the examination of documents.

UNIT – II: Handwriting and Signature Examination
Basics of Handwriting and Signature Examination, Principles of Handwriting Identification, General Characteristics - Line Quality, Speed, Slant, Shading, Rhythm, Size, Skill, Movement, Alignment, Relative Size and Proportion, Pen Lifts, Pen Pressure, Pen Position, Pen Pause, Terminal Strokes, Connecting Strokes. Individual Characteristics of Handwriting and Signature. Standards for Comparison of Handwriting and Signature. Merits and Demerits of Exemplar and Non-Exemplar Samples During Comparison of Handwriting.

Practice –To study handwriting and signature examinations

UNIT – III: Forgery and its Detection
Definition, Types and Examination of Forgery - Traced Forgery, Simulated Forgery, Freehand Forgery, Digital and Electronic Forgery. Sections Related to Forgery. Alterations in Documents Including Physical Erasures and Chemical Erasures, Additions, Over-Writings and Obliterations. Indented and Invisible Writings, Charred Documents, Disguised Writing and Anonymous Letters. Legal Consequences and Case Studies on Forged Documents.

Practice -To study alteration in documents.

UNIT – IV: Tools and Techniques in Questioned Document
Hand Lens (Examination of strokes, ink flow, paper fibers), Stereo Microscope (Indentation, sequence of strokes, paper fiber analysis), Comparison Microscope (Side-by-side handwriting and signature comparison), Video Spectral Comparator (Ink differentiation, document alterations, security features), Ultraviolet (UV) Lamp (security features, fluorescence in ink), Oblique Light Source (Indented writings, erasures, forgeries), Electrostatic Detection Apparatus (Indented writings, pressure marks, latent impressions), Thin Layer Chromatography (Ink differentiation, detection of alterations), High-Resolution Scanners (Digitization, enhancement of faded text) and Transmitted Light Source (Detection of watermarks, paper transparency analysis).

Practice -To study various tools in examination of questioned documents.

UNIT – V: Security Documents and Printed Documents
Traditional Printing Techniques: Letterpress Printing, Gravure Printing, Flexographic Printing, Screen Printing, Intaglio Printing, Lithographic Printing, and Stencil Printing.
Modern Printing Techniques: Offset Printing, Digital Printing, Inkjet Printing, Laser Printing, Dot Matrix Printing, Thermal Printing, Electrophotographic Printing, 3D Printing, Magneto-graphic Printing, Electrostatic Printing. Techniques for the Examination of Printed Documents. Security Documents: Definition, Importance, Types and Security Features. Printing Processes and Examination of Security Documents including Counterfeit Indian Currency Notes, Passports, Visas, Credit Cards, Plastic Cards, and Stamp Papers.

Practice -To study security features in various documents.

Activities:
1. Visit to the paper mill.
2. Visit to Security Printing Press.
3. Visit to the Currency Note Printing Press.

Textbooks:

1. Huber, R. A., & Headrick, A. M. (1999). *Handwriting identification: Facts and fundamentals*. CRC Press.
2. Hilton, O. (1993). *Scientific examination of questioned documents*. CRC Press.

Reference Books:

1. Bisesi, M. S., & Omar, J. L. (2006). *Principles of forensic document examination*. CRC Press.
2. Levinson, J. (2001). *Questioned documents: A lawyer's handbook*. Academic Press.

Web Links:

1. https://le.fbi.gov/science-and-lab/biometrics-and-fingerprints
2. https://www.aafs.org/?gad_source=1&gclid=Cj0KCQjwytS-BhCKARIsAMGJyzo2H_M5_7I7cfbK0JrJels0f9CGNepzgfAGZOtiKazm22Xx6fbtiDQaAgx0EALw_wcB
3. https://www.asqde.org/
4. https://dfsl.karnataka.gov.in/23/questioned-documents-section/en
5. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000016FS/P000695/M006281/ET/1516191959FSC_P8_M1_e-text.pdf

Fingerprint And Impression Evidence

Course Code: 2509FS30 L T P C
Semester- II 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Developing an understanding and appreciation for the scope of fingerprint examination.

CO2: To develop understanding about classification of fingerprints.

CO3: Develop an understanding of various methods of development of Fingerprints.

CO4: Develop comprehensive knowledge on fingerprint patterns, fingerprint classification, and the various methods of fingerprint development- physical and chemical.

CO5: Develop comprehensive knowledge about lip prints and other impression evidence.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	1	-	2	1	2	1	1	2
CO2	3	1	2	-	-	1	-	1	-	-	1
CO3	3	2	3	1	-	2	-	2	1	2	1
CO4	3	2	3	1	1	2	1	2	1	2	2
CO5	2	2	2	1	1	2	-	2	-	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: History, Development & Basics of Fingerprint Science

Definition, History and development of Fingerprints in India and abroad. Morphology and anatomy of dermal skin. Embryology of fingerprint - Morphology of volar pad and configurational areas, development of volar pad, formation of friction ridges. Sweat glands - eccrine, sebaceous and apocrine. Theory, principles and Forensic significance of Fingerprint. Case studies.

Practice -To record the Plain and Rolled fingerprint of the subject.

UNIT – II: Fingerprint Classification Systems

Basic classification of Fingerprint - Arch, Loop, Whorl and Composite. Rules for placing core and delta, counting and tracing of ridges and ridge density. Classification of Fingerprints - Different systems of classifications (Ivon, Vucetich, Purkinje, Francis Galton, Henry 10-digit,

Henry FBI extension and Battley single digit classification), their modification till date and their utilities.

Practice -To study the Ridge Tracing, Counting and Density of Fingerprints.

UNIT – III: Taking and Collection of Fingerprints

Types of Fingerprint- rolled, plain, chance, latent, patent and plastic. Collection of latent, patent and plastic fingerprint: methods, procedure, precautions, limitations, lifting and preservation of fingerprint. Taking of fingerprint: Taking fingerprints of living person - purpose, requirements, procedures, precaution, limitation and collection, Taking fingerprints of dead bodies - purpose, requirements, procedures, precaution, limitation and collection (techniques of recording fingerprints of dead bodies of different stages, viz, immediately after death and after rigor mortis, decomposed and charred bodies) and Collection of Fingerprints using Digital Scanner.

Practice -To study the Classification of Fingerprints.

UNIT – IV: Development and Comparison of Fingerprint

Development of Fingerprint: conventional methods - black powder, magnetic powder and fluorescent powder. Chemical methods - Silver Nitrate, Ninhydrin and its analogues, Physical Developer etc., Fuming methods - Iodine Fuming, Cyanoacrylate Fuming, Soot method, Hydrogen Fluoride Fuming and Metal Deposition method. Comparison of Fingerprint: Class and Individual characteristics (minutiae), Fundamentals of comparison - print to print, trace to record, trace to print, trace to trace, and documentation of fingerprint. AFIS (Automated Fingerprint Identification System).

Practice -To develop the Fingerprints on various surfaces.

UNIT – V: Impression Evidence

Lip Print: Introduction, History, Classification, Collection, Development, Identification and Comparison of lip prints. Ear Print: Introduction, History, Morphology of the ear, Procedure of taking standards from the suspects, Identification and comparison of ear prints. Footprints: History, Classification, Collection, Development, Identification and Comparison of Footprints. Palm prints: History, Classification, Collection, Development, Identification and Comparison of Palm prints.

Practice -To study and analyse the impression evidence.

Activities:

1. Visit to the Fingerprint Bureau.

Textbooks:

1. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2016). *Fingerprint detection and identification: Advances and challenges*. CRC Press.
2. Lee, H. C., & Gaensslen, R. E. (2001). *Advances in fingerprint technology* (2nd ed.). CRC Press.

Reference Books:

1. American Society of Questioned Document Examiners (ASQDE). (n.d.). *Fingerprint analysis and classification methods.*
2. National Institute of Justice (NIJ). (2011). *The fingerprint sourcebook.* Retrieved from www.ojp.gov

Web Links:

1. https://nij.ojp.gov/topics/articles/overview-impression-and-pattern-evidenceNational Institute of Justice
2. https://www.forensicsciencesimplified.org/prints/how.html
3. https://forensiccoe.org/impression-and-pattern-evidence/Forensic_Technology_Center of Excellence
4. https://www.nist.gov/oles/pattern-and-impression-evidenceNIST
5. https://forensicresources.org/2013/techniques-for-collecting-and-analyzing-fingerprints/

Instrumentation

Course Code: 2509FS31 L T P C
Semester- II 3 0 1 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the principles and applications of Microscopic techniques in forensic analysis.
CO2: Explain the working principles of chromatography, and techniques.
CO3: Explain the working principles of Spectroscopic techniques.
CO4: Apply instrumental techniques for elemental analysis of Forensic Samples.
CO5: Understand the principles and applications of Biological and Biochemical Analytical techniques.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	3	2	-	2	1	2	1	2	1
CO2	3	-	3	2	-	2	-	2	-	2	1
CO3	3	-	3	2	-	2	-	2	-	2	1
CO4	3	1	3	3	1	2	1	3	1	2	1
CO5	3	1	2	2	3	2	1	2	1	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus

UNIT I: Microscopy and Optical Techniques

Fundamental principles of Microscopy. Types, Principle and Working of: Light microscopes - Simple and Compound Microscope. Specialized Microscopes - Comparison, Phase Contrast, Stereoscopic, Polarizing, Fluorescence, and Infrared (IR). Electron Microscopes - Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM).

Practice -Compare structural features of physical evidence using compound and phase contrast microscopes.

UNIT II: Chromatography

Introduction to chromatography- Partition, Adsorption, Ion Exchange, Affinity, and Size Exclusion Chromatography. Principle and Working of: Gas Chromatography (GC), Gas-Liquid and Gas-Solid Chromatography, GC-MS, Tandem GC-MS/MS, and Headspace GC. High-Performance Liquid Chromatography (HPLC), LC-MS, and Tandem LC-MS/MS. Theoretical concepts of Separation and Extraction - Adsorption, Partition, Solvent Extraction,

Supercritical Fluid Extraction, Accelerated Solvent Extraction, Solid Phase Extraction, and Solid Phase Microextraction.

Practice -Perform separation and identification of volatile compounds using Gas Chromatography (GC).

UNIT III: Spectroscopy
Electromagnetic spectrum and radiation properties. Absorption and emission spectra, molecular vibrations, and fluorescence. Principle and Working of: UV-Visible Spectroscopy-Infrared (IR) Spectroscopy, Fourier Transform IR (FT-IR), Raman Spectroscopy, Near-Infrared (FT-NIR) spectroscopy, Nuclear Magnetic Resonance (NMR) Spectroscopy, Neutron Activation Analysis (NAA) and Mass Spectrometry (MS) techniques.

Practice -Analyze molecular vibrations in a sample using FTIR spectroscopy.

UNIT IV: Elemental Analysis and Separation Techniques
Principle and Working of: Atomic Absorption Spectroscopy (AAS) and Atomic Emission Spectroscopy (AES), Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), Mass Spectrometry (ICP-MS) and X-ray Spectroscopy (XRF, EDXRF)

Practice -Determine trace elements in a sample using UV- Visible Spectroscopy.

UNIT V: Biological and Biochemical Analytical Techniques
Introduction to pH, buffer systems, and pH meters. Physiological solutions and theories of precipitation, coagulation, sedimentation, and centrifugation. Centrifugation techniques - Density Gradient, Differential, and Preparative Centrifugation. Electrophoretic techniques: Zone Electrophoresis (ZE) - Paper Electrophoresis (PE), Gel Electrophoresis and (AGE, PAGE, SDS-PAGE), Isoelectric Focusing (IEF).

Practice -Separate proteins in a sample using SDS-PAGE electrophoresis.

Activities
1. Visit to the Instrumentation facility Centre.

Textbooks:

1. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of Instrumental Analysis. Cengage Learning.
2. Willard, H. H., Merritt, L. L., Dean, J. A., & Settle, F. A. (1988). Instrumental Methods of Analysis. CBS Publishers.

Reference Books:

1. Barbara, H. S. (2007). Forensic Science: Advanced Investigations. Cengage Learning.
2. Nielsen, S. S. (2017). Food Analysis Laboratory Manual. Springer.

Web Links:

1. https://www.scribd.com/document/572808383/Analytical-Techniques-in-Forensic-Science-2021?
2. https://www.researchgate.net/publication/380690427_Analytical_Techniques_in_Forensic_Science_Spectroscopy_and_Chromatography?
3. https://www.americanlaboratory.com/914-Application-Notes/38746-New-Elemental-Analysis-Techniques-for-the-Analytical-Chemistry-Laboratory/?
4. https://ajptr.com/assets/upload/publish_article/AJPTR_102013.pdf?utm_source=chatgpt.com
5. https://www.researchgate.net/publication/380690427_Analytical_Techniques_in_Forensic_Science_Spectroscopy_and_Chromatography

Forensic Toxicology & Pharmacology

L	T	P	C
2	0	2	4

Course Code: 2509FS49
Semester- III
Course Outcomes:
At the end of the course, students will be able to:

CO1: Understand the fundamentals of forensic toxicology, including the classification, action, and effects of poisons.
CO2: Analyze the pharmacokinetics and pharmacodynamics of drugs, including dose-response relationships and drug interactions.
CO3: Employ advanced analytical techniques like TLC, HPLC, and GC-MS for toxicological investigations.
CO4: Perform practical analyses of narcotics, psychotropic substances, and vegetable poisons using scientific methods.
CO5: Interpret toxicological findings and apply knowledge to solve forensic cases ethically and accurately.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2	2	2	2	1	2	1	1	1
CO2	3	-	2	2	-	2	-	2	-	2	1
CO3	3	1	3	1	1	2	-	3	2	2	1
CO4	3	2	3	1	2	2	-	3	2	2	1
CO5	3	1	2	1	3	3	2	3	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT-I- Introduction to Forensic Toxicology
Forensic Toxicology: Introduction, Branches, Nature, Need, Scope, Concepts and Significance. Poisons: Definition and Classification. Poisoning: Types, Signs and Symptoms. Mode of Action, Factors affecting the Action of Poisons, Toxicological Exhibits in Fatal and Survival Cases. Laws related to Poisons.

Practice -Thin Layer Chromatography for common Drugs encountered.

UNIT II- Toxicokinetics & Toxicodynamics
Toxicokinetics- Routes of administration of poisons- Inhalation, Ingestion, Injection, topical. Mode of action of poisons, Clinical features in poisoning. Elimination of poisons- Urinary

excretion, fecal excretion and other routes of elimination. Toxicodynamics- Introduction and Toxicodynamics of poisons. Introduction to antidotes, types of antidotes.

Practice –Identification of Metals by Preliminary Examination.

UNIT-III- Extraction, Isolation and Clean-Up Procedures
Extraction of Non-Volatile Organic Poison, Stas-Otto, Ammonium Sulphate Method, Acid Digestion Methods, Solid Phase Microextraction Techniques, Solvent Extraction Methods. Volatile Poisons: Industrial Solvent Acid and Basic Distillation. Toxic Cations: Dry Ashing and Wet Digestion Process. Toxic Anions: Dialysis Method.

Practice -Extraction of Various Volatile and Non-Volatile Poisons

Unit IV- Analytical Techniques in Toxicology
Sampling and Preservation: Collection and storage of biological and non-biological samples. Screening and Identification: Color tests, Chromatographic techniques (TLC, HPLC, GC-MS). Quantitative Analysis: Spectrophotometry, immunoassays, and fluorometry and their applications in Forensic Toxicology. Interpretation of Results, Challenges in forensic toxicology analysis.

Practice –Instrumental analysis of Various Poisons.

UNIT V- Pharmacology & Different Classes of Drugs
Introduction to Pharmacology, Nature Source, forms, classification, schedule and classes of drugs. Route of administration of Drugs, Factor affecting the effects of Drug, Adverse drug reactions. Introduction to Drugs & Cosmetics. Laws related to Drugs. Pharmacokinetics: LD, LD50, ED50, ADME, Dose response relationship, Pharmacodynamics- Introduction and Pharmacodynamics of Drugs.

Practice -Qualitative and Quantitative analysis of various Cosmetic products.

Activities
1. Visit to the Instrumentation facility Centre.

Textbooks
1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Modi, R. B. J. P. (2013). A textbook of medical jurisprudence and toxicology. Elsevier.

Reference Books
1. Casarett, L J and Doul John ; Toxicology :The Basic Science of Poison, Macmillan Publ. Co. New York (1975).
2. Levine, B. (Ed.). (2003). Principles of forensic toxicology. Amer. Assoc. for Clinical Chemistry.

Weblinks
1. Swayam- https://onlinecourses.swayam2.ac.in/ini24_bt04/preview
2. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_pg/697
3. https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/forensic-toxicology

4. https://www.scitechnol.com/forensic-toxicology-pharmacology.php
5. https://www.coursera.org/courses?query=toxicology&utm_

Forensic Chemistry and Explosives

Course Code: 2509FS50 L T P C
Semester- III 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand fundamental principles of forensic chemistry, including chemical analysis and its application to forensic evidence, Role of Forensic Chemist in Court proceedings.

CO2: Analyze controlled substances, narcotics, and psychotropic drugs using chemical and instrumental methods under the NDPS Act.

CO3: Gain expertise in the classification, chemistry, and forensic investigation of explosives, including post-blast residue analysis.

CO4: Investigate fire and arson cases by understanding fire patterns, thermodynamics, and the analysis of fire debris and petroleum products.

CO5: Conduct forensic analysis of food and beverages, identifying adulterants and ensuring compliance with food safety regulations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2	2	1	2	1	2	1	2	1
CO2	3	1	3	3	2	2	-	3	1	2	1
CO3	3	1	3	3	2	2	1	3	1	2	1
CO4	3	2	3	3	1	2	1	3	1	2	1
CO5	3	1	2	2	2	2	-	2	1	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Introduction to Forensic Chemistry

Forensic Chemistry: Definition, Scope, Significance and Role of Forensic Chemistry in Criminal Investigation. Chemical evidence, Explosive, Trace Evidence and its Forensic significance. Types of cases/exhibits received for analysis at the Forensic Chemistry Division. Overview of Forensic Chemical Analysis. Case Study. Ethical Consideration and Expert Testimony in Forensic analysis.

Practice -Chemical Analysis of Explosives material.

UNIT – II: Narcotic Drugs and Psychotropic Substances
Introduction to Narcotic Drugs and Psychotropic Substances: Definition and classification, Global and national drug trafficking patterns. Intelligence gathering, detection, and surveillance. Role of forensic experts in drug-related cases. Challenges in investigation and prosecution. Drug Abuse, Rehabilitation, and Prevention: Psychological and physiological effects of drug abuse. Rehabilitation centers and de-addiction programs. Role of government policies, NGOs, and public awareness campaigns. Narcotic Drugs & Psychotropic Substances Act 1985, and relevant Sections.

Practice -Qualitative and Quantitative analysis of Narcotic Drugs and Psychotropic Substances by colour tests, and Instrumental techniques.

UNIT – III: Explosives, Fire and Arson
Introduction, classification and chemistry of explosives, Various types of IEDs and their reconstruction, Accidental Explosions, Mechanism of explosion and their effects, Post blast residue analysis (organic and inorganic) by chemical and instrumental techniques and interpretation of results. Introduction to Fires, Types of Fires, and Causes of fire, Patterns of fire, Thermodynamics of fire, Accelerants and incendiary devices, Forensic Analysis of Fire Debris by Instrumental methods. Explosives Act 1984, and relevant sections

Practice -Examinations of Accelerants as per BIS specifications.

UNIT – IV: Forensic Analysis of Food & Beverages
Adulteration: Definition, nature and current scenario, types of adulteration, food adulteration and food safety- Milk and milk product adulteration, edible oil and fat, sweetening agent adulteration, Food grains and product adulteration. Food Adulteration Act 1954 and relevant sections.
Beverages: Introduction, Definition of alcohol and illicit liquor, Alcoholic and nonalcoholic beverages and their composition, absorption, detoxification and excretions of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunk driving, Analytical techniques in the analysis of alcohol and other articles. Case studies.

Practice -Qualitative and Quantitative analysis of various Food Products and Food adulterants

UNIT – V: Petroleum Products and Industrial Chemicals
Introduction to Petroleum products, Classification and Properties, adulteration in petroleum products as per BIS Specifications and Forensic Analysis. Introduction to the Industrial chemicals, Classification, properties, Qualitative and Quantitative analysis and their forensic significance.
Practice -Prominent Case Studies related to Forensic Chemistry and Toxicology- Classroom Activity.

Activities
1. Visit to Explosive unit.

Textbooks

1. Maudham Bassett et al; Voget's Textbook of Quantitative Chemical Analysis, 6th Ed. Longman Essex.
2. Jitrin Y. (1993). Modern Methods & Application in Analysis of Explosives. England, John Wiley & Sons.

Reference Books

1. Burger A. (2004). Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6th Ed. NY, John Wiley & Sons.
2. Boudreau JE, Etal; Arson & Arson Investigation, Survey & Assessment National Institutes Of Law Enforcement, U.S. Deptt Of Justice, U.S. Govt Printing Press.

Weblinks

1. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_pg/692
2. https://www.sciencedirect.com/journal/forensic-chemistry
3. http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/IN__I_e_P_P__1_F_S__16151_P_0_F_C_a_E__16513_M_3_S_A_t_S_o_E_P_B_R_C_P_A_F_O_E_E__16543_16544
4. https://www.sciencedirect.com/journal/forensic-chemistry
5. https://www.explosives.org/

Digital & Cyber Forensics

L	T	P	C
3	0	1	4

Course Code: 2509FS51
Semester- III
Course Outcomes:
At the end of the course, students will be able to:

CO1: Gain an understanding of digital forensics principles and their role in investigations.
CO2: Identify various forms of cybercrime and apply relevant legal frameworks.
CO3: Acquire and analyze digital evidence using appropriate forensic tools.
CO4: Conduct forensic investigations on computers, networks, and mobile devices.
CO5: Explore emerging challenges and ethical considerations in digital forensics.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	2	1	2	1	2	2
CO2	3	2	2	2	3	2	1	2	1	1	2
CO3	3	1	3	2	1	2	1	3	1	2	1
CO4	3	2	3	2	1	2	1	3	1	2	1
CO5	3	1	2	2	3	2	1	2	1	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	2

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Digital and Cyber Forensics
Overview of digital forensics, scope, significance, and evolution. Types and characteristics of digital evidence, challenges in evidence handling. Principles of forensic science applied to digital investigations. Roles and responsibilities of forensic experts in law enforcement and corporate environments.

Practice -Creating and analyzing a forensic disk image using FTK Imager.

UNIT – II: Cybercrime and Investigation Methods
Classification of cybercrimes: hacking, identity theft, phishing, cyberstalking, online fraud, and ransomware. Cybercriminal techniques, including malware and social engineering. Legal frameworks in Digital India Act (IT Act 2000, BNS provisions) and international cyber laws (GDPR, CFAA). Investigation process: incident response, data collection, preservation, and forensic documentation.

Practice-Recovering deleted files and metadata with Autopsy.

UNIT – III: Digital Evidence Handling and Acquisition
Sources of digital evidence: computers, mobile devices, cloud platforms, and IoT. Methods of data acquisition: live and dead forensics, disk imaging, and volatile data extraction. Forensic imaging tools (FTK Imager, Autopsy, EnCase) and techniques for data integrity verification. Chain of custody maintenance and evidence documentation.

Practice -Examining network traffic and identifying anomalies using Wireshark.

UNIT – IV: Forensic Analysis and Tools
Windows and Linux forensic artifacts, registry analysis, and log examination. Memory forensics: RAM capture and analysis. File system examination: FAT, NTFS, Ext3, and Ext4. Network forensics: packet analysis, log tracing, and IP tracking. Mobile forensics: extraction of call logs, messages, and deleted data.

Practice -Extracting and analyzing mobile data with forensic tools.

UNIT – V: Challenges and Advancements in Digital Forensics
Emerging challenges: anti-forensic techniques, encryption, and anonymization. Integration of artificial intelligence and machine learning in forensic analysis. Advancements in cyber forensics: blockchain investigations, cloud forensics, and IoT forensics. Ethical considerations and real-world forensic case studies.

Practice -Detecting hidden information in images using steganalysis techniques.

Textbooks:
1. "Incident Response & Computer Forensics" – Kevin Mandia, Chris Prosise
2. "Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes" – Albert Marcella, Robert Greenfield

Reference Books:
1. "Digital Evidence and Computer Crime" – Eoghan Casey.
2. "The Art of Computer Virus Research and Defense" – Peter Szor.

Web Links:
1. https://www.researchgate.net/publication/253393425_Digital_Forensics_and_Cyber_Crime
2. https://annamalaiuniversity.ac.in/studport/download/engg/it/resources/Cyber%20Forensics.pdf
3. https://mrcet.com/downloads/digital_notes/CSE/III%20Year/12082022/DIGITAL%20FORENSICS.pdf
4. https://www.coursera.org/learn/digital-forensics-concepts
5. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-0

Forensic Biology & Serology

Course Code: 2509FS52 L T P C
Semester- IV 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain cell structure, metabolism, and organ systems.
CO2: Describe immunity, blood physiology, and antigen-antibody interactions.
CO3: Classify microorganisms and understand microbial genetics.
CO4: Identify and analyze biological evidence in forensic serology.
CO5: Examine forensic biology aspects like hair, fibers, diatoms, and toxic plants.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	1	-	2	-	1	1
CO2	3	-	2	2	-	1	-	2	-	1	1
CO3	3	-	2	2	-	1	-	2	-	2	1
CO4	3	2	3	2	2	2	1	3	1	2	2
CO5	3	2	2	2	1	2	1	2	1	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Biology

Definition, Scope, and Importance of Biology, Cell Structure and Function – Prokaryotic vs. Eukaryotic Cells, Structure and Function of Cell Organelles, Structure and Organization of Cytoskeleton and Cell Movements, Cell Cycle and Cell Division: Mitosis and Meiosis, Cellular respiration and metabolism – Glycolysis, Kreb Cycle, and Electron Transport Chain (ETC), Biomolecules and Their Functions, Introduction to Nervous system, Respiratory system, Circulatory system, Endocrine system, Excretory system & Digestive system.

Practice -Determination of ABO blood group and Absorption elution assay for dried blood stains.

UNIT – II: Immunology and Blood Physiology

Immunity: Definition, & Types: Innate, Acquired, and Delayed. Immunogens & Antigens - Definition, types & factors influencing antigenicity; Antibody - Definition, structures, types, properties and functions of immunoglobulin. Antigen - Antibody Reactions – Agglutination, Precipitation & Complement Fixation. Blood – Function, Composition, and Formation of Blood cells. Types of Blood cells and Blood Group Systems (ABO, Rh, MN, etc.).

Practice -Identification of Biological Fluids (Dry & Wet) - Blood, Semen, Saliva, and Urine.

UNIT – III: Basics of Microbiology

Introduction to Microbiology, classification of microorganisms (bacteria, viruses, fungi, protozoa), Bacterial Structure and Function (Gram-positive vs. Gram-negative bacteria), Bacterial growth and reproduction, Virology – Structure, Classification and Viral replication. Microbial Genetics - Horizontal gene transfer: Transformation, transduction, conjugation, Plasmids and antibiotic resistance, and Applications of Microbiology.

Practice -Isolation and Microscopic Examination of Diatoms, Pollen Grains, etc.

UNIT – IV: Basics of Forensic Serology

Definition, Scope of Forensic Serology and Biological Evidence. Class and Individual Characteristics of Biological Evidence. Presumptive and Confirmatory Assays in Biological Evidence Examination, Nature, Composition, Identification and Forensic Significance of Biological Fluids – Blood, Semen, Saliva, Urine, Sweat, and Other Fluids. Species Identification.

Practice -Microscopic Examination and differentiation of human and animal hair.

UNIT – V: Basics of Forensic Biology

Introduction to Forensic Biology, Importance of Biological Evidence, Hair and Fiber Analysis, Differences Between Human and Animal Hair, Hair Structure – Cuticle, Cortex, Medulla, Fiber Types and Identification, Diatoms and Pollen in Forensics, Collection and Study of Diatoms and Pollen, Role of Plants in Crime Investigation, Poisonous Plants – Ricinus, Abrus, Datura, Aconitum.

Practice -Physical and Chemical Methods to Examine Natural and Synthetic Fibers.

Activities:

1. Visit to a Botanical Garden.

Textbooks:

1. Fundamentals of Medical Microbiology and Immunology" by William W. Yotis
2. Forensic Biology" by Richard Li

Reference Books:

1. Forensic Serology" by R.E. Gaensslen
2. Medical Microbiology" by Patrick R. Murray, Ken S. Rosenthal, and Michael A. Pfaller

Web Links:

1. https://dofs-gbi.georgia.gov/document/document/forensic-biology-0/download
2. https://link.springer.com/book/10.1007/978-1-4684-0116-5?utm
3. https://libraryguides.missouri.edu/healthtextbooks/microbiology?utm
4. https://www.ncbi.nlm.nih.gov/books/NBK279396/

Medical, Skeletal & Dental Forensics

Course Code: 2509FS53 L T P C
Semester- IV 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain the principles of forensic medicine, legal procedures, and medico-legal documentation.

CO2: Identify human remains using forensic anthropology techniques, including skeletal analysis and reconstruction.

CO3: Analyze age, sex, ancestry, and stature estimation from bones and soft tissues.

CO4: Understand forensic odontology, including dental identification, bite mark analysis, and age estimation.

CO5: Apply forensic pathology concepts in injury analysis, postmortem changes, and cause of death determination.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	2	3	3	2	2	1	1	2
CO2	3	2	2	2	1	2	1	2	1	2	1
CO3	3	1	2	2	1	2	-	2	-	2	1
CO4	3	1	2	1	1	2	1	2	-	2	1
CO5	3	1	2	2	2	1	2	3	1	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Introduction to Forensic Medicine & Legal Aspects

Introduction to Forensic Medicine, Definition, scope, and historical development, Role of forensic medicine in crime investigation, Legal and Ethical Aspects: Inquest, Medical Examiner System, Summons or Subpoena, Medical Evidence, Conduct of Doctor in the Court, Medical Jurisprudence - Medical Council of India, Ethical and Legal aspects of Medical Practice, Medical Negligence.

Practice -Report on Visit to an Autopsy Examination

UNIT – II: Death and Changes after Death

Thanatology, Types of Death, Death of Certificate, Modes of Death, Manner of Death, Changes after Death – Immediate Changes, Clinical examinations and Death tests, Early Changes, and

Late Changes. Injuries and its classification. Forensic Entomology - Estimating the time since death, The use of insects in death investigations.

Practice -Skeletal Examination for Forensic Anthropology

UNIT – III: Medico-legal Autopsy
Autopsy, Types of Autopsy, Medico-legal autopsy, Objectives, Autopsy Report, Requirements for Autopsy, Autopsy procedure - External Examination, Internal Examination (Types of Incisions), Autopsy Techniques (Virchow Technique, Rokitansky Technique, Ghon Technique, Letulle Technique), Fetal Autopsy, Exhumation – Purpose and Procedure.

Practice -Bite Mark Analysis in Forensic Odontology

UNIT – IV: Forensic Anthropology
Introduction, Definition, History and Development to Human Anatomy and Physiology – Axial Skeleton and Appendicular Skeleton, Forensic Identification from Skeletal Remains – Sex Determination, Age Estimation, and Stature Estimation and Differentiation of Human and Animal Bones, Facial Reconstruction and Superimposition. Role of Anthropologist at Crime Scene.

Practice -Age estimation from skull sutures

UNIT – V: Odontological Investigations
Definition, Scope and Importance of Forensic Odontology. Development and Architecture of Teeth. Dental Identification, Method of Identification (Comparative and Reconstructive Identification), Determination of Sex and Race from Teeth. Age Estimation from Teeth. Bite Mark Evidence - Definition, Classification, Collection, Examination and Analysis. Dentition Library.

Practice -Sex Determination from human bones and Difference between Animal and Human Bones.

Activities:
1. Autopsy Visit
2. Visit to an Anthropological Study Centre.
3. Visit to a Dental Hospital.

Textbooks:

1. Reddy, K. S. N**.** (2022). *The Essentials of Forensic Medicine and Toxicology* (34th Ed.). Jaypee Brothers Medical Publishers.
2. Angi M. Christensen, Nicholas v. Passalacqua , Eric j . Bartelink Forensic Anthropology current methods and practice.

Reference Books:

1. Doge, S. D. (2021). *Forensic Medicine and Toxicology for MBBS and Medical Practitioners*. Elsevier.
2. Review of Forensic Medicine and Toxicology by Gautam Biswas.

Web Links:

1. https://nij.ojp.gov
2. https://www.medscape.com/pathology
3. https://www.sciencedirect.com/journal/forensic-science-international
4. https://www.autopsy.online
5. https://www.aafs.org

Forensic Genetics and DNA Fingerprinting

L	T	P	C
3	0	1	4

Course Code: 2509FS54
Semester- IV
Course Outcomes:
At the end of the course, students will be able to:

CO1: Explain genetic principles, inheritance patterns, and DNA organization.
CO2: Demonstrate DNA isolation, extraction, quantification, and separation techniques.
CO3: Understand forensic DNA profiling methods like STR, VNTR, RFLP, Y-STR, X-STR, and mtDNA.
CO4: Apply NGS, population genetics, and bioinformatics in forensic DNA analysis.
CO5: Analyze DNA databases, legal admissibility, and advancements in rapid DNA testing.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	1	-	2	-	2	1
CO2	3		3	2		2	-	3	1	2	1
CO3	3	1	3	2	1	2	1	3	1	2	1
CO4	3	-	3	3	1	2	1	3	1	3	1
CO5	3	1	2	2	3	3	2	3	1	3	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Genetics
Introduction to Genetics, Mendelian principles of inheritance, Non-Mendelian inheritance, Sex determination, Sex-linked, sex-limited, and sex-influenced inheritance patterns, Discovery and experimental evidence of genetic material, Composition and structural differences between prokaryotic and eukaryotic genetic material, Organization of DNA in chromosomes, Molecular Structure and Function of DNA & RNA.

Practice -Demonstration of DNA Extraction method.

UNIT – II: DNA Replication and Genetic Information Flow
Central Dogma of Life, DNA replication - Mechanism, enzymes involved, and models (semi-conservative, conservative, dispersive), Transcription: Process, factors, and post-transcriptional modifications, Genetic code: Characteristics, redundancy, and universality, Translation and protein synthesis: Ribosome structure, initiation, elongation, and termination. Genetic Mutations and Polymorphisms.

Practice -Demonstration of DNA Separation methods- Gel Electrophoresis.

UNIT – III: DNA Extraction, Quantification, and Separation Techniques
DNA Isolation and Extraction - Importance of DNA isolation in forensic analysis, Sources of DNA in forensic samples, Challenges in forensic DNA extraction (degradation, contamination, inhibitors), DNA Extraction Methods – Chemical and Physical DNA extraction methods, DNA Quantification Techniques - Slot Blot Assay, Fluorescent Intercalating Dye (FID) Assay, PCR-Based Quantification, DNA Separation Techniques - Supporting Matrices and their role in separation, Gel Electrophoresis – Principle, types (Agarose vs. PAGE), and forensic applications, Capillary Electrophoresis (CE) – Mechanism, and forensic applications.

Practice -Exploring DNA Databases for Forensic Applications

UNIT – IV: DNA Profiling
DNA Typing Techniques – VNTRs, RFLP, STRs, Multiplex STR, SNPs, Specialized DNA Analysis Methods – mtDNA, Y-Chromosome and X-Chromosome STR Analysis, Rapid DNA Testing, DNA Databases and Forensic Databanks - National and International DNA Databases – CODIS (USA), NDDB (India), UK NDNAD, Ethical and Legal Considerations – Privacy concerns, retention policies, and misuse prevention, Human Genome Project, and DNA Regulation Bill, 2019.

Practice -Extraction and Observation of DNA from Onion Cells

UNIT – V: Forensic Genomics and Bioinformatics
Introduction to Next-Generation Sequencing (NGS) in Forensic DNA Analysis, Population Genetics in Forensic DNA typing – Principle of Hardy-Weinberg Equilibrium (HWE) and its assumptions, Basics of DNA methylation and epigenetics, Introduction to bioinformatics and its application in Forensics Science. Integrated information retrieval. Major databases in bioinformatics (NCBI (National Center for Biotechnology Information), ENSEMBL (Genome browser for vertebrate genomes), GenBank (DNA sequence database), CODIS (Combined DNA Index System), YHRD (Y-Chromosome Haplotype Reference Database), mtDB (Mitochondrial DNA database).

Practice -Study of Barr Bodies in Buccal Smear Slides to Identify Genetic Sex in Females.

Activities
1. Visit to CDFD.
2. Visit to CCMB.

Textbooks:
1. Fundamentals of Genetics" by Peter J. Russell
2. Forensic DNA Biology: A Laboratory Manual" by Kelly M. Elkins

Reference Books:
1. Forensic DNA Typing" by John M. Butler
2. Principles of Genetics" by Snustad & Simmons

Web Links:

1. https://nij.ojp.gov/topics/forensics/dna-evidence
2. https://www.ncbi.nlm.nih.gov/genbank/
3. https://yhrd.org/
4. https://www.fbi.gov/services/laboratory/biometric-analysis/codis
5. https://www.genome.gov/human-genome-project

Forensic Physics and Ballistics

Course Code: 2509FS01

L	T	P	C
2	0	2	4

Semester- V

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental principles and classifications of firearms, ammunition, and their mechanisms.

CO2: Analyze the concepts of internal, external, and terminal ballistics, including trajectory computation and wound ballistics.

CO3: Examine and interpret forensic physics evidence such as glass, paint, and soil using qualitative and quantitative techniques.

CO4: Apply forensic engineering principles in the analysis of construction materials, structural failures, and crash investigations.

CO5: Evaluate speaker identification techniques and tape authentication through acoustic analysis and speech signal processing

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	1	1	2	1	2	1	2	1
CO2	3	2	3	2	2	2	1	3	1	2	1
CO3	3	1	3	2	1	2	-	3	1	2	1
CO4	3	1	3	3	1	2	1	3	1	3	1
CO5	3	-	3	2	2	2	2	3	1	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT - I: Introduction to Forensic Physics

Glass: Introduction, Types and Their Compositions, Glass Fractures and its Examination, Determination of Direction of Impact, Physical Examination & Interpretation of Glass Evidence and its Forensic Importance. Paint: Introduction, Composition and Classification, Qualitative and Quantitative Analysis of Paint Evidence Using Analytical Techniques and its Forensic Importance. Soil: Definitions, Formation, Types, Composition and Colour of Soil Evidence, Qualitative and Quantitative Analysis of Soil Evidence Using Advanced Techniques and its Forensic Importance.

Practice -Microscopic examination and comparison of soil, glass and paint chip samples from different locations.

UNIT - II: Basics of Firearm

Firearms: Definition, Characteristics, Classification, History and Background of Firearms. Functional Assembly & Operating Principle of Firearms. Characteristics & Working Mechanism of Standard: Rifled Firearms, Small Arms and Shotguns. Non-Standard: Improvised, Country Made and Imitative Firearms. Ammunition: Constructional Parts, Classification based on Constructional Features, Functional Assembly of Different Types of Ammunition & their Types. Safety Aspects for Handling Firearms and Ammunition, Cartridge - Firing Mechanism.

Practice -Identification and comparison of tool marks on various substrates (Fired Bullets, Cartridge case, etc).

UNIT - III: Internal, External and Terminal Ballistics

Internal Ballistics: Definition, General Elementary & Other Principle Problems - Heat Problems, Pressure, Recoil, Vibration, Jump, & Barrel Fouling. External Ballistics: Definition, Trajectory Formation, its Computation, Vacuum Trajectories, iIts Measurement, and Parameters Involved in Exterior Ballistics. Terminal Ballistics: Effect of projectile on target based on: nature of target, bullet shape, striking velocity, striking angle, intermediate targets, threshold velocity for penetration of skin / flesh / bones.

Practice -To calculate the angle of Yaw from the bullet trajectory.

UNIT - IV: Wound Ballistics and Gunshot Residues

Wound Ballistics: Threshold velocity for penetration of skin/flesh/bones, preparation of Gel Block, penetration in Gel Block and other targets. Nature of wounds - entry, exit, explosive wounds. Evaluation of Injuries, Post-mortem and Antemortem firearm injuries. Differentiating between Accidental and Suicidal Firing, Range of Firing. Gunshot Residues/ Powder Residues: GSR distribution, Location, source and collection of GSR, Reconstruction of sequence of events involved in a shooting case, analysis of GSR: Spot test, Chemical test, Identification of shooter.

Practice -Chemical Analysis of Gunshot Residue.

UNIT - V: Forensic Engineering

Introduction to Forensic Engineering Examination and Analysis of the Construction Materials, Sampling, Collection & Preservation of the Materials with Relevant Information Required for the Investigation. Determination of Adulterants by Physical, Chemical and Instrumental Methods. Investigation and Observation of Collapsed Structures & Causes of Failure, Vehicular accident Investigations, Railways accident Investigation and Flight crash Investigation.

Practice -Analysis of Building materials to determine Adulterants.

Activities:

1. Visit to Bell of Arms.

Textbooks:

1. Heard, B. J. (2008). *Handbook of firearms and ballistics: Examining and interpreting forensic evidence* (2nd ed.). Wiley.
2. Rathore, L. (2021). *Ballistic in forensic science*. Walnut Publication.
3.

Reference Books:

1. Mann, R. W., & Goliath, J. R. (2019). *Forensic firearm examination*. Academic Press.
2. Heard, B. J. (2013). *Forensic ballistics in court: Interpretation and presentation of firearms evidence*. Wiley-Blackwell.

Web Links:

1. https://www.nist.gov/firearms-and-toolmarks
2. https://www.scribd.com/document/457481678/FORENSIC-BALLISTIC-FINAL
3. https://www.hilarispublisher.com/open-access/unveiling-the-mysteries-of-forensic-ballistics-solving-crimes-one-bullet-at-a-time-99959.html
4. https://link.springer.com/article/10.1007/s11042-022-14037-x
5. https://dfsl.maharashtra.gov.in/en/ballistics

Forensic Psychology

Course Code: 2509FS02

L	T	P	C
3	0	1	4

Semester- V

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the legal aspects of forensic psychology.
CO2: To know the significance of criminal profiling.
CO3: Explain the importance of psychological assessment in gauging criminal behaviour.
CO4: Understand the psychology legal proceedings.
CO5: Explain the critical assessment of advanced forensic techniques like polygraphy, narco analysis and brain electrical oscillation signatures.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	2	3	2	2	2	1	2	2
CO2	3	-	1	2	2	2	1	2	-	2	1
CO3	3	-	1	3	2	2	1	3	-	2	1
CO4	3	1	1	2	3	2	3	2	1	2	2
CO5	3	-	2	2	2	2	2	3	1	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	2
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Basics of Forensic Psychology

Definition, History and Fundamental Concepts of Forensic Psychology and Forensic Psychiatry. Laws Related to Forensic Psychology and Ethical issues. Assessment of mental competency. Different types of mental disorders. Psychology of evidence – Eyewitness testimony, Confession evidence, and Criminal profiling. Psychology in the courtroom, with special reference to Section 22 BNS.

Practice- To evaluate personality traits using the NEO-PI-3 and analyse differences among individuals based on the Five-Factor Model.

UNIT – II: Psychology and Criminal Behaviour

Psychopathology and Personality Disorder. Psychological Assessment and its importance. Serial murderers, Psychology of Terrorism, Biological Factors and Crime – Social Learning Theories, and Psycho-Social Factors. Juvenile delinquency – Theories of Offending (Social Cognition, Moral Reasoning), Child Abuse (Physical, Sexual, Emotional), Juvenile Sex Offenders, and Legal Controversies.

Practice- To analyse unconscious thought processes and personality traits through the Rorschach InkBlot Test.

UNIT – III: Psychological Disorders
Classification of Psychiatric disorders. Common Psychiatric Disorders - Schizophrenia, Bipolar Disorders, Anxiety Disorders, Phobia, Personality Disorder, and Attention Deficit Hyperactivity Disorder. Psychology of Serial murderers and terrorism. Use of Media and Intelligence for Commission of Crime, Gender Justice and Crime.

Practice- Detection of Deception Using Polygraph Testing.

UNIT – IV: Psychology in Legal Proceedings
Competency to Stand Trial and Criminal Responsibility – Eyewitness Testimony, Memory Recall and False Confessions. Role of Expert Witness in Court – Impact of Media on Legal Proceedings, Jury Decision Making and Psychological Influence – Psychology of False Allegation.

Practice- To assess cognitive abilities in individuals aged 11-16 using the Bhatia Battery of Performance Intelligence Test.

UNIT - V: Interrogative techniques and Forensic Psychiatry
History, Objectives, Principle, Procedure, Stages of Examination, Admissibility & Importance of: Polygraph (Lie detection), Brain Fingerprinting/Brain Mapping, Narco analysis, Brain Electrical Oscillation Signature Profiling (BEOS) and LVA. NHRC Guidelines, Admissibility in Court. Forensic Psychiatry – Delirium, Delusion, Hallucination, Illusion, Impulse and Psychopath.

Practice- BEOS Profiling in Psychological Assessment.

Activities
1. Visit to the Rehabilitation Centre.

Textbooks:

1. Bartol, C. R., & Bartol, A. M. (2021). *Introduction to forensic psychology: Research and application* (6th ed.). Sage Publications.
2. Wrightsman, L. S. (2001). *Forensic psychology*. Wadsworth/Thomson Learning.

Reference Books:

1. Melton, G. B., Petrila, J., Poythress, N. G., & Slobogin, C. (2007). *Psychological evaluations for the courts: A handbook for mental health professionals and lawyers* (3rd ed.). The Guilford Press.
2. Roesch, R., Zapf, P. A., & Hart, S. D. (Eds.). (2009). *Forensic psychology and law*. Wiley.

Web Links:

1. https://www.open.edu/openlearn/health-sports-psychology/forensic-psychology/content-section-overview?utm_source=chatgpt.com&active-tab=description-tab
2. https://www.apa.org/
3. https://www.apa.org/ed/graduate/specialize/forensic
4. https://www.verywellmind.com/an-overview-of-forensic-psychology-2794901
5. https://psychology.org.au/psychology/about-psychology/types-of-psychologists/forensic-psychology

Multimedia Forensics

Course Code: 2509FS03

L	T	P	C
2	0	2	4

Semester- V

Course Outcomes:

At the end of the course, students will be able to:

CO1: Analyze digital images, videos, and audio for forensic investigations.
CO2: Detects and investigates forgery, tampering, and deep fake content.
CO3: Apply forensic techniques to extract and authenticate multimedia metadata.
CO4: Use forensic tools to enhance, recover, and validate multimedia evidence.
CO5: Understand legal frameworks and ethical concerns in multimedia forensics.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	3	2	1	2	1	3	1	2	2
CO2	3	1	3	2	2	2	2	3	1	3	2
CO3	3	-	3	2	1	2	1	3	-	2	1
CO4	3	1	3	2	1	2	1	3	1	2	1
CO5	3	-	1	2	3	2	2	2	1	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Introduction to Multimedia Forensics

Introduction to multimedia forensics: definition, importance, and applications in law enforcement, journalism, and cybercrime investigations. Types of multimedia evidence: images, videos, audio, and metadata. Basic principles of digital imaging: pixel representation, compression techniques for formats (JPEG and MPEG), and steganography. Role of metadata in forensics: EXIF data, geotagging, timestamps, and device identification. Challenges in multimedia forensics: format inconsistencies, data manipulation, and storage artifacts.

Practice- Metadata extraction from images and videos.

UNIT – II: Image Forensics

Image authentication techniques: source camera identification, sensor noise analysis, and PRNU (Photo Response Non-Uniformity). Image forgery detection: copy-move forgery, splicing,

resampling, and compression artifacts. Steganalysis: detecting hidden messages using statistical and deep learning techniques. Image enhancement and recovery: sharpening, denoising, contrast adjustments, and restoration of degraded images. Forensic tools for image analysis: Amped Authenticate, Ghiro.

Practice- Detecting image tampering using PRNU, error level analysis, and machine learning techniques.

UNIT – III: Video Forensics

Video evidence acquisition: sources, formats, frame rates, and encoding techniques. Video forgery detection: frame duplication, frame insertion/deletion, and inter-frame inconsistencies. Deepfake detection: AI-based manipulation techniques, facial morphing, and deep learning models for detecting synthetic content. Video enhancement techniques: stabilization, noise reduction, and motion analysis. Tools for video forensics: Amped FIVE, FFmpeg, VideoCleaner, and Deepware Scanner.

Practice- Video analysis for frame manipulation and deepfake detection.

UNIT – IV: Audio Forensics

Fundamentals of digital audio: sampling, bitrate, codecs, and compression techniques. Audio authentication: voice profiling, microphone forensics, and tampering detection. Noise reduction and speech enhancement techniques. Speaker identification and voice cloning detection. Deepfake audio detection and forensic speaker verification. Forensic tools for audio analysis: Adobe Audition, Praat, GoldWave, and WaveSurfer.

Practice- Audio enhancement and forensic analysis of voice recordings.

UNIT – V: Legal and Ethical Aspects of Multimedia Forensics

Legal admissibility of multimedia evidence: chain of custody, authenticity verification, and digital rights management (DRM). Cyber laws related to multimedia evidence: IT Act 2000 (Digital India Act, 2023), GDPR, copyright laws, and ethical guidelines. Privacy concerns in multimedia forensics: ethical hacking, consent-based investigations, and the impact of manipulated media. Case studies on multimedia forensics: high-profile digital forgery cases, fake news detection, and forensic applications in cybercrime investigations.

Practice- Using forensic tools such as Amped Authenticate, Forensically, Deepware Scanner, and Adobe Audition.

Textbooks:

1. Multimedia Forensics by Husrev Taha Sencar and Nasir Memon
2. Multimedia Forensics and Security: Foundations, Innovations, and Applications edited by Chang-Tsun Li

Reference Books:

1. Handbook of Digital and Multimedia Forensic Evidence by John J. Barbara
2. Malware Forensics: Investigating and Analyzing Malicious Code by Cameron H. Malin, Eoghan Casey, and James M. Aquilina

Web Links:

1. https://www.nist.gov/itl/iad/multimedia-forensics
2. https://deepware.ai/
3. https://detectdeepfakes.mit.edu/
4. https://29a.ch/photo-forensics/
5. https://library.oapen.org/handle/20.500.12657/54043

Multidisciplinary Courses (MDC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS32	II	Fundamentals of Cyber Security	FC	2			2	50	50	100	-
2509FS04	V	Cyber Law	AC	2			2	50	50	100	-
2509FS05	VI	Cyber Criminology	AC	3			3	50	50	100	-
Total				7			**7**				

Fundamentals of Cyber Security

Course Code: 2509FS32 L T P C
Semester- II 2 0 0 2

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental principles of cybersecurity, cyber threats, and vulnerabilities.

CO2: Analyze various attack types, including malware, phishing, and social engineering, and implement countermeasures.

CO3: Demonstrate knowledge of cryptographic techniques and secure communication protocols.

CO4: Apply digital forensics methodologies to investigate security incidents and data breaches.

CO5: Assess cybersecurity frameworks, laws, and ethical considerations in securing digital assets.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2	2	2	2	1	2	1	2	2
CO2	3	1	3	2	2	2	1	3	1	3	2
CO3	3	-	3	2	2	2	-	3	-	3	1
CO4	3	1	3	2	2	2	1	3	1	3	1
CO5	3	-	2	2	3	3	2	3	1	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	2

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Cyber Security

Overview of Cyber Security: Definition, Scope, and Importance; Cyber Threats and Attack Vectors: Malware, Phishing, Ransomware, Insider Threats; Security Concepts: Confidentiality, Integrity, Availability (CIA Triad); Cybersecurity Frameworks: NIST, ISO 27001, OWASP; Cyber Risk Management & Security Policies; Security Incident Handling and Response.

UNIT – II: Cryptography and Secure Communication

Introduction to cryptography: historical perspective and modern-day cryptographic algorithms. Symmetric and asymmetric encryption: AES, DES, RSA, and ECC. Hashing techniques: MD5, SHA-1, SHA-256. Digital signatures and Public Key Infrastructure (PKI). Secure network protocols: HTTPS, TLS/SSL, VPNs, and end-to-end encryption. Cryptanalysis techniques and common vulnerabilities in cryptographic systems.

UNIT – III: Cyber Threats and Attacks

Classification of cyber threats: malware, phishing, denial-of-service (DoS), and advanced persistent threats (APTs). Network-based attacks: man-in-the-middle (MITM), DNS spoofing, and packet sniffing. Social engineering techniques and countermeasures. Emerging threats: IoT-based attacks, ransomware, and supply chain attacks. Case studies of significant cyber incidents.

UNIT – IV: Network Security and Firewalls

Basics of network security: TCP/IP vulnerabilities, network attacks, and defense mechanisms. Firewalls: types, working principles, and configuration. Intrusion Detection and Prevention Systems (IDS/IPS). Securing wireless networks: WPA, WPA2, WPA3. Virtual Private Networks (VPNs) and secure remote access. Basics of cloud security and Zero Trust Architecture.

UNIT – V: Cyber Crime Investigation & Forensic Tools

Cyber Crime Categories: Identity Theft, Financial Fraud, Cyber Terrorism; Digital Forensic Tools: Autopsy, FTK, EnCase, Volatility; Memory Forensics & Log Analysis; Email and Mobile Forensics: Data Extraction and Analysis; Network Forensics: Packet Analysis, Wireshark, Snort; Case Studies: Notable Cybercrime Investigations.

Textbooks:

1. William Stallings – *Cryptography and Network Security: Principles and Practice*
2. Eoghan Casey – *Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet*

Reference Books:

1. Bruce Schneier – *Applied Cryptography: Protocols, Algorithms, and Source Code in C*
2. Nelson Phillips & Enfinger Steuart – *Guide to Computer Forensics and Investigations*

Web Links:

1. https://www.nist.gov/cyberframework
2. https://owasp.org/
3. https://www.sans.org/
4. https://www.eccouncil.org/
5. https://zoboko.com/book/jvxqg19r/fundamentals-of-cyber-security

Cyber Law

Course Code: 2509FS04 L T P C
Semester- V 2 0 0 2

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the foundational principles of cyber law, its evolution, and its role in regulating cyberspace and digital activities.

CO2: Analyze various types of cybercrimes and apply relevant legal frameworks, including national and international provisions, to address and mitigate these offenses.

CO3: Evaluate the legal aspects of e-commerce transactions, data protection laws, and their implications for consumer rights and cross-border data management.

CO4: Examine the legal frameworks governing cybersecurity, encryption, and intellectual property rights in cyberspace, and apply them to real-world scenarios.

CO5: Explore the emerging legal and ethical challenges associated with advanced technologies like AI, IoT, and blockchain, and propose legal strategies to address these issues effectively.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	2	3	2	2	2	-	2	2
CO2	3	1	1	2	3	2	2	2	-	2	2
CO3	3	-	1	2	3	2	1	2	-	2	2
CO4	3	-	2	2	3	2	2	2	-	2	2
CO5	3	-	2	3	3	2	2	3	1	3	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	3

Unit-Wise Syllabus:

UNIT – I: Introduction to Cyber Law

Definition, Importance, and Need for Cyber Law. Evolution and History of Cyber law, Overview of the Information Technology Act 2000 (Digital India Act, 2023), Amendments, and Key Provisions. Legal Recognition of Electronic Records, Digital Signatures, and Electronic Governance. Overview of National and International Cyber Law Frameworks.

UNIT – II: Cybercrimes and Legal Frameworks
Classification of cybercrimes: hacking, identity theft, cyberbullying, and cyberstalking. Legal provisions for cyber offenses under global frameworks. Introduction to Indian IT Act, 2000 (basic concepts). Role of international bodies in cybercrime regulation. Case studies on the application of laws in cybercrime investigations.

UNIT – III: E-Commerce and Data Protection Laws
Legal framework governing e-commerce transactions: digital contracts, e-signatures, and consumer rights. Overview of the General Data Protection Regulation (GDPR). Comparative analysis of GDPR with Indian data protection frameworks (e.g., Personal Data Protection Bill). Laws related to the regulation of payment systems and digital wallets. Cross-border data transfer regulations and challenges.

UNIT – IV: Cybersecurity and Intellectual Property Laws
Legal provisions for cybersecurity and critical infrastructure protection (e.g., Section 70 of IT Act). Laws related to encryption and decryption in India and internationally. Intellectual property issues in cyberspace: copyright infringement, software piracy, and cybersquatting. Case studies on IP disputes in digital spaces. Emerging frameworks for protecting AI-generated content.

UNIT – V: Emerging Laws and Ethical Issues in Cyberspace
Legal implications of AI, IoT, blockchain, and cryptocurrencies (e.g., recent legislation on crypto assets). Challenges in regulating deepfakes and virtual reality environments. International laws addressing cyber terrorism and cross-border cybercrimes. Ethical issues in cyberspace and the role of cyber ethics frameworks. Future trends and potential reforms in cyber law.

Textbooks:
1. Pavan Duggal – *Cyber Law: The Indian Perspective*
2. Kumar Saurabh – *Fundamentals of Cyber Law and Cyber Security*

Reference Books:
1. Anirudh Rastogi – *Cyber Law: Law of Information Technology and Internet*
2. Nandan Kamath – *Law Relating to Computers, Internet & E-Commerce*

Web Links:
1. https://www.geeksforgeeks.org/what-is-cyber-law/
2. https://www.simplilearn.com/what-is-cyber-law-article
3. https://www.meity.gov.in/cyber-laws
4. https://www.india.gov.in/topics/law-justice/cyber-law
5. https://emeritus.org/in/learn/cyber-law/

Cyber Criminology
Semester VI

Course Code: 2509FS05 L T P C
Semester- VI 3 0 0 3

Course Outcomes:

At the end of the course, students will be able to:

CO1: Demonstrate an understanding of the fundamental concepts of cyber criminology, including its scope, historical evolution, and the classification of cybercriminals, as well as the societal and individual impacts of cybercrime.

CO2: Identify and classify various types of cybercrimes, analyze techniques used in cyber offenses, and evaluate case studies to understand the operations of cybercriminal networks and the dark web.

CO3: Analyze the psychological and sociological factors influencing cybercriminal behavior, applying relevant criminological theories to understand offender motivations and behavioral patterns.

CO4: Apply investigative techniques and digital forensic methodologies to identify and collect digital evidence, ensuring adherence to best practices in cybercrime investigation and evidence handling.

CO5: Examine emerging trends in cybercrime, including the misuse of advanced technologies, and propose strategies to address ethical challenges and future threats in the field of cyber criminology.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	3	3	2	2	2	-	2	2
CO2	3	1	2	3	3	2	2	3	1	3	2
CO3	3	-	1	3	3	2	1	3	-	3	2
CO4	3	2	3	2	2	2	2	3	1	2	2
CO5	3	-	2	3	3	2	2	3	1	3	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT – I: Introduction to Cyber Criminology

Definition, scope, and importance of cyber criminology. Evolution and history of cybercrime. Types of cybercriminals: hackers, fraudsters, cyberterrorists, cyberstalkers, and online predators.

Cybercrime statistics and emerging trends. Impact of cybercrime on society, businesses, and individuals. Interdisciplinary role of criminology in digital offense analysis.

UNIT – II: Types and Techniques of Cyber Offenses
Classification of cybercrimes: financial fraud, identity theft, cyberstalking, cyberbullying, child exploitation, and cyber espionage. Understanding the dark web and cybercriminal networks. Techniques used in cyber offenses: phishing, ransomware, trojans, spyware, and advanced persistent threats (APT). Case studies of significant cybercrime incidents.

UNIT – III: Behavioral and Sociological Aspects of Cyber Offenders
Psychological traits and motivations of cybercriminals. Online disinhibition effect and the role of anonymity. Theories explaining cybercriminal behavior: Routine Activity Theory, Strain Theory, and Social Learning Theory. Social media influence on cyber deviance. Profiling and behavioral analysis of cyber offenders.

UNIT – IV: Investigative Approaches in Cybercrime
Introduction to digital forensics in cybercrime investigation. Types of digital evidence: logs, metadata, emails, and network packets. Techniques in cybercrime investigation: live forensics, mobile forensics, and network forensics. Use of AI and machine learning in cybercrime detection. Best practices in evidence handling and chain of custody. Cybercrime prevention strategies.

UNIT – V: Future Trends and Ethical Challenges in Cybercrime
Emerging technologies and their misuse: AI, deepfakes, IoT vulnerabilities, and metaverse crimes. Role of cryptocurrencies and blockchain in cyber offenses. Ethical hacking and penetration testing as countermeasures. Predictive modeling and threat intelligence in cybercrime prevention. Societal and ethical challenges in combating cybercrime.

Textbooks:

1. K. Jaishankar – *Cyber Criminology: Exploring Internet Crimes and Criminal Behavior*
2. Debarati Halder & K. Jaishankar – *Cyber Crime and Victimization of Women: Laws, Rights, and Regulations*

Reference Books:

1. David S. Wall – *Cybercrime: The Transformation of Crime in the Information Age*
2. George Weimann – *Cyberterrorism: How Real is the Threat?*

Web Links:

1. https://cybercrime.gov.in/
2. https://www.coe.int/en/web/cybercrime
3. https://www.interpol.int/Crimes/Cybercrime
4. https://www.bbau.ac.in/dept/Law/TM/1.pdf
5. https://criminology.fsu.edu/sites/g/files/upcbnu3076/files/2022-04/Cyber-Criminology-Flowchart.2022.pdf

Ability Enhancement Courses (AEC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS33	I	Essential Cognitive Skills for Graduates	FC			1	1	100	-	100	-
2509FS34	II	Advanced Cognitive Skills for Graduates	FC			1	1	100		100	ECS
2509FS35	II	Human Values and Professional Ethics	FC				2	50	50	100	-
2509FS55	IV	Forensic Report Writing	IC	2			2	50	50	100	-
2509FS67	V	Intellectual Property Right & Patents	AC	2			2	50	50	100	-
2509FS07	VI	Student Activity Based Learning	AC				2	-	-	-	-
Total				**6**	**0**	**2**	**10**				

Essential Cognitive Skills for Graduates
Semester I
(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS33

Semester- I	L	T	P	C
Course Outcomes:	0	0	1	1

At the end of the course, student will be able to:

CO1: Recognize the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2: Apply communication skills through various language learning activities.
CO3: Analyze the English speech sounds, stress, intonation and syllable division for better listening and speaking comprehension.
CO4: Enable them to learn and apply fundamentals of English grammar concepts for improved language.
CO5: Make use of various types of vocabulary in different academic and professional careers.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	-	-	-	-	-	1	3	2	1	-	3
CO2	-	-	-	-	-	2	3	2	1	-	3
CO3	-	-	-	-	-	1	3	2	-	-	3
CO4	-	-	-	-	-	2	2	1	-	-	2
CO5	-	-	-	-	-	1	2	2	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Outstanding people A/B/C/D
Listening: Conversation about Jocelyn Bell- Burnell, Podcast: The 30-day challenge, Starting a new job, Conversation about technology
Speaking: Discussing inspiring people, Asking and answering questions about challenges, explaining a process; Checking understanding, Discussing technology.

Reading Articles: *Protector of the sea* and the woman *who reinvented children's TV, Interviews*: 30-day challenge, Article: *Tech free!*
Writing: Article Organizing an article
Grammar: Review of Tenses, Questions
Vocabulary: Character adjectives, trying and succeeding
Pronunciation: The letter *e*; Word stress, Rapid speech

UNIT II: Survival A/B/C/D
Listening: Conversation about a survival situation, Interview: The Tiger, Cooking for a friend, talking about getting lost.
Speaking Telling a survival story, giving advice; Asking questions, giving compliments and responding, Discussing the natural environment.
Reading Article: Lost at sea, Leaflet: *How to survive…an animal attack,* Leaflet: Be wise and survive.
Writing Guidelines, organizing guidelines in a leaflet.
Grammar Narrative tenses, Future time clauses and conditionals.
Vocabulary Expressions with *get*, Animals and the environment.
Pronunciation Sound and Spelling: *g*, Intonation in question tags.

UNIT III: Talent A/B/C/D
Listening: Conversation: learning experiences, Radio Programme: The sports gene, Making wedding plans, Interviews about sport.
Speaking: Talking about something you have put a lot of effort into, discussing sport and ways to improve performance, planning a party, Talking about popular sports.
Reading Text about learning; *Learning to learn*, Article: *Born to be the best*; Three articles about athletes, Article: Fitness: Seattle snapshot.
Writing: Article describing data.
Grammar: Multi-word verbs, Present perfect and present perfect continuous.
Vocabulary: Ability and achievement, word connected with sport.
Pronunciation Word stress, sound and spelling consonant sounds.

UNIT IV: Life Lessons A/B/C/D
Listening Interview: Psychology of money; Two monologues: Life-changing events, Two monologues; training for a job, Presenting photos, Three monologues; living in different places.
Speaking: Talking about how your life has changes, discuss experiences of training and rules, describing photos: Expressing careful disagreement, Discussing living in a different country.
Reading: Two texts about life-changing events that helped people become rich, Article: *Training for the emergency frontline,* Advert for being an international student 'buddy
Writing: Job application, giving a positive impression.
Grammar: *Used to* and *would*.
Vocabulary: Cause and result, Talking about difficulty Pronunciation Sound and spelling: *u*

UNIT V: Chance A/B/C/D

Listening Monologue: What are your chances? Conversation: Talking about work, Money problems, News reports: environmental problems.
Speaking: Discussing possible future events, Role Play: job interview, Explaining and responding to an idea for a café, Giving opinions on environmental problems.
Reading Quiz: Are you an optimist or a pessimist? Article: Why we think we're going to have a long and happy life, Quiz: The unknown continent; Article: Cooking in Antarctica, Essay about protecting the environment.
Writing: For and against essay, Arguing for and against an idea.
Grammar: Future probability, Future perfect and future continuous.
Vocabulary: Adjectives describing attitude, The natural world.
Pronunciation: Sound and spelling : *th*, Intonation groups.

Text Book:

1. Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones. ISBN: 978-1107468726.

Suggested Software:

1. Cambridge Empower
2. Soft X (K-Van Solutions)

Reference Books:

1. Effective Technical Communication, M Ashraf Rizvi, ISBN: 9352605780.
2. Raymond Murphy: English Grammar in Use, Cambridge University Press. Fifth Edition, ISBN: 978-3125354241.
3. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013, ISBN: 9788120314955

Web Links:

1. www.cambridgeone.org/login
2. https://www.britishcouncil.in/english/online
3. www.englishmedialab.com

Advanced Cognitive Skills for Graduates

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS34

Semester- II	L	T	P	C
Course Outcomes: At the end of the course, student will be able to:	0	0	1	1

CO1: Recognize the basics of communication and summarize formal and informal language expressions in all aspects.
CO2: Establish and maintain interpersonal relationships and transmit the message through different language activities.
CO3: Use language effectively to prepare and demonstrate proficiency in facing various types of interviews.
CO4: Demonstrate and exhibit professionalism in participating in various public speaking activities like debates, group discussions and presentation skills.
CO5: Identify the basic elements of writing and apply the fundamentals to compose e-mails catering to different professional needs.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	-	-	-	-	-	1	3	2	1	-	3
CO2	-	-	-	-	-	1	3	2	2	-	3
CO3	-	-	-	-	-	2	3	2	2	-	3
CO4	-	-	-	-	-	2	3	2	2	-	3
CO5	-	-	-	-	-	2	2	1	1	-	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus

UNIT I: Around the globe A/B/C/D

Listening: Two monologues about sightseeing tours, Interview: disappearing languages, Asking for a favour, conversation: a trip to the Grand Canyon
Speaking: Comparing different tourist destinations, Agreeing and disagreeing, Asking for a favour, Discussing local tourist destinations.
Reading: Website bout four tourist destinations; Website: *Where to go?*
Writing: Travel blog, Using descriptive language
Grammar: Infinitives and *–ing* forms

Vocabulary: Travel and tourism, Describing changes Pronunciation Consonant clusters, Consonant sounds

UNIT II: City living A/B/C/D

Listening: Interview: 'Smart' cities: Two monologues talking about 'smart' cities, Two monologues: house renovations, Flat hunting, Interviews about a new shopping centre
Speaking: Discussing good and bad points about a city
Reading: Article: *Quick-slow down!* Article: *Who puts the 'real' in reality TV?* Email: Complaining about an important issue.
Writing: Email of complaint, Using formal language
Grammar: *Too/enough*; so/such, Causative *have/get*
Vocabulary Describing life in cities, Film and TV; Houses
Pronunciation Sound and spelling: *o*, Stress in compound nouns.

UNIT III: Dilemmas A/B/C/D

Listening: Radio programme: person finance, three monologues about honesty, Going to the bank, Conversation about a TV programme
Speaking: Giving opinions on financial matters, discussing moral dilemmas, talking about hopes and worries Discussing programmes about crime
Reading: Article*: Is it time to give up on cash?* Newspaper article: *The honesty experiment*, Review: *Crime with a smile*
Writing Review, organising a review
Grammar: First and second conditionals, third conditional; *should have+past participle*
Vocabulary: Money and finance, Crime
Pronunciation: Stressed and unstressed words; Sound and spelling: *l*, Word groups

UNIT IV: Discoveries A/B/C/D

Listening: Conversation about inventions, Conversation about an email hoax, Finding the perfect flat, Four monologues about alternative medicine
Speaking: Talking about inventions, describing a hoax or a scam or a case of fraud, Giving and receiving surprises
Reading: Article: *Too good to be true?* Article: *The rise and fall of Barry Minkow, Essay: The Value of alternative medicine*
Writing: Opinion essay, presenting a series of arguments
Grammar Relative clauses, Reported speech; Reporting verbs
Vocabulary Health, Verbs describing thought and knowledge Pronunciation Sound and spelling : *ui*, Linking and intrusion

UNIT V: Possibilities A/B/C/D

Listening: Interview about Dan Cooper, Two monologues: pursuing a dream, Celebrating good news, conversation about goals
Speaking: Telling stories about coincidences, Describing and comparing brave or amazing people, telling an important piece of news, Talking about performing

Reading: Story: The man who disappeared; Blog: *The Wreck of the Titan*, Article: *Dream to help*, Story: Rosa's diary: *The ultimate goal*
Writing: Story, making a story interesting
Grammar Past modals of deduction, Wishes and regrets
Vocabulary Adjectives with prefixes, Verbs of effort
Pronunciation Word stress, Linking, Consonant clusters

Text Book:

1. Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones. ISBN: 978-1107468726

Suggested Software:

1. Cambridge Empower
2. Soft X (K-Van Solutions)

Reference Books:

1. Technical Communication. Raman Meenakshi, Sangeeta-Sharma. Oxford University Press.2018, ISBN: 97893549772256.
2. Practical English Usage -Michael Swan, ISBN: 9780194202466
3. English Conversation Practice, Taylor Grant: Tata McGraw-Hill Education India, ISBN: 978-0070996038.

Web links:

1. https://www.cambridgeone.org/login
2. https://www.coursera.org/
3. https://www.skillshare.com/
4. https://www.mindtools.com/cawh8bu/communication-tools

Human Values and Professional Ethics

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS35

Semester- II	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: Understand the importance of human values and ethics in personal and professional life.

CO2: Analyze ethical dilemmas and develop decision-making skills based on ethical principles.

CO3: Foster a sense of responsibility, empathy, and social awareness in diverse scenarios.

CO4: Apply ethical frameworks to real-world problems in various fields.

CO5: Promote a balanced and value-driven lifestyle for personal and societal well-being.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	-	2	3	2	2	2	2	1	2
CO2	1	-	-	2	3	2	2	3	2	1	2
CO3	-	-	-	2	3	1	2	2	3	1	3
CO4	1	-	-	3	3	2	2	3	2	2	2
CO5	-	-	-	2	3	1	2	2	3	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Unit-Wise Syllabus:

UNIT I: Fundamentals of Human Values

Definition and significance of human values. Universal values: truth, compassion, non-violence, empathy, and integrity. Importance of self-awareness and emotional intelligence. Role of values in shaping character and fostering interpersonal relationships.

UNIT II: Ethics and Ethical Decision-Making

Definition and importance of ethics. Difference between ethics, morals, and laws. Ethical theories: utilitarianism, deontology, and virtue ethics. Frameworks for resolving ethical dilemmas. Role of ethical reasoning in personal and societal decision-making.

UNIT III: Professional Ethics and Workplace Dynamics
Principles of professional ethics: integrity, transparency, and accountability. Codes of conduct and corporate social responsibility (CSR). Ethical leadership and workplace diversity. Ethical challenges: conflicts of interest, harassment, and whistleblowing. Promoting inclusivity and respect in professional environments.

UNIT IV: Values and Ethics in Technology and Society
Ethical implications of technological advancements. Data privacy, artificial intelligence, and digital rights. Ethical challenges in technology: cybersecurity threats, misinformation, and digital inequality. Responsibility in the ethical use of technology for societal well-being.

UNIT V: Cultivating Ethical Behavior and Global Perspectives
Development of moral courage, empathy, and conflict resolution skills. Cross-cultural ethics and global citizenship. Addressing environmental sustainability, social justice, and global inequality. Integration of human values and ethics into personal and professional life.

Textbooks

1. "Human Values and Professional Ethics" by R.R. Gaur, R. Sangal, and G.P. Bagaria. Excel Books.
2. A comprehensive textbook focusing on value-based education and "Professional Ethics and Human Values" by M. Govindarajan, S. Natarajan, and V.S. Senthilkumar. PHI Learning.

Reference Books

1. "Moral Issues in Business" by William H. Shaw and Vincent Barry. Cengage Learning.
2. "Values and Ethics for Organizations: Theory and Practice" by Chakraborty S.K. Oxford University Press.

Weblinks

1. https://www.socialworkers.org/About/Ethics/Code-of-Ethics/Code-of-Ethics-English?utm
2. https://hass.mines.edu/nature-and-human-values/?utm_
3. https://plato.stanford.edu/entries/ethics/
4. https://www.unesco.org/en/ethics
5. https://pll.harvard.edu/course/ethics-action

Forensic Report Writing

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS55

Semester- IV	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: Understand the principles and formats of forensic report writing for legal and investigative purposes.

CO2: Develop skills to write clear, concise, and objective forensic reports.

CO3: Analyze evidence and present findings in an accurate, legally admissible format.

CO4: Ensure reports comply with ethical and professional standards.

CO5: Communicate forensic results effectively to legal professionals and stakeholders.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	3	3	3	2	2	1	2
CO2	3	1	2	-	2	3	3	2	2	-	2
CO3	3	2	3	-	3	3	3	3	2	-	2
CO4	2	-	-	1	3	2	2	2	2	1	2
CO5	2	1	1	-	3	2	3	2	2	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT I: Fundamentals of Forensic Report Writing

Definition and significance of forensic report writing. Principles of effective technical writing. Structure and components of forensic reports. Importance of clarity, brevity, and precision in report writing. Role of reports in forensic investigations and legal contexts.

UNIT II: Types of Forensic Reports

Classification of forensic reports: analytical reports, expert opinion reports, and crime scene reports. Characteristics of preliminary and final reports. Reporting for different forensic disciplines: toxicology, ballistics, serology, and digital forensics. Examples and templates for various types of forensic reports.

UNIT III: Report Writing Process and Documentation Standards
Steps in report preparation: data collection, analysis, interpretation, and presentation. Documentation standards for forensic reports, including formatting, citations, and referencing. Use of tables, graphs, and photographs in reports. Ensuring objectivity and avoiding biases in reporting. Handling confidential and sensitive information.

UNIT IV: Legal Aspects and Court Presentation of Reports
Admissibility of forensic reports as evidence in court. Legal terminology and requirements for forensic documentation. Role of an expert witness in presenting reports in court. Importance of accuracy and integrity in report writing. Common legal challenges and errors in forensic reports.

UNIT V: Emerging Trends and Technologies in Forensic Report Writing
Advancements in forensic documentation tools and software. Integration of artificial intelligence and machine learning for automated report generation. Digital reporting platforms and paperless documentation systems. Use of blockchain technology for secure and tamper-proof forensic documentation. Future trends in enhancing the accuracy, accessibility, and efficiency of forensic report writing.

Textbooks

1. Forensic Science: An Introduction to Scientific and Investigative Techniques by Stuart H. James, Jon J. Nordby, and Suzanne Bell
2. Forensic Science Handbook, Volume 1 by Richard Saferstein

Reference Books

1. Forensic Testimony: Science, Law and Expert Evidence by C. Michael Bowers
2. Expert Report Writing in Toxicology: Forensic, Environmental, and Industrial Applications by Michael D. Coleman

Weblinks

1. https://nij.ojp.gov/topics/forensics
2. American Academy of Forensic Sciences (AAFS)
3. SWGDE (Scientific Working Group on Digital Evidence)
4. https://www.salvationdata.com/work-tips/write-a-forensic-report/?utm
5. https://www.sifsindia.com/blog-details/forensic-report-writing-best-practices?utm

Intellectual Property Rights and Patents

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS67

Semester- V	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: Understand the fundamental concepts of Intellectual Property Rights (IPR) and their significance in innovation, business, and legal frameworks.

CO2: Analyze various types of intellectual property, including patents, copyrights, trademarks, trade secrets, and geographical indications, along with their legal protections.

CO3: Develop the ability to navigate the patent filing process, including patent search, drafting, and examination, while understanding the criteria for patentability.

CO4: Apply knowledge of IPR enforcement mechanisms, dispute resolution strategies, and legal frameworks to address infringement and ethical considerations.

CO5: Explore emerging trends in IPR, including digital copyright, AI-driven intellectual property, and career opportunities in the field of intellectual property law and consultancy.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2	2	3	2	2	2	2	1	2
CO2	2	1	2	-	2	2	2	2	2	-	2
CO3	2	2	3	-	3	2	2	2	2	-	2
CO4	2	-	-	1	3	2	2	2	2	1	2
CO5	2	1	1	-	3	2	3	2	2	-	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	3
CO5	2	-

Unit-Wise Syllabus:

UNIT I: Introduction to Intellectual Property Rights (IPR)

Definition and Scope of IPR, Importance of Intellectual Property in Innovation and Business, Types of Intellectual Property (Patents, Trademarks, Copyrights, Trade Secrets, Industrial Designs, Geographical Indications), International Treaties and Conventions on IPR (TRIPS, WIPO, Berne Convention, Paris Convention).

UNIT II: Patents – Fundamentals and Procedures
Definition and Importance of Patents, Criteria for Patentability, Types of Patents (Utility, Design, Plant), Patent Filing Process (National and International), Patent Search and Examination, Patent Drafting and Specification, Rights and Obligations of Patentees, Duration and Renewal of Patents.

UNIT III: Copyrights and Related Rights
Definition and Scope of Copyright, Works Protected Under Copyright Law, Rights of Copyright Owners, Limitations and Exceptions (Fair Use Doctrine), Copyright Infringement and Remedies, Copyright Registration Process, Digital Copyright and Protection Against Online Piracy**.**

UNIT IV: Trademarks and Brand Protection
Definition and Importance of Trademarks, Types of Trademarks (Word Marks, Logos, Certification Marks, Collective Marks), Trademark Registration Process, Infringement and Passing Off, Remedies for Trademark Violation, Role of Trademarks in Brand Identity and Business Growth.

UNIT V: Trade Secrets and Industrial Designs
Definition and Importance of Trade Secrets, Trade Secret Protection Strategies, Differences Between Patents and Trade Secrets, Legal Framework for Trade Secrets, Industrial Designs and Their Protection, Registration Process for Industrial Designs, Case Studies on Trade Secret Violations.

Textbooks:

1. Ganguli, P. (2001). *Intellectual Property Rights: Unleashing the Knowledge Economy.* Tata McGraw-Hill.
2. Narayanan, P. (2019). *Intellectual Property Law.* Eastern Law House.

References:

1. Das, J. K. (2018). *Intellectual Property Rights.* PHI Learning Pvt. Ltd.
2. David, B. (2021). *Copyright Law: A Handbook of Contemporary Research.* Edward Elgar Publishing.
3.

Web Links:

1. https://www.wipo.int/
2. https://ipindia.gov.in/
3. https://www.uspto.gov/
4. https://ec.europa.eu/growth/industry/intellectual-property_en
5. https://www.inta.org/

Skill Enhancement Courses (SEC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS36	I	Insurance Forensics and Fraud Investigation	FC	2		0	2	50	50	100	-
2509FS56	III	IT Skills	IC	0		2	2	50	50	100	-
2509FS57	IV	Court Testimony	IC	2			2	50	50	100	-
2509FS08	VI	Research Methodology & Scientific Writing	AC	3			3	50	50	100	-
Total				**7**		**2**	**9**				

Insurance Forensics and Fraud Investigation

Course Code: 2509FS36 L T P C
Semester- I 2 0 0 2

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain the role of forensic science in insurance investigations and differentiate it from forensic accounting.

CO2: Identify various types of insurance fraud and analyze common fraud indicators and red flags.

CO3: Apply forensic investigative techniques such as document analysis, digital forensics, and surveillance in fraud detection.

CO4: Interpret legal frameworks and ethical considerations governing insurance fraud investigations.

CO5: Evaluate emerging trends like AI, blockchain, and cyber fraud in insurance investigations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	2	3	2	2	2	-	2	2
CO2	3	1	1	2	3	2	2	3	-	2	2
CO3	3	2	3	2	3	3	2	3	1	2	2
CO4	2	-	-	1	3	2	2	2	1	1	2
CO5	2	-	2	3	2	2	1	3	1	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit-Wise Syllabus:

UNIT I: Fundamentals of Insurance and the Role of Forensic Science

Introduction to Insurance, Types of Insurance, Nature and Scope of Insurance Fraud, Historical Background and Modern Trends, Role of Forensic Science in Insurance Investigations, Forensic Science vs. Forensic Accounting, Contribution of Forensic Disciplines, Code of Ethics for Insurance Investigators, Insurance Fraud Prevention Model Act, Structure and Functions of Insurance Regulatory Bodies.

UNIT II: Classification of Insurance Frauds

Classification of Insurance Frauds, Life Insurance Fraud, Health Insurance Fraud, Vehicle Insurance Fraud, Property Insurance Fraud, Liability and Workers' Compensation Fraud, Employer and Insider Frauds, Modus Operandi and Indicators of Fraud, False and Inflated Claims, Identity Theft, Fake Documentation, Internal Collusion, Fictitious Beneficiaries, Red Flags and Predictive Indicators, Case Studies – Indian and International.

UNIT III: Investigative Techniques and Forensic Applications

Role and Duties of Insurance Fraud Investigator, Locating Information Sources, Evidence Collection and Documentation, Witness Interviewing, Evidence Preservation and Chain of Custody, Forensic Accounting Techniques, Document Analysis, Digital Forensics in Insurance, Arson Investigation, Toxicology in Death Claims, Surveillance Techniques, Foot and Vehicle Surveillance, Use of Technology and Equipment.

UNIT IV: Legal, Ethical, and Policy Framework

Insurance Policy as a Legal Contract, Policy Language and Interpretation, First-party and Third-party Claims, Innocent Co-Insured Doctrine, Loss Payees, Legal Framework Governing Insurance Fraud, Indian Penal Code, Insurance Act, PMLA, Role of IRDAI, SEBI, CBI, Conducting Examination Under Oath, Ethical Issues in Investigations, Presentation of Expert Opinions in Court.

UNIT V: Emerging Trends, Practical Cases, and Global Perspective

Cyber Insurance Fraud, Digital Claims Fraud, Artificial Intelligence in Fraud Detection, Blockchain in Insurance, International Insurance Frauds, Expert Selection and Validation, Scientific Testing and Reliability, Fraudulent Disbursements, Money Laundering, Economic and Commercial Damages, Tracing Matrimonial Assets, White Collar Crimes, Case File Preparation, Mock Investigations and Trials.

Textbooks

1. Forensic Accounting and Fraud Examination by William Hopwood, George Young, and Jay Leiner.
2. Forensic Accounting and Fraud Examination by Daniel Calivinson-Ashley.

Reference Books

1. Property Investigation Checklists: Uncovering Insurance Fraud by Michael H. Boyer and Barry Zalma.
2. Tackling Insurance Fraud: Law and Practice by Lynne Skajaa and Mark Simpson.

Weblinks

1. https://www.acfe.com/training-events-and-products/all-products/product-detail-page?s=Insurance-Fraud-Casebook-Paying-a-Premium-for-Crime
2. https://acfe-india.org/investigating-fraud-a-step-by-step-guide/
3. https://www.taylorfrancis.com/books/mono/10.1201/b19668/healthcare-fraud-investigation-guidebook-charles-piper

4. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118700990
5. https://www.fraud-magazine.com/ifcb/

IT Skills

L	T	P	C
0	0	2	2

Course Code: 2509FS56
Semester- III
Course Outcomes:
At the end of the course, students will be able to:

CO1: Understand the role of computing and information technology in the digital world.
CO2: Identify, describe, and apply emerging technologies in teaching and learning environments.
CO3: Effectively apply written, oral, and interpersonal communication skills and use information technology.
CO4: Analyze organizational context, strategy, operations, processes, and performance.
CO5: Understand the importance of keeping safe online.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	2	2	2	2	1	2	2
CO2	2	-	1	2	2	2	2	2	2	3	2
CO3	1	-	1	-	-	2	3	1	2	-	3
CO4	2	-	2	2	2	2	2	3	2	2	2
CO5	1	-	-	1	3	1	1	2	1	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	1

Unit-Wise Syllabus:

UNIT I: Introduction to Computer & Office Automation
Introduction of Computer: Overview of Computer, Computer Input and Output devices, Operating System, hardware and Software. Introduction to Ram ,Rom ,CPU and more devices. Introduction to Office Automation: Overview of Office Automation, Importance and Benefits of Office Automation, Role in Modern Work Environments, Integration with Business Processes, Challenges and Considerations.

UNIT II: Microsoft Word
Microsoft Word: Introduction to MS Word, Getting Familiar with the Interface, Creating a New Document, Basic Text Formatting, Bold, Italic, Underline), Aligning Text (Left, Center, Right),Saving and Opening Documents,Navigate Through a Document, Insert hyperlinks, Search

for text, Replace, Create bookmarks, Move to a specific location or object in a document, Apply document themes, Apply document style sets, Insert headers and footers, Insert page numbers, Format page background elements, Create a numbered or bulleted list, Change bullet characters or number formats for a list level, Define a custom bullet character or number format.

UNIT III: Microsoft Excel

Introduction to MS Excel Create a workbook, Search for data within a workbook, Change worksheet tab color, Rename a worksheet, Insert and delete columns or rows, Change workbook themes, Adjust row height and column width, Insert headers and footers, Hide or unhide worksheets, data validation, Duplicate Values, Apply styles to tables, Filter records, Sort data by multiple columns, Change sort order, Remove duplicate records, Perform calculations by using the SUM function, MIN and MAX functions, COUNT function, AVERAGE function, Create a new chart, Resize charts, Save a workbook as a template, Manage workbook versions, Protect a worksheet

UNIT IV: MS PowerPoint

Microsoft PowerPoint: Create a Presentation, Insert and Format Slides, Modify Slides, Handouts, and Notes, Configure a Presentation for Print, Configure and Present a Slide Show, Insert and Format Text, Insert and Format Shapes and Text Boxes, Insert and Format Images, Order and Group Objects, Insert and Format Tables, Insert and Format Charts, Insert and Format SmartArt graphics, Apply Slide Transitions, Animate Slide Content. Set Timing for Transitions and Animations.

UNIT V:Microsoft Outlook

Create messages, Create and send messages Configure message, Format messages, Format text Apply, themes and styles, Apply styles, Create hyperlinks, Insert images, Manage schedules, Insert memorized content, Insert signatures, Configure calendar settings ,Work with multiple calendars Share calendar information, Create appointments and events Create meetings Manage calendar items, Create tasks Manage tasks Create and manage notes, Create journal entries, Create and manage contacts Create and modify contact records Store contact records Share contact records and address books.

Textbooks:

1. Digital Logic and Computer Design – M. Morris Mano
2. Digital Fundamentals – Thomas L. Floyd

Reference Books:

1. Digital Logic Design and Computer Organization – Nikrouz Faroughi
2. Fundamentals of Digital Logic with VHDL Design – Stephen Brown & Zvonko Vranesic

Web Links:

1. https://www.coursera.org/browse/information-technology
2. https://www.globalknowledge.com/us-en/training/course-catalog/
3. https://alison.com/courses/it

4. https://www.cbtnuggets.com/it-training
5. https://skillsbuild.org/learners

Court Testimony

Course Code: 2509FS57

Semester- IV	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: To impart a thorough understanding of the roles and responsibilities of forensic experts in court proceedings.

CO2: To develop the ability to communicate forensic findings effectively to a legal audience.

CO3: To familiarize students with courtroom etiquette, protocols, and legal standards.

CO4: To analyze the admissibility and probative value of forensic evidence in legal proceedings.

CO5: To enhance practical skills in presenting expert testimony through mock trials and case simulations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	2	3	3	2	2	2	1	2
CO2	2	-	-	-	3	3	2	2	2	-	3
CO3	2	-	-	1	3	2	2	1	2	-	2
CO4	3	-	2	-	3	2	2	2	2	1	2
CO5	2	2	1	1	3	2	2	3	3	1	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		
CO5		

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Courtroom Testimony

Overview of the legal system: hierarchy of courts and their functions. Role of forensic experts in judicial proceedings. Admissibility of forensic evidence: Daubert and Frye standards. Key legal terminologies related to expert testimony. Importance of accuracy, neutrality, and scientific rigor in testimony.

UNIT – II: Preparing for Courtroom Testimony

Reviewing forensic reports and case files for trial readiness. Interaction with attorneys: pre-trial consultations and understanding case strategy. Creating and presenting demonstrative evidence: charts, photographs, and digital tools. Drafting expert opinions in compliance with legal standards. Importance of preparing for direct and cross-examinations.

UNIT – III: Testimony Delivery Techniques

Strategies for clear and confident communication in court. Explaining scientific concepts in layman's terms. Handling objections, interruptions, and challenging questions professionally. Use of visual aids to strengthen testimony. Maintaining composure under pressure and adapting to courtroom dynamics.

UNIT – IV: Cross-Examination and Legal Challenges

Understanding the objectives of cross-examination. Techniques for answering leading and challenging questions. Identifying and addressing attempts to discredit testimony. Handling contradictory evidence or expert opinions. Case examples of successful and flawed testimonies. Legal and ethical pitfalls to avoid during testimony.

UNIT – V: Ethical Considerations and Professionalism in Court Testimony

Ethical obligations of forensic experts: honesty, impartiality, and objectivity. Understanding the consequences of biased or false testimony. Professional standards and codes of conduct for expert witnesses. Managing conflicts of interest and maintaining credibility. Case studies highlighting ethical dilemmas and best practices in courtroom testimony.

Textbooks

1. Courtroom Testimony for the Fingerprint Expert by Hillary Moses Daluz
2. Forensic Expert Witness: Roles and Responsibilities by Leila Schneps and Coralie Colmez

Reference Books

1. The Expert Witness Handbook by Dan Poynter
2. Forensic Testimony: Science, Law and Expert Evidence by C. Michael Bowers

Weblinks

1. https://nij.ojp.gov/nij-hosted-online-training-courses/law-101-legal-guide-forensic-expert/general-testifying-tips/fundamental-guidelines-deposition-and-trial-testimony
2. The Expert Witness Institute (EWI)
3. Forensic Science Society (now CSFS) - Expert Witness Resources
4. https://www.aafs.org/
5. https://www.testifyingtraining.com/

Research Methodology & Scientific Writing

Course Code: 2509FS08

Semester- VI	L	T	P	C
Course Outcomes:	3	0	0	3

At the end of the course, students will be able to:

CO1: To develop an understanding of the principles and processes of research in scientific disciplines.

CO2: To equip students with skills to design, conduct, and analyze research effectively.

CO3: To familiarize students with various methodologies and tools used in scientific research.

CO4: To develop skills in qualitative and quantitative data analysis and presentation.

CO5: To understand ethical considerations and integrity in conducting and reporting research.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	1	2	1	1	-	2	1	3	2
CO2	2	-	1	2	1	2	-	3	2	3	2
CO3	2	-	2	2	1	2	-	3	2	3	1
CO4	1	-	2	2	1	3	1	3	2	2	2
CO5	1	-	1	1	3	2	1	2	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	3	-

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Research Methodology

Introduction to research: definitions, objectives, and types of research. Scientific methods and approaches: exploratory, descriptive, and experimental research. Formulating research problems and hypotheses. Importance of literature review and its organization. Research design: qualitative and quantitative approaches.

UNIT – II: Data Collection and Analysis

Techniques for data collection: surveys, interviews, observations, and experiments. Sampling methods and their significance. Tools for data analysis: statistical software and manual methods.

Interpretation of data: significance testing, correlation, and regression analysis. Representation of data: tables, graphs, and charts.

UNIT – III: Scientific Writing Techniques

Structure of a scientific paper: abstract, introduction, methodology, results, discussion, and conclusion. Writing research proposals and grant applications. Style and tone of scientific writing: clarity, precision, and conciseness. Citation and referencing styles: APA, MLA, and Chicago. Writing ethics: plagiarism, authorship conflicts, and retractions.

UNIT – IV: Advanced Tools and Techniques for Research and Writing

Use of software for research management: reference managers (e.g., Zotero, EndNote, Mendeley). Statistical analysis tools: SPSS, R, and Python for data interpretation. Digital tools for collaboration and project management in research. Techniques for systematic reviews and meta-analysis. Preparing illustrations, diagrams, and graphs using specialized software. Role of artificial intelligence in enhancing research efficiency and writing quality.

UNIT – V: Ethics and Current Trends in Research

Ethical considerations in research: consent, confidentiality, and research misconduct. Importance of reproducibility and transparency in research. Role of artificial intelligence and big data in modern research. Emerging trends in interdisciplinary research. Case studies on successful research methodologies and their global impact.

Textbooks

1. Research Methodology: Methods and Techniques by C.R. Kothari and Gaurav Garg
2. The Craft of Research by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

Reference Books

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by John W. Creswell and J. David Creswell
2. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded by Joshua Schimel

Weblinks

1. MIT OpenCourseWare: Introduction to Research Methods
2. https://www.springeropen.com/roadmapasia/author-workshop
3. https://researcheracademy.elsevier.com/
4. https://ocw.mit.edu/
5. https://researcheracademy.elsevier.com/

Value Added Courses (VAC)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS58	III	Entrepreneurship Development	IC	2			2	50	50	100	-
2509FS09	V	Environmental Science	AC	2			2	50	50	100	-
2509FS10	VI	Forensic Journalism & Investigative Reporting	AC	2			2	50	50	100	-
Total				**6**			**6**				

Entrepreneurship Development

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS58

Semester- III	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: To understand entrepreneurship, its types, traits, factors influencing it, and the role of women entrepreneurs and SHGs in economic development.

CO2: To identify business opportunities, generate ideas using various techniques, and understand the importance of intellectual property rights.

CO3: To analyze and evaluate business opportunities through market, technical, cost-benefit, and network analysis for project feasibility.

CO4: To learn the business planning process, its advantages, and develop skills to create a model project report for a new venture.

CO5: To explore sources of finance, including venture capital, commercial banks, and government schemes, and understand funding processes.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	-	2	2	1	-	2	3	2	3
CO2	1	-	1	2	2	1	-	2	2	3	2
CO3	1	-	2	2	1	2	-	3	2	3	2
CO4	1	-	2	2	1	3	-	3	2	3	2
CO5	1	-	1	1	2	2	-	2	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Entrepreneurship Entrepreneur

Meaning of entrepreneurship – Types of Entrepreneurship – Traits of entrepreneurship – Factors promoting entrepreneurship- Barriers to entrepreneurship- the entrepreneurial culture- Stages in entrepreneurial process – Women entrepreneurship and economic development- SHG.

UNIT II: Developing Successful Business Ideas
Recognizing opportunities – trend analysis – generating ideas – Brainstorming, Focus Groups, Surveys, Customer advisory boards, Day in the life research – Encouraging focal point for ideas and creativity at a firm level-Protecting ideas from being lost or stolen – Patents and IPR.

UNIT III: Opportunity Identification and Evaluation
Opportunity identification and product/service selection – Generation and screening the project ideas – Market analysis, Technical analysis, Cost benefit analysis and network analysis- Project formulation – Assessment of project feasibility- Dealing with basic and initial problems of setting up of Enterprises.

UNIT IV: Business Planning Process Meaning of business plan
Business plan process- Advantages of business planning- preparing a model project report for starting a new venture (Team-based project work).

UNIT V: Funding Sources of Finance
Venture capital- Venture capital process- Business angles- Commercial banks- Government Grants and Schemes.

Textbooks:
1. Reddy, Entrepreneurship: Text & Cases - Cengage, New Delhi.
2. Kuratko/rao, Entrepreneurship: a south asian perpective.- Cengage, New Delhi.
3. Leach/Melicher, Entrepreneurial Finance – Cengage. , New Delhi.
4. K.Sundar – Entrepreneurship Development – Vijay Nicole Imprints private Limited
5. Khanka S.S., Entrepreneurial Development, S.Chand & Co. Ltd., New Delhi, 2001.

References:
1. Barringer, B., Entrepreneurship: Successfully Launching New Ventures, 3rd Edition, Pearson, 2011.
2. Bessant, J., and Tidd, J., Innovation and Entrepreneurship, 2nd Edition, John Wiley &Sons, 2011.
3. Desai, V., Small Scale Industries and Entrepreneurship, Himalaya Publishing House, 2011.
4. Donald, F.K., Entrepreneurship- Theory, Process and Practice, 9th Edition, Cengage Learning, 2014.
5. Hirsch, R.D., Peters, M. and Shepherd, D., Entrepreneurship, 6th Edition, Tata McGraw-Hill Education Pvt.Ltd., 2006.

Weblinks
1. http://inventors.about.com/od/entrepreneur/
2. http://learnthat.com/tag/entrepreneurship/
3. www.managementstudyguide.com
4. www.quintcareers.com
5. www.entrepreneur.com

Environmental Science

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS09

Semester- V	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: To develop an understanding of fundamental concepts of environmental science, including its components and significance in sustainable development.

CO2: To equip students with knowledge of environmental pollution, its sources, effects, and control measures to mitigate environmental degradation.

CO3: To familiarize students with global environmental issues such as climate change, global warming, and biodiversity loss, along with strategies for conservation.

CO4: To develop an understanding of environmental laws, policies, and the role of government and organizations in environmental protection.

CO5: To enhance awareness of sustainable development practices, green technologies, and the role of individuals and industries in achieving sustainability

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	1	2	2	1	-	2	2	1	3
CO2	1	-	2	2	2	2	-	2	2	2	2
CO3	1	-	1	2	2	1	-	2	2	2	1
CO4	1	-	1	1	3	2	-	2	1	1	1
CO5	1	-	2	2	2	2	-	2	2	3	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	2
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Fundamentals of Environmental Science

Definition, Scope, and Importance of Environmental Science, Components of Environment (Lithosphere, Hydrosphere, Atmosphere, Biosphere), Natural Resources (Renewable and Non-Renewable), Biodiversity and Its Conservation.

UNIT II: Environmental Pollution and Control Measures
Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Radioactive Pollution, Sources and Effects of Pollution, Pollution Control Measures, Solid Waste Management, 3Rs (Reduce, Reuse, Recycle), Waste Disposal Methods.

UNIT III: Climate Change and Global Environmental Issues
Greenhouse Effect, Global Warming, Ozone Layer Depletion, Acid Rain, Deforestation, Impact of Deforestation on Climate, Sustainable Development Goals (SDGs), Environmental Policies.

UNIT IV: Environmental Laws and Policies
Environmental Protection Act (1986), Water (Prevention and Control of Pollution) Act (1974), Air (Prevention and Control of Pollution) Act (1981), Wildlife Protection Act (1972), Role of Government, Role of NGOs in Environmental Protection.

UNIT V: Sustainable Development and Green Technologies
Concepts and Principles of Sustainable Development, Renewable Energy Sources (Solar, Wind, Hydro, Biomass), Eco-friendly Technologies, Green Infrastructure, Role of Individuals in Sustainability, Role of Industries in Sustainability.

Textbooks:

1. Basu, M., Xavier, S., & Nag, P. (2007). *Fundamentals of Environmental Studies.* Cambridge University Press.
2. Cunningham, W. P., & Cunningham, M. A. (2017). *Environmental Science: A Global Concern.* McGraw Hill.

References:

1. Carson, R. (1962). *Silent Spring.* Houghton Mifflin Harcourt.
2. Odum, E. P. (1971). *Fundamentals of Ecology.* W.B. Saunders.

Web Links:

1. https://www.unep.org/ (United Nations Environment Programme)
2. https://www.ipcc.ch/ (Intergovernmental Panel on Climate Change)
3. https://www.epa.gov/ (United States Environmental Protection Agency)
4. https://www.iucn.org/ (International Union for Conservation of Nature)
5. https://www.cbd.int/ (Convention on Biological Diversity)

Forensic Journalism and Investigative Reporting

(Common to B.Sc. Forensic Science & B.Sc. Cyber Security & Digital Forensics)

Course Code: 2509FS10

Semester- VI	L	T	P	C
Course Outcomes:	2	0	0	2

At the end of the course, students will be able to:

CO1: To understand the fundamentals of forensic journalism, investigative reporting, ethical considerations, and the role of media in crime and justice.

CO2: To develop skills in investigative techniques, data collection, interview methods, and the use of digital tools for fact-finding and verification.

CO3: To analyze media laws, crime reporting, ethical dilemmas, and the legal framework governing journalistic practices, including contempt of court and defamation.

CO4: To explore the role of digital forensics, cybersecurity, and emerging technologies in investigative journalism, along with strategies to identify misinformation and fake news.

CO5: To gain practical experience in undercover reporting, financial crime investigations, human rights journalism, and conflict reporting while adhering to ethical and legal boundaries

Mapping of Course Outcomes with Program Outcomes:

CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO1	2	-	1	2	3	2	2	2	2	2	3
CO2	2	-	2	2	2	2	2	3	3	2	2
CO3	1	-	1	2	3	2	3	2	2	1	3
CO4	2	-	3	2	2	2	1	3	2	3	2
CO5	2	-	2	2	3	2	2	3	3	2	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	**PSO1**	**PSO2**
CO1	3	3
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	1

Unit-Wise Syllabus:

UNIT I: Introduction to Forensic Journalism and Investigative Reporting

Definition and Scope of Forensic Journalism, Principles and Ethics in Investigative Reporting, Role of Media in Crime and Justice, Differences Between Traditional and Investigative Journalism, Evolution of Investigative Journalism, Responsibilities of a Forensic Journalist.

UNIT II: Investigative Techniques and Data Collection
Methods of Investigative Journalism, Primary and Secondary Sources, Interview Techniques and Witness Testimonies, Freedom of Information Act and Accessing Public Records, Open-Source Intelligence (OSINT), Use of Digital Tools for Investigation, Challenges in Data Collection.

UNIT III: Crime Reporting and Media Laws
Types of Crime Reporting (White-Collar, Organized, Cybercrime), Role of Media in Criminal Investigations, Ethical Dilemmas in Crime Reporting, Contempt of Court and Defamation, Protection of Journalistic Sources, Media Trials and Their Impact on Justice, Press Laws and Journalistic Privileges.

UNIT IV: Digital Forensics and Investigative Journalism
Role of Digital Forensics in Journalism, Cybercrime Investigation and Reporting, Identifying and Verifying Fake News, Use of AI and Big Data in Investigative Reporting, Tracking Digital Footprints, Cybersecurity for Journalists, Case Studies on Digital Investigations.

UNIT V: Undercover Reporting and Surveillance Journalism
Ethical Considerations in Undercover Journalism, Covert Reporting Techniques, Surveillance Laws and Privacy Issues, Hidden Cameras and Recording Devices, Whistleblower Protection, Legal and Ethical Boundaries in Investigative Journalism, Case Studies on Undercover Operations.

Textbooks:

1. Houston, B. (2009). *The Investigative Reporter's Handbook: A Guide to Documents, Databases, and Techniques.* Bedford/St. Martin's.
2. de Burgh, H. (2008). *Investigative Journalism.* Routledge.

References:

1. Pilger, J. (2005). *Tell Me No Lies: Investigative Journalism and Its Triumphs.* Vintage.
2. Schudson, M. (2008). *Why Democracies Need an Unlovable Press.* Polity Press.

Web Links:

1. https://www.icfj.org/ (International Center for Journalists)
2. https://gijn.org/ (Global Investigative Journalism Network)
3. https://www.pulitzer.org/ (The Pulitzer Prizes)
4. https://www.cjr.org/ (Columbia Journalism Review)
5. https://www.reporterslab.org/ (Duke Reporters' Lab)

Internships (SI)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS12	V	Summer Internship	AC			2	2	100		100	-
Total						**2**	**2**				

Project (PROJ)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS13	VI	Project	AC			4	4	50	50	100	-
	Total					**4**	**4**				-

Mandatory Courses (MC)

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509AC01	I	Constitution of India	FC	2				100	-	100	-
2509AC02	II	Indian Science & Technology	FC	2				100	-	100	-
2509AC03	III	Health & Wellness, Yoga Education, Sports, and Fitness	FC	2				100	-	100	-
2509AC04	IV	Indian History & Culture	FC	2				100	-	100	-
2509AC05	V	Indian Philosophy & Ethics	FC	2				100	-	100	-
		Total		**10**							

Constitution of India

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509AC01
Semester- I

Course Outcomes:	L	T	P	C
At the end of the course, students will be able to:	2	0	0	2

CO1: Understand the Indian Constitution's meaning, importance, evolution, Preamble, and salient features.
CO2: Explain Fundamental Rights, DPSP, and Fundamental Duties, assessing their role in governance and society.
CO3: Describe the structure, powers, and functions of the Union and State Governments, including key executives and legislative bodies.
CO4: Examine the Judiciary, Centre-State relations, emergency provisions, and constitutional bodies like the Election Commission, Finance Commission, UPSC, SPSC, and CAG.
CO5: Evaluate key amendments, legal provisions, and contemporary issues, including RTI, reservations, elections, judicial activism, PIL, human rights, and landmark judgments.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	1	2	3	1	2	1	1	1	3
CO2	1	-	1	2	3	1	2	1	2	1	3
CO3	1	-	1	2	3	1	3	1	2	1	2
CO4	1	-	1	2	3	1	3	1	2	1	2
CO5	1	-	1	2	3	1	3	1	2	1	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Unit-Wise Syllabus:

UNIT I: Introduction to the Indian Constitution
Meaning, importance, and evolution of the Constitution, Preamble: Objectives and features, Salient features of the Indian Constitution, Fundamental Rights: Articles 12-35, Directive Principles of State Policy (DPSP), Fundamental Duties.

UNIT II: Structure of Government
Union Government: President, Prime Minister and Council of Ministers, Parliament (Lok Sabha & Rajya Sabha) – Structure, powers, and functions, State Government: Governor, Chief Minister and Council of Ministers, State Legislature (Legislative Assembly & Legislative Council), Judiciary: Supreme Court – Composition, powers, and jurisdiction, High Courts and Subordinate Courts.

UNIT III: Federalism and Constitutional Bodies
Indian Federalism: Features, nature, and issues, Centre-State relations: Legislative, administrative, and financial, Emergency provisions: Articles 352, 356, 360, Constitutional Bodies: Election Commission of India, Finance Commission, Union Public Service Commission (UPSC), State Public Service Commission (SPSC), Comptroller and Auditor General (CAG).

UNIT IV: Amendments and Important Provisions
Constitutional Amendments: Procedure and significant amendments (42nd, 44th, 73rd, 74th), Right to Information (RTI) Act, 2005, Reservation policies and social justice, Special provisions for Scheduled Castes, Scheduled Tribes, and Other Backward Classes, Anti-Defection Law.

UNIT V: Governance, Policies, and Contemporary Issues
Political parties and elections in India, Local self-government: Panchayati Raj and municipalities, Public Interest Litigation (PIL) and judicial activism, Human rights and women's rights in the Constitution, Important Supreme Court judgments and their impact, Contemporary issues: Constitutional challenges and reforms.

Textbooks

1. Basu, D. D. (2021). *Introduction to the Constitution of India* (26th ed.). LexisNexis.
2. Pylee, M. V. (2019). *India's Constitution* (16th ed.). S. Chand Publishing.

References

1. Seervai, H. M. (2017). *Constitutional Law of India* (4th ed.). Universal Law Publishing.
2. Austin, G. (2016). *The Indian Constitution: Cornerstone of a Nation*. Oxford University Press.

Web Links

1. https://legislative.gov.in/constitution-of-india
2. https://www.india.gov.in/my-government/constitution-india
3. https://www.mea.gov.in/Images/pdf1/Part1.pdf
4. https://indiankanoon.org/
5. https://niti.gov.in/

Indian Science & Technology
Semester II
(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

	L	T	P	C
Course Code:2509AC02				
Semester- II	2	0	0	2

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the evolution, importance, and contributions of science and technology in India.

CO2: Demonstrate knowledge of India's space and defense technologies, including ISRO missions and DRDO advancements.

CO3: Describe the development of IT, AI, cybersecurity, 5G, and e-governance in India.

CO4: Examine advancements in biotechnology, healthcare, DNA fingerprinting, and ethical concerns.

CO5: Evaluate energy resources, environmental policies, sustainability, and disaster management.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	1	2	2	1	-	2	2	2	3
CO2	2	-	2	2	2	1	-	2	2	3	2
CO3	2	-	2	2	2	2	1	3	2	3	2
CO4	3	-	2	3	2	2	1	3	2	3	2
CO5	2	-	2	3	3	2	1	3	2	2	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	2
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Introduction to Science and Technology in India

Definition and scope of science and technology, Historical development of science and technology in ancient, medieval, and modern India, Contributions of Indian scientists, Role of science and technology in national development.

UNIT II: Space and Defence Technologies
Indian space programs: ISRO, major satellite missions (INSAT, IRS, Chandrayaan, Mangalyaan, Gaganyaan), Remote sensing and its applications, Defence technology: DRDO, missile systems (Agni, Prithvi, BrahMos), Indigenous weapon systems and advancements in military technology.

UNIT III: Information Technology and Communication
Evolution of IT and communication in India, Digital India initiative, Artificial Intelligence and Machine Learning, Cybersecurity and data protection laws, 5G technology and its impact, E-governance and its role in development.

UNIT IV: Biotechnology and Healthcare
Biotechnology in agriculture, GM crops, and biofertilizers, Healthcare advancements: Vaccines, pharmaceutical research, and AYUSH, Stem cell research and regenerative medicine, DNA fingerprinting and forensic applications, Ethical issues in biotechnology.

UNIT V: Energy, Environment, and Sustainable Development
Renewable and non-renewable energy resources, Nuclear energy in India, Policies on sustainable development and climate change, Environmental conservation and green technologies, Role of science and technology in disaster management.

Textbooks

1. Agrawal, B. N., & Agrawal, R. (2017). *Satellite Technology: Principles and Applications* (3rd ed.). Wiley India.
2. Rao, C. N. R. (2010). *Understanding Chemistry* (2nd ed.). University Press.

References

1. Kalam, A. P. J., & Rajan, Y. S. (1998). *India 2020: A Vision for the New Millennium*. Penguin Books India.
2. Chattopadhyay, D. (2014). *Science and Society in India*. Pearson Education.

Web Links

1. https://www.isro.gov.in/
2. https://www.drdo.gov.in/
3. https://dst.gov.in/
4. https://www.niti.gov.in/
5. https://www.csir.res.in/

Health & Wellness, Yoga Education, Sports, and Fitness
Semester III
(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

	L	T	P	C
Course Code: 2509AC03	2	0	0	2

Semester- III

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the meaning, importance, and components of health, wellness, and nutrition.

CO2: Demonstrate knowledge of wellness management, fitness, and the impact of diet and doping.

CO3: Describe the principles and benefits of yoga for mental and physical well-being.

CO4: Examine various yoga practices, including asanas, pranayama, meditation, and mudras.

CO5: Evaluate different fitness activities, including aerobics, dance fitness, and resistance training.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	1	2	2	-	-	2	2	1	3
CO2	1	-	2	2	2	-	-	2	2	1	2
CO3	1	-	1	2	2	-	-	2	2	1	3
CO4	1	-	1	2	2	-	-	2	2	1	2
CO5	1	-	2	2	1	-	-	2	2	1	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Health & Wellness

Define and differentiate health and wellness – Components of health wellness and their relationship between physical activity – Local, demographic, societal issues and factors affecting health and wellness.

Diet and nutrition for health & wellness – Essential components of balanced diet for healthy living with specific reference to the role of carbohydrates, proteins, fats, vitamins & minerals – malnutrition, under nutrition and over nutrition.

UNIT II: Management of Health And Wellness

Meaning & importance of various dimensions of wellness. Relationship of physical fitness in achieving wellness. Drugs, doping and wellness. Role of diet and exercise in health management.

UNIT III: Yoga Education

Meaning and definition of yoga and its aims and objectives – Basic principles of yoga and its importance in our daily life – Yoga for mental attitude – Mind, body, breath and emotional level for higher plan of living.

UNIT IV: Yoga Practices

Types and limbs of yoga – Yoga postures – Asana – Breathing Practices – Pranayama – Relaxation-Meditation – Mudra.

UNIT V: Fitness Activities

Types of fitness activities – Outdoor activities – Basic movement patterns. Indoor activity – Aerobics/Dance Fitness, Resistance Training for fitness.

Textbooks:

1. Hoeger, W. W. K., & Hoeger, S. A. (2021). *Principles and Labs for Fitness and Wellness* (15th ed.). Cengage Learning.
2. Khanna, G. L. (2020). *Health and Physical Education*. Sports Publication.

References:

1. Chaturvedi, A. (2019). *Fitness and Wellness: A Holistic Approach*. Khel Sahitya Kendra.
2. Saraswati, S. (2008). *Asana Pranayama Mudra Bandha*. Bihar School of Yoga.

Web Links:

1. https://www.who.int/health-topics/
2. https://www.nhp.gov.in/health-wellness-home_pg
3. https://www.ayush.gov.in/
4. https://www.cdc.gov/physicalactivity/
5. https://www.yogajournal.com/

Indian History & Culture

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509AC04 L T P C
Semester- IV 2 0 0 2

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand Early Societies – Analyze Harappan civilization, urban planning, and cultural continuity.

CO2: Explore Vedic Age & Religions – Study Vedic society, Mahajanapadas, and the impact of Jainism & Buddhism.

CO3: Assess Mauryan Governance – Examine Chandragupta, Asoka's policies, and Mauryan cultural influence.

CO4: Analyze Post-Mauryan to Gupta Era – Explore political, social, and cultural developments under key rulers.

CO5: Evaluate Harshavardhana & Southern Kingdoms – Study Harsha's rule and contributions of Chalukyas & Pallavas.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	3	1	1	-	2	1	2	3
CO2	2	-	1	3	2	1	-	2	1	1	3
CO3	2	-	2	3	2	1	1	2	1	2	2
CO4	2	-	2	3	2	1	-	2	1	2	2
CO5	2	-	2	3	2	1	-	2	1	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Early Societies and Harappan Civilization

India's geographical and environmental setting, sources of history, and prehistoric cultures (Paleolithic, Mesolithic, Chalcolithic, Megalithic, and rock art). Examines the Harappan Civilization, its urban planning, socio-economic life, religious beliefs, decline, and cultural continuity.

UNIT II: Vedic Age and the 6th Century B.C.
Discusses Rig Vedic and Later Vedic polity, society, economy, and religion. Explores the Mahajanapadas, rise of Magadha, Persian and Greek influences, and the emergence of Jainism and Buddhism, including their teachings and impact.

UNIT III: Mauryan Empire
Focuses on the establishment of the Mauryan Empire, Chandragupta Maurya's rule, and Megasthenes' accounts. Highlights Asoka's administration, policies, promotion of Buddhism, and Mauryan art and culture.

UNIT IV: Post-Mauryan to Gupta Period
Covers the Sungas, Satavahanas, Indo-Greeks, Kushans, and their contributions. Discusses the Gupta Empire's rise, administration, key rulers, social, economic, and religious developments, along with advancements in science, literature, and art.

UNITV: Harshavardhana and South Indian Kingdoms
Examines Harshavardhana's rule, administration, and contributions. Highlights the Chalukyas of Badami (Pulakesi II) and Pallavas, focusing on their political history, literature, and architectural achievements.

Textbooks:

1. An advanced history of India – causes and decline of Guptas by B.C. Majumdar and others, 1967, Macmillan.
2. Ancient India by R.C. Majumdar, 1977, Motilal Banarasi Das.

Reference Books:

1. History of Ancient India by Krishnaswamy Aiyangar, 1980, Seema Publishers.
2. Ancient India by V.D. Mahajan, 1985, S.Chand and Company.

Web Links:

1. https://iasscore.in/upsc-syllabus/history/ancient-history?
2. https://byjus.com/free-ias-prep/ncert-ancient-history-notes/?
3. https://exams.nta.ac.in/CUET-PG/images/syllabus/humanities/Ancient%20Indian%20History%2C%20Culture%20%26%20Architecture%20%20%28HUQP01%29.pdf?
4. https://skmu.ac.in/syllabus/Sybllaus-Ancient-Indian-History-converted.pdf?

Indian Philosophy & Ethics

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509AC05

L	T	P	C
2	0	0	2

Semester- V

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the foundational concepts and common features of Indian philosophical schools, including the Upanishadic view of the self and critique of ritual.

CO2: Explain key doctrines of heterodox traditions such as Cārvāka materialism, Buddhist Four Noble Truths, and Jain Anekāntavāda and Syādvāda.

CO3: Analyze the metaphysical and epistemological views of orthodox schools like Nyāya, Vaiśeṣika, Mīmāṃsā, and Sāṃkhya, including causation theories.

CO4: Evaluate the philosophical contributions of Vedānta schools, especially Śaṃkara's Advaita and Rāmānuja's Viśiṣṭādvaita, on concepts like Brahman and Māyā.

CO5: Discuss ethical theories in Indian philosophy including the puruṣārthas, Nishkama Karma from the Gita, and the moral teachings of Jainism and Buddhism.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	2	3	2	-	-	2	1	2	3
CO2	1	-	2	3	3	-	-	2	1	2	3
CO3	1	-	3	3	2	-	-	3	1	2	2
CO4	1	-	2	3	2	-	-	2	1	2	2
CO5	1	-	2	2	3	-	-	2	2	2	3

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Unit-Wise Syllabus:

UNIT I : The foundational concepts of Indian philosophy

Introduction and the foundational concepts of Indian philosophy, highlighting common features across different schools and the Upanishadic doctrine of the self and critique of ritual.

UNIT II: Heterodox traditions
Cārvāka's materialism, Buddhist teachings on the Four Noble Truths and Dependent Origination, and Jainism's doctrines of Anekāntavāda and Syādvāda.

UNIT III : The orthodox schools.
The epistemological and metaphysical perspectives of orthodox schools-such as Nyāya-Vaiśeṣika, Mīmāṃsā, and Sāṃkhya's dualistic approach to reality, along with debates on causation like Asatkāryavāda and Satkāryavāda.

UNIT IV: Philosophical Perspectives in Vedānta
Vedānta schools, particularly Śaṃkara's Advaita Vedānta, which discusses Brahman and Māyā, and Rāmānuja's Viśiṣṭādvaita, which critiques Māyā and presents a theistic interpretation of Brahman.

UNIT V:Ethical Foundations in Indian Philosophy
Indian ethical theories, covering moral philosophy, family and societal values, the four puruṣārthas (Dharma, Artha, Kāma, Mokṣa), Nishkama Karma as explained in the Bhagavad Gita, and ethical teachings in Jainism and Buddhism.

Textbooks:

1. **Hiriyanna, M.** (1995). *Outlines of Indian Philosophy*. Motilal Banarsidass.
2. **Chatterjee, S. C. & Datta, D. M.** (1984). *An Introduction to Indian Philosophy*. University of Calcutta.

Reference Books:

1. **Dasgupta, S. N.** (2009). *A History of Indian Philosophy (Vol. I–V)*. Motilal Banarsidass.
2. **Raju, P. T.** (2006). *Structural Depths of Indian Thought*. South Asia Books.

Web Links:

1. https://plato.stanford.edu
2. https://iep.utm.edu
3. https://www.swami-krishnananda.org
4. https://hds.harvard.edu/sacred
5. https://www.bbc.co.uk/bitesize

B.Sc. Forensic Science
Minor Stream: Physics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS37	I	Mathematical Physics	FC	2		2	4	50	50	100	-
2509FS38	II	Mechanics and Properties of Matter	FC	2		2	4	50	50	100	-
2509FS59	III	Waves & Optics	IC	2		2	4	50	50	100	MMP
2509FS60	IV	Electricity and Magnetism	IC	2		2	4	50	50	100	MPM
2509FS14	V	Modern Physics	AC	2		2	4	50	50	100	EM
2509FS15	VI	Applications of Electricity & Electronics	AC	2		2	4	50	50	100	EM
Total				**12**		**12**	**24**				

Mathematical Physics

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS37
Semester- I
Course Outcomes:

L	T	P	C
2	0	2	4

At the end of the course, students will be able to:

CO1: Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.
CO2: To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations
CO3: To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.
CO4: Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.
CO5: To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	3	2	1	2	-	3	1	2	1
CO2	1	-	2	3	1	2	-	2	1	2	1
CO3	1	-	2	3	1	2	-	2	1	2	1
CO4	1	-	3	3	1	2	-	2	1	2	1
CO5	1	-	2	2	1	2	-	2	1	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Essentials of Mathematics

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems Statistical Measures: Mean, Median, Mode of a data and problems.

Practice- Verification of Vector Addition and Analysis of Forces Using a Force Table.

UNIT II: Essentials of Physics

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe.

Practice- Statistical Analysis of Experimental Data: Mean, Median, Mode, and Error Calculation.

UNIT III: Classical Mechanics in Physics

D'Alembert's principle, cyclic coordinates, variational principle, Lagrange's equation of motion, central force and scattering problems, rigid body motion; small oscillations, Hamilton' s formalisms; Poisson bracket; special theory of relativity: Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Practice- Study of Oscillatory Motion in a Spring-Mass System and Validation of Small Oscillations Theory.

UNIT IV- Linear algebra

Linear vector space: basis, orthogonality and completeness; matrices; vector calculus; linear differential equations; elements of complex analysis: Cauchy-Riemann conditions, Cauchy's theorems, singularities, residue theorem and applications; Laplace transforms, Fourier analysis; elementary ideas about tensors: covariant and contra variant tensor, Levi-Civita and Christoffel symbols.

Practice- Fourier Analysis of Waveforms Using Function Generator and Oscilloscope

UNIT V: Applications of Physics & Mathematics

Applications of Mathematics in Physics: Calculus, Differential Equations & Complex Analysis Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Practice- Measurement of Carrier Density and Mobility in Semiconductors Using the Hall Effect.

Textbooks

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. ElementaryTrigonometry by H.S.Hall and S.R.Knight

Reference Books

1. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
2. Physics for Scientists and Engineers with Modern Physics" byRaymond A. Serway and John W. Jewett Jr.

Web Links

1. https://ocw.mit.edu/search/?d=Physics&s=department_course_numbers.sort_coursenum
2. https://www.khanacademy.org/science/physics
3. https://phys.libretexts.org/Bookshelves/Mathematical_Physics_and_Pedagogy
4. https://tutorial.math.lamar.edu/
5. https://mathworld.wolfram.com/

Mechanics and Properties of Matter

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS38
Semester- II

L	T	P	C
2	0	2	4

Course Outcomes:

At the end of the course, students will be able to:
CO1: Students will be able to understand and apply the concepts of scalar and vector fields, calculate the gradient of a scalar field, determine the divergence and curl of a vector field.
CO2: Students will be able to apply the laws of motion, solve equations of motion for variable mass systems.
CO3: Students will be able to define a rigid body and comprehend rotational kinematic relations, derive equations of motion for rotating bodies, analyze the precession of a top and gyroscope, understand the precession of the equinoxes.
CO4: Students will be able to define central forces and provide examples, understand the characteristics and conservative nature of central forces, derive equations of motion under central forces.
CO5: Students will be able to differentiate between Galilean relativity and the concept of absolute frames, comprehend the postulates of the special theory of relativity, apply Lorentz transformations, understand and solve problem**s**

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2	1	1	-	-	3	1	2	-
CO2	2	2	2	1	1	-	-	3	1	2	-
CO3	2	2	2	1	1	-	-	2	1	2	-
CO4	2	2	2	1	1	-	-	2	1	2	-
CO5	2	2	2	1	1	-	-	2	1	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT-I Vector Analysis

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

Practice- Determine Viscosity of liquid by the flow method (Poiseuille's method).

UNIT-II Mechanics of Particles

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

Practice- Determine Young's modulus of the material of a bar (scale) by uniform bending.

UNIT-III Mechanics of Rigid bodies and Continuous

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, Precession of a top, Gyroscope, Precession of the equinoxes. Elastic constants of isotropic solids and their relations, Poisson's ratio and expression for Poisson's ratio. Classification of beams, types of bending, point load, distributed load.

Practice- Determine Young's modulus of the material a bar (scale) by non- uniform bending.

UNIT-IV Central forces

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equations of motion under a . Derivation of Kepler's laws. Motion of satellites.

Practice- Calculate Surface tension of a liquid by capillary rise method.

UNIT-V Special Theory of Relativity

Galilean relativity, Absolute frames. Michelson-Morley experiment, The negative result. Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

Practice- Determination of radius of capillary tube by Hg thread method.

Textbooks

1. Mechanics - D.S. Mathur, Sulthan Chand & Co, New Delhi
2. Mechanics - J.C. Upadhyaya, Ramprasad & Co., Agra.

Reference Books

1. Mechanics by J.C. Slater and N.H. Frank – A classic resource on the fundamentals of mechanics.
2. An Introduction to Mechanics by Daniel Kleppner and Robert J. Kolenkow – Covers Newtonian mechanics and advanced applications.

Web Links

1. https://ocw.mit.edu/search/?d=Physics&s=department_course_numbers.sort_coursenum
2. https://www.khanacademy.org/science/physics
3. https://phys.libretexts.org/Bookshelves/Mathematical_Physics_and_Pedagogy
4. https://tutorial.math.lamar.edu/
5. https://mathworld.wolfram.com/

Waves & Optics
Semester III
(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS59

Semester- III	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Understand the fundamental concepts of wave motion, oscillatory systems, and energy transport in waves.

CO2: Analyze wave propagation in different media and its applications, including acoustics and the Doppler effect.

CO3: Apply the principles of geometrical optics to design and understand the working of optical systems and instruments.

CO4: Explore the wave nature of light through interference, diffraction, and polarization, and apply these principles in practical scenarios.

CO5: Understand advanced optical technologies such as lasers and fiber optics and their applications in communication and medical fields.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	1	3	1	1	2	-
CO2	2	-	2	2	-	1	3	1	1	2	-
CO3	2	-	3	2	-	1	2	1	1	2	-
CO4	2	-	3	2	-	1	2	1	1	2	-
CO5	2	-	3	2	-	1	2	1	1	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Waves and Oscillations

Introduction to wave motion, types of waves (mechanical and electromagnetic), longitudinal and transverse waves, derivation of wave equation, characteristics of simple harmonic motion (SHM), damped oscillations, forced oscillations, resonance and its applications, principle of superposition, formation of standing waves, beats, energy transport in waves.

Practice- Determine the velocity of sound in air using the resonance tube method.

UNIT II: Wave Propagation and Acoustics
Wave propagation in solids, gases, and liquids, sound waves and their speed in various media, Doppler effect and its applications in sound and light, acoustics of buildings, reverberation, echo, absorption of sound, Sabine's formula for reverberation time, factors affecting sound quality in auditoriums.

Practice- Measure the refractive index of a given glass slab using the critical angle method.

UNIT III: Geometrical Optics
Laws of reflection and refraction, total internal reflection, critical angle and applications (optical fibers, mirages), image formation by spherical mirrors and thin lenses, lens maker's formula, magnification, chromatic aberration, spherical aberration, methods to minimize aberrations, applications of lenses and mirrors in optical instruments.

Practice- Study the interference pattern using Young's double-slit experiment and determine the wavelength of light.

UNIT-IV: Wave Optics
Principle of superposition in light waves, interference of light, Young's double-slit experiment, conditions for constructive and destructive interference, thin-film interference, Fresnel and Fraunhofer diffraction, single-slit diffraction, diffraction grating, resolving power of optical instruments, polarization of light, types of polarization, Brewster's law, Malus's law, applications of polarized light.

Practice- Observe diffraction using a single-slit and calculate the slit width.

UNIT-V: Advanced Topics in Optics
Introduction to lasers, principles of laser action, population inversion, stimulated emission, applications of lasers in communication and medicine, optical instruments (microscopes, telescopes), resolving power, fiber optics, principle and structure of optical fibers, advantages and applications in communication, sensors, and medical technology.

Practice- Demonstrate the working of optical fibers and study light propagation through different fiber structures.

Textbooks
1. Optics by Eugene Hecht
2. Introduction to Classical Mechanics by David Morin

Reference Books

1. The Feynman Lectures on Physics, Volume 1 by Richard P. Feynman, Robert B. Leighton, and Matthew Sands
2. Wave Physics by Stephen Nettel

Web Links

1. https://ocw.mit.edu/courses/physics/
2. https://hyperphysics.phy-astr.gsu.edu/hbase/wavcon.html
3. https://www.khanacademy.org/science/physics/waves-and-optics
4. https://scienceworld.wolfram.com/physics/topics/Waves.html
5. https://www.physicsclassroom.com/class/light

Electricity and Magnetism

(Common to

B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS60

Semester- IV	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Explain the fundamental principles of electrostatics and their applications in charge distributions and capacitance.

CO2: Analyze the principles of current electricity and apply them to solve electrical circuit problems.

CO3: Understand the magnetic effects of current and their applications in devices like galvanometers and solenoids.

CO4: Explore electromagnetic induction, Faraday's laws, and their applications in modern electrical systems.

CO5: Comprehend Maxwell's equations and the propagation of electromagnetic waves in free space and their technological applications.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	3	2	-	1	-	2	1	2	-
CO2	2	-	3	2	-	1	-	2	1	2	-
CO3	2	-	3	2	-	1	-	2	1	2	-
CO4	2	-	3	2	-	1	-	2	1	2	-
CO5	2	-	3	2	-	1	-	2	1	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT-I: Electrostatics

Electric charge and its properties, Coulomb's law, electric field and electric flux, Gauss's law and its applications, electric potential, potential energy of a system of charges, conductors and insulators, capacitance, energy stored in a capacitor, dielectrics and their behavior in an electric field.

Practice- Verify Ohm's Law using a resistor.

UNIT-II: Current Electricity
Electric current, drift velocity and mobility, Ohm's law, electrical resistance and resistivity, temperature dependence of resistance, combination of resistances, Kirchhoff's laws and their applications in electrical circuits, Wheatstone bridge, potentiometer and its applications, heating effects of current, Joule's law, thermoelectric effects.

Practice- Study and verify Kirchhoff's Current and Voltage Laws.

UNIT-III: Magnetic Effects of Current
Biot-Savart law, Ampere's circuital law, magnetic field due to a straight conductor, circular loop, and solenoid, force on a charged particle moving in a magnetic field, torque on a current loop in a magnetic field, moving coil galvanometer, conversion of galvanometer to ammeter and voltmeter.

Practice- Determine the horizontal component of Earth's magnetic field using a tangent galvanometer.

UNIT-IV: Electromagnetic Induction
Faraday's laws of electromagnetic induction, Lenz's law, self-inductance and mutual inductance, energy stored in an inductor, eddy currents, applications of electromagnetic induction (e.g., transformers, electric generators, and induction cooktops).

Practice- Measure the capacitance and dielectric constant of a given material.

UNIT-V: Maxwell's Equations and Electromagnetic Waves
Displacement current, Maxwell's equations (integral and differential forms), electromagnetic wave propagation, wave equation for free space, energy density in electromagnetic waves, Poynting vector, applications of electromagnetic waves in communication technologies.

Practice- Study electromagnetic induction using a solenoid and calculate induced EMF.

Textbooks
1. Introduction to Electrodynamics by David J. Griffiths
2. Electricity and Magnetism by Edward M. Purcell and David J. Morin

Reference Books
1. Electromagnetic Fields and Waves by Paul Lorrain and Dale Corson
2. Classical Electrodynamics by John D. Jackson

Web Links
1. https://ocw.mit.edu/courses/physics/
2. https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields

3. https://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecon.html
4. https://www.physicsclassroom.com/class/estatics
5. https://scienceworld.wolfram.com/physics/topics/Electricity.html

Modern Physics

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS14

Semester- V	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Understand the fundamental principles of relativity and its applications in modern physics.

CO2: Develop a comprehensive understanding of quantum mechanics and its implications for atomic and subatomic systems.

CO3: Analyze atomic spectra and the behavior of atomic structures under different physical conditions.

CO4: Explore the principles and applications of nuclear physics in energy and medical technologies.

CO5: Gain insights into particle physics and cosmology to understand the universe at a fundamental level.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	1	-	-	2	1	2	-
CO2	2	-	3	2	-	1	-	3	1	3	-
CO3	2	-	3	2	-	1	-	2	1	2	-
CO4	2	-	3	2	1	1	-	2	1	3	-
CO5	2	-	2	2	1	-	-	2	1	3	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-Wise Syllabus:

UNIT I: Relativity

Introduction to classical mechanics and its limitations, Einstein's theory of special relativity, postulates of relativity, Lorentz transformations, time dilation, length contraction, relativistic mass and energy, mass-energy equivalence, applications of relativity.

Practice- Verify the photoelectric effect and determine the Planck's constant.

UNIT II: Quantum Mechanics
Wave-particle duality, Planck's hypothesis, photoelectric effect, Compton effect, de Broglie hypothesis, Davisson-Germer experiment, Heisenberg's uncertainty principle, Schrödinger wave equation (time-dependent and time-independent forms), particle in a box, quantum tunneling, applications of quantum mechanics.

Practice- Study the characteristics of alpha, beta, and gamma radiation using a GM counter.
UNIT III: Atomic Structure
Bohr's model of the hydrogen atom, energy levels, spectral series, fine structure, vector atom model, quantum numbers, Zeeman effect, Stark effect, spin-orbit coupling, introduction to atomic spectra.

Practice- Determine the wavelength of monochromatic light using a diffraction grating.

UNIT IV: Nuclear Physics
Structure of the nucleus, nuclear forces, binding energy, mass defect, nuclear models (liquid drop model and shell model), radioactivity, alpha, beta, and gamma decay, half-life and mean life, nuclear fission and fusion, applications of nuclear physics in energy production and medicine.

Practice- Demonstrate the quantum tunneling effect using a simulated setup.

UNIT V: Particle Physics and Cosmology
Fundamental particles, classification of particles (leptons, baryons, mesons), quark model, fundamental forces of nature, standard model of particle physics, Higgs boson, introduction to cosmology, Big Bang theory, dark matter, dark energy, and the expanding universe.

Practice- Measure the charge-to-mass ratio (e/me/me/m) of an electron using Thomson's method.

Textbooks
1. Concepts of Modern Physics by Arthur Beiser
2. Modern Physics for Scientists and Engineers by John R. Taylor, Chris D. Zafiratos, and Michael A. Dubson

Reference Books
1. Special Relativity and Classical Field Theory by Leonard Susskind and Art Friedman
2. Relativity: The Special and General Theory by Albert Einstein

Web Links
1. HyperPhysics - Modern Physics: https://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. MIT OpenCourseWare - Modern Physics: https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/

3. Khan Academy - Quantum Mechanics and Nuclear Physics: https://www.khanacademy.org/science/physics
4. Physics LibreTexts - Modern Physics: https://phys.libretexts.org/
5. Particle Data Group (PDG): https://pdg.lbl.gov/

Applications of Electricity & Electronics

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS15

Semester- VI	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Understand the fundamental principles of electricity and apply them to analyze electrical circuits.
CO2: Gain knowledge of electrical machines and their applications in various industries.
CO3: Explore the working and applications of semiconductor devices in electronics.
CO4: Develop skills in designing and analyzing analog and digital electronic circuits.
CO5: Understand the applications of electricity and electronics in instrumentation, communication, and automation systems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	2	2	-	1	-	1	2	2	-
CO2	1	-	2	2	-	1	-	1	2	2	-
CO3	1	-	2	2	-	1	-	1	2	3	1
CO4	1	-	2	2	-	2	-	1	2	3	1
CO5	1	-	2	2	-	2	-	1	2	3	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit-wise Syllabus

UNIT I: Fundamentals of Electricity

Basic concepts of electric charge, current, voltage, resistance, and power, Ohm's law and its applications, series and parallel circuits, Kirchhoff's laws, calculation of electrical energy and cost, introduction to AC and DC, RMS and average values, power factor and its significance.

Practice- Verify Ohm's law and study the characteristics of series and parallel circuits.

UNIT II: Electrical Machines
Principles of electromagnetic induction, construction and working of transformers, types and applications of transformers, construction and working of DC machines (generators and motors), AC machines (synchronous and induction motors), basic concepts of electric drives and their applications.

Practice- Determine the efficiency and regulation of a single-phase transformer under different loads.

UNIT III: Semiconductor Devices
Introduction to semiconductors, PN junction diode, characteristics and applications (rectifiers, voltage regulators), Zener diode, bipolar junction transistors (BJTs), field-effect transistors (FETs), thyristors, optoelectronic devices (LED, photodiode, and solar cell), applications in power electronics.
Practice- Study the VI characteristics of a PN junction diode and Zener diode.

UNIT IV: Analog and Digital Electronics
Operational amplifiers (OP-AMPs): characteristics and applications (amplifiers, oscillators, and filters), introduction to digital electronics, logic gates, Boolean algebra, combinational and sequential circuits, flip-flops, counters, and shift registers, introduction to microcontrollers and their applications.

Practice- Design and implement basic logic gates and verify truth tables using a breadboard.

UNIT V: Applications and Instrumentation
Electric heating and welding, applications of electricity in lighting (incandescent, fluorescent, and LED lamps), basics of electrical measuring instruments (voltmeter, ammeter, wattmeter, multimeter), introduction to sensors and transducers, applications of electronics in communication, automation, and medical technologies.

Practice- Build and test a simple OP-AMP-based amplifier circuit.

Textbooks
1. Basic Electrical Engineering by D.P. Kothari and I.J. Nagrath
2. Principles of Electronics by V.K. Mehta and Rohit Mehta

Reference Books
1. Electrical Machines by J.B. Gupta
2. Power Electronics: Circuits, Devices, and Applications by Muhammad H. Rashid

Web Links
1. Khan Academy - Electricity and Circuits: https://www.khanacademy.org/science/electrical-engineering
2. All About Circuits: https://www.allaboutcircuits.com/

3. Electronics Tutorials: https://www.electronics-tutorials.ws/
4. MIT OpenCourseWare - Electrical Engineering: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
5. Electrical4U - Basics of Electrical and Electronics: https://www.electrical4u.com/

Minor Stream: Chemistry

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS39	I	Fundamentals of Inorganic and Physical Chemistry	FC	2		2	4	50	50	100	-
2509FS40	II	Fundamentals of Organic and General Chemistry	FC	2		2	4	50	50	100	-
2509FS61	III	Chemistry of Complex Compounds and Physical Chemistry	IC	2		2	4	50	50	100	-
2509FS62	IV	Chemistry of Organic Compounds	IC	2		2	4	50	50	100	-
2509FS16	V	Spectroscopy and Structural Identification of Organic Compounds	AC	2		2	4	50	50	100	-
2509FS17	VI	Analytical Chemistry	AC	2		2	4	50	50	100	-
Total				**12**		**12**	**24**				

Fundamentals of Inorganic and Physical Chemistry

Course Code: 2509FS39 | L | T | P | C
Semester- I | 2 | 0 | 2 | 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the Periodic Table and Periodic Trends
CO2: Explore the Chemistry of p-block Elements
CO3: Analyze the Properties of d and f-block Elements
CO4: Examine the Properties of Solutions and Ionic Equilibria
CO5: Understand Acids, Bases, and Buffer Solutions

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	1	1	-	-	-
CO2	2	-	3	3	-	-	1	1	-	-	-
CO3	2	-	3	3	-	-	1	1	-	-	-
CO4	1	-	2	2	-	-	3	3	-	-	-
CO5	2	-	2	2	-	-	3	3	-	1	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**1**	**-**
CO5	**1**	**-**

Unit-Wise Syllabus:

UNIT – I: Periodic table

Classification of elements into s, p, d, f blocks. Periodicity-periodic law and arrangement of elements in the periodic table, group number, horizontal, vertical, and diagonal relationships in the periodic table. Trend in atomic radii, ionization potential, electron affinity; electronegativity, metallic nature, oxidation states and variable valency.

UNIT – II: Chemistry of p-block elements

Preparations, structures, classification and uses of of Diborane, Borazine, Silicones, Phosphonitrilic halides, Oxides and Oxoacids of Sulphur, Pseudo halogens, Interhalogen compounds, Xenon Fluorides and Oxyfluorides.

UNIT – III: Chemistry of d and f-block elements

Characteristics of d and f-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability

of various. Oxidation states. Lanthanide contraction, consequences of lanthanide contraction, actinide contraction, comparison of lanthanides and actinides.

UNIT – IV: Solutions

Types of solutions, Concentration and its measurements, Ionic equilibrium Ionic product, common ion effect, solubility and solubility product. Ideal and non-ideal solutions, Raoult's law. Dilute solutions Colligative properties- RLVP, Osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

UNIT – V: Acids and Bases

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, classification-protic and aprotic solvents, Types of indicators, Buffer solutions, Types of chemical reactions. Definition of p^{H}, p^{OH} p^{ka} and p^{kb}, Types of salts, Salts hydrolysis.

Practical Work:

Qualitative Inorganic Salt Analysis

Analysis of simple salt containing one anion and cation from the following Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate. Cations: Lead, Copper, Iron, Aluminium, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Potassium and Ammonium.

Quantitative volumetric Analysis

1. Determination of concentration of given unknown HCl solution by Standard NaOH solution
2. Determination of concentration of given unknown CH_3COOH solution by standard NaOH solution
3. Determination of concentration of given unknown NH_4OH solution by standard HCl solution

Textbooks:

1. Unified Chemistry by O.P. Agarwal.
2. Kalyani Series by Y.R. Sharma

Reference Books:

1. Textbook of physical chemistry by S Glass tone
2. Advanced physical chemistry by Bahl and Tuli

Web Links:

1. https://www.fishersci.com/us/en/periodic-table.html
2. https://www.vedantu.com/chemistry/acids-and-bases?utm
3. https://www.bbc.co.uk/bitesize/guides/zyn3b9q/revision/1

Fundamentals of Organic and General Chemistry

Course Code: 2509FS40

L	T	P	C
2	0	2	4

Semester- II

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand Structural Theory in Organic Chemistry
CO2: Analyze **physical and chemical properties** of alkanes.
CO3: Describe **electrophilic and nucleophilic addition reactions** of alkenes and alkynes.
CO4: Understand Chemical Bonding Concepts
CO5: Understand **D, L, R, S, and E, Z configurations** and their applications

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	2	-
CO2	2	-	3	1	-	-	-	2	-	1	-
CO3	2	-	3	2	-	-	-	2	-	-	-
CO4	3	-	2	2	-	-	-	1	-	1	-
CO5	2	-	2	2	-	-	-	1	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**-**
CO3	**2**	**1**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT – I: Structural theory in Organic Chemistry

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect - Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals.

UNIT – II: Saturated Hydrocarbons (Alkanes and Cycloalkanes)

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane). General

molecular formula of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT – III: Unsaturated Hydrocarbons (Alkenes and Alkynes)
General methods of preparation, physical and chemical properties, Saytzeff and Hofmann eliminations (with mechanism), Electrophilic Additions, (H2, HX) mechanism (Markovnikov/ Anti Markovnikov addition) with suitable examples- addition of X2, HX, hydroxylation, Diels Alder reaction, 1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT – IV: Chemical bonding
Types of bonds ionic and covalent bonds, Fajan's rule, factors affecting Fajans rule, Chemical Bonding Valence bond theory, hybridization, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT – V: Stereochemistry of carbon compounds
Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with example- Glyceraldehyde, D, L, R, S and E, Z- configuration with examples. Definition of Racemic mixture.

Practical Work:
Analysis of mixture salts containing two anions and two cations (From two different groups) from the following: Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate. Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

1. Combustion Test (Alkanes vs. Alkenes)
2. Bromine Water Test (Unsaturation Test for Alkenes)
3. Reaction with Acidified Potassium Permanganate (Baeyer's Test)
4. Oxidation of Alkanes and Alkenes

Textbooks:

1. Unified Chemistry by Dr. O.P. Agarwal
2. Kalyani Series by Y.R. Sharma

Reference Books:

1. Text book of physical chemistry by K L Kapoor
2. Textbook of physical chemistry by S Glass tone

Web Links:

1. https://unacademy.com/content/jee/study-material/chemistry/alkane?utm
2. https://www.khanacademy.org/science/chemistry/chemical-bonds?utm
3. https://egonw.github.io/cdkbook/stereo.html?utm

Chemistry of Complex Compounds and Physical Chemistry

Course Code: 2509FS61 | **L** | **T** | **P** | **C**
Semester-III | **2** | 0 | 2 | 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain structural and stereoisomerism in coordination complexes with coordination numbers 4 and 6.

CO2: Understand inorganic reaction mechanisms and distinguish between labile and inert complexes**.**

CO3: Apply Phase Rule to Different Systems

CO4: Understand Electrochemistry and Electrochemical Cells

CO5: Analyze Chemical Kinetics and Reaction Rates

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	1	-	1	-
CO2	3	-	3	2	-	-	-	2	-	-	-
CO3	2	-	3	2	-	-	-	3	-	1	-
CO4	2	-	3	2	-	-	-	3	-	1	-
CO5	2	-	3	1	-	-	-	3	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT – I: Coordinator Chemistry

Coordinator Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes.

UNIT - II: **Stability of metal complexes**
Introduction to inorganic reaction mechanisms. Labile and inert complexes, ligand substitution reactions -SN1 and SN2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

UNIT-III: Phase rule
Concept of phase, components, degrees of freedom. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point, freezing mixtures.

UNIT – IV: **Electrochemistry:**
Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, Debye-Huckel-Onsager's equation for strong electrolytes, conductometric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations.

UNIT – V: **Chemical Kinetics**
The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions. Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories

Practical Work:
1. Conductometric titration- Determination of concentration of HCl solution using standard NaOH solution.
2. Conductometric titration- Determination of concentration of CH_3COOH Solution using standard NaOH solution.
3. Conductometric titration- Determination of concentration of CH_3COOH and HCl in a mixture using standard NaOH solution.
4. Potentiometric titration- Determination of Fe (II) using standard $K_2Cr_2O_7$ solution.
5. Determination of rate constant for acid catalysed ester hydrolysis.

Textbooks:
1. Chemical Kinetics" – *Keith J. Laidler*
2. The Chemistry of the Coordination Compounds" – *J.C. Bailar Jr*

Reference Books:

1. Concise Inorganic Chemistry by J.D. Lee
2. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

Web Links

1. https://www.chemguide.co.uk/inorganic/complexions/
2. https://www.sciencedirect.com/topics/chemistry/electrochemistry
3. https://en.wikipedia.org/wiki/Chemical_kinetics

Chemistry of Organic Compounds

Course Code: 2509FS62
Semester- IV

L	T	P	C
2	0	2	4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Apply Hückel's rule to determine the aromaticity of benzenoid and non-benzenoid compounds.
CO2: Analyze Alcohols and Phenols
CO3: Explain the structure, preparation, and reactivity **of** aldehydes and ketones**.**
CO4: Understand the Chemistry of Carboxylic Acids and Their Derivatives
CO5: Understand the Zwitterion structure and its impact on solubility, melting point, and amphoteric character

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	2	-	3	1	-	-	-	2	-	1	-
CO3	3	-	3	2	-	-	-	2	-	-	-
CO4	2	-	3	1	-	-	-	3	-	-	-
CO5	2	-	2	2	-	-	-	2	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**1**
CO3	**2**	**1**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT – I: Benzene and its reactivity

Concept of resonance, resonance energy. Concept of aromaticity – aromaticity, Huckel's rule - application to Benzenoid and Non - Benzenoid compounds, Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Crafts alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples. Orientation of Amino, methoxy, Carboxy, nitro, and Halogens.

UNIT-II: Alcohols & Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Reduction; Oxidation of Diols by Periodic Acid, Pinacol- Pinacolone Rearrangement. Phenols: Preparation

and Properties; Acidity and Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism

UNIT III: Carbonyl Compounds
Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives. Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro, Haloform Reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner). Addition Reactions of α, βunsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism.

UNIT III: Carboxylic Acids and their Derivatives
General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituent acidic strength. Typical reactions of carboxylic acids, hydroxyl acids and unsaturated acids. Preparation and Reactions of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group- Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups.

UNIT – V: **Amino acids**
Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis. Physical properties: Zwitterion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups

Practical Work:
Organic Qualitative analysis:
Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

Organic Synthesis:
1. Benzoylation of Aniline
2. Nitration of Acetanilide
3. Acetylation of Aniline
4. Acetylation of Salicylic acid

Textbooks:
1. Organic Chemistry" **–** Paula Yurkanis Bruice
2. A Textbook of Organic Chemistry" – *Arun Bahl and B.S. Bahl*

Reference Books:

1. "Organic Chemistry" – *T.W. Graham Solomons and Craig B. Fryhle*
2. "Structure and Mechanism in Organic Chemistry" – *C.K. Ingold*

Web Links

1. http://hyperphysics.phy-astr.gsu.edu/hbase/Organic/carbonyl.html
2. https://www.masterorganicchemistry.com/topic/benzene-and-aromaticity/
3. https://www.britannica.com/science/amino-acid

Spectroscopy and Structural Identification of Organic Compounds

L	T	P	C
2	0	2	4

Course Code: 2509FS16
Semester- V
Course Outcomes:
At the end of the course, students will be able to:

CO1: Understand the Principles and Applications of Rotational and Vibrational Spectroscopy
CO2: Apply Electronic Spectroscopy to Analyze Organic Compounds
CO3: Interpret Nuclear Magnetic Resonance (NMR) Spectroscopy Data
CO4: Explain the basic principles of mass spectrometry, including electron impact ionization (EI), molecular ions, base peaks, and metastable ions**.**
CO5: Utilize IR, NMR, and mass spectral data to determine the structure of organic compounds like propionic acid, methyl propionate, phenyl acetylene.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	2	-	2	2	-	-	-	2	-	1	-
CO3	3	-	2	2	-	-	-	2	-	-	-
CO4	2	-	2	1	-	-	-	3	-	1	-
CO5	3	-	2	2	-	2	-	3	-	-	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT – I: Rotational and Vibrational spectroscopy
Rotation spectroscopy: Principle, Selection rules, rotational spectrum of a diatomic molecule, intensities of spectral lines, determination of bond lengths, isotopic substitution. Vibrational Spectroscopy: Classical Equation of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibrations. Selection rules for vibrational transitions. Functional group and fingerprint region. IR spectra of alkanes, alkenes, alcohols, aldehydes, ketones, carboxylic acids and their derivatives

UNIT – II: Electronic spectroscopy

Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α, β – unsaturated compounds

UNIT – III: Nuclear Magnetic Resonance (NMR) spectroscopy

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT – IV: Mass Spectroscopy

Basic principles, electron Ionization (Electron Impact ionization, EI), Molecular ions, base signal metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, Butyraldehyde, Propionic acid.

UNIT – V: Structural analysis of organic compounds using IR, NMR, mass spectral data

Propionic acid, methyl propionate, Phenyl acetylene, acetophenone and Butane-2, 3-dione.

Practical Work:

1. Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer
2. Determination of Absorption Spectrum of a $CuSO_4$ using UV-Visible Spectroscopy
3. Determination of Absorption Spectrum of a $KMnO_4$ using UV-Visible Spectroscopy
4. IR spectral values of the following functional groups a) Alcohols b) Aldehydes c) ketones
5. Identification of the following functional groups by IR spectrum

1) Hydro carbons 2) Amines 3) Carboxylic acids

Textbooks:

1. "Introduction to Spectroscopy" – Donald L. Pavia
2. "Fundamentals of Molecular Spectroscopy" – C.N. Banwell and E.M. McCash

Reference Books:

1. Organic Spectroscopy by William Kemp
2. Organic Spectroscopy: Principles and Applications" – Jag Mohan

Web Links

1. https://www.nist.gov/pml/quantum-measurement/spectroscopy
2. https://www.rsc.org/education/teachers/resources/aflchem/resources/57/index.htm
3. https://www.thermofisher.com/us/en/home/industrial/mass-spectrometry/mass-spectrometry-learning-center.html

Analytical Chemistry

Course Code: 2509FS17 | **L** | **T** | **P** | **C**
Semester- VI | **2** | 0 | 2 | 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental steps involved in chemical analysis.
CO2: Differentiate types of errors in chemical analysis and apply methods to minimize them
CO3: Explain the principles of solvent extraction and apply them in chemical separations
CO4: Describe the principles of chromatography and classify different chromatographic techniques
CO5: Explain the experimental procedures of Column Chromatography and its applications.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	2	-	2	1	-	-	-	3	-	1	-
CO3	2	-	2	1	-	-	-	2	-	-	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	2	1	-	2	-	2	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**1**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT – I: Quantitative analysis

Steps involved in chemical analysis. Principles of volumetric analysis: Theories of acid-base, redox, complex metric, iodometric and precipitation titrations. Detection of end point in redox titration, choice of indicators for the saturations. Principles of gravimetric analysis, precipitation, coagulation, peptization, co-precipitation, post-precipitation, digestion, filtration and washing of precipitate

UNIT - II: Treatment of analytical data

Types of errors, significant figures and its importance, accuracy-methods of expressing accuracy, absolute and relative errors, error analysis and minimization of errors. Precision - methods of expressing precision, standard deviation and confidence limit. The correlation coefficient.

UNIT – III: **Separation techniques in Chemical analysis**
Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application Determination of Iron (III). Ion Exchange: Introduction, action of ion exchange resins, separation of inorganic mixtures, applications.

UNIT– IV: Chromatography-1
Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors affecting R_f values. Paper Chromatography: Principles, R_f values, experimental procedures, choice of paper and solvent systems, developments of chromatogram-ascending, descending and radial. Two dimensional chromatography, applications.

UNIT– V: Chromatography-2
Thin layer Chromatography (TLC): Advantages. Principles. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications. Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation techniques, Applications. HPLC: Basic principles and applications.

Practical Work:
Qualitative Inorganic Salt Analysis

1. Determination of Zn(II)/ Mg(II) using EDTA 3. Determination of Fe (II) present in an Iron tablet using KMnO4 -Redox titration.
2. Determination of Saponification value of oil and Iodine value of oil.
3. Paper chromatographic separation of $Fe^{3+,}$ $Al^{3+,}$ and $Cr^{3+.}$
4. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
5. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC.
6. Separation by Column Chromatography – Mixture of Ortho and Para Nitroaniline.

Textbooks:

1. Fundamentals of Analytical Chemistry" – *Douglas A. Skoog, Donald M. West, F. James Holler, and Stanley R. Crouch*
2. "Quantitative Chemical Analysis" – *Daniel C. Harris*

Reference Books:

1. Analytical Chemistry by Skoog and Miller
2. Textbook of qualitative inorganic analysis by A.I. Vogel

Web Links

1. https://www.thoughtco.com/definition-of-qualitative-analysis-604627
2. https://www.slideshare.net/slideshow/separation-techniques-1733995/1733995?
3. https://www.thermofisher.com

Minor Stream: Botany

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS41	I	Non-vascular Plants	FC	2		2	4	50	50	100	-
2509FS42	II	Vascular Plant	FC	2		2	4	50	50	100	-
2509FS63	III	Plant Anatomy and Embryology of Angiosperms	IC	2		2	4	50	50	100	-
2509FS64	IV	Plant Ecology, Biodiversity and Phytogeography	IC	2		2	4	50	50	100	-
2509FS18	V	Cell Biology and Genetics	AC	2		2	4	50	50	100	-
2509FS19	VI	Plant Physiology and Metabolism	AC	2		2	4	50	50	100	-
Total				**12**		**12**	**24**				

Non-vascular Plants

Course Code: 2509FS41

Semester-I	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Understand the general characteristics, classification, thallus organization, and ecological importance of algae, fungi, and bryophytes.

CO2: Analyze the structure, reproduction, and life cycle of selected algal and fungal groups, including their role in biotechnology and industry.

CO3: Apply knowledge of fungal taxonomy, nutrition, and reproduction, including heterothallism and parasexuality, to ecological and industrial applications.

CO4: Evaluate the biological significance, reproductive strategies, and evolutionary aspects of bryophytes and their role in plant evolution.

CO5: Develop skills in recognizing and differentiating major groups of algae, fungi, and bryophytes based on morphological and reproductive features.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	1	-	1	-
CO2	3	-	3	3	-	-	-	2	-	2	-
CO3	2	-	3	3	-	-	-	2	-	2	-
CO4	3	-	2	3	-	-	-	2	-	1	-
CO5	2	-	2	2	-	-	-	1	-	1	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**1**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT-I: Introduction to Algae

General Characteristics of Algae, Occurrence and Distribution, Cell Structure, Pigments, Flagella and Reserve Food Material, Classification of Algae (F.E. Fritsch, 1935 & Lee, 2008), Thallus Organization and Life Cycles in Algae, Ecological and Economic Importance of Algae.

Practice- To identify and study the morphological and structural characteristics of selected algae and fungi using prepared slides.

UNIT-II: Biology of Selected Algae
Occurrence, Structure, Reproduction and Life Cycle of:Chlorophyceae, Spirogyra, Phaeophyceae: Ectocarpus, Xanthophyceae: Vaucheria, Rhodophyceae: Polysiphonia, Bacillariophyceae, Culture and Cultivation of Chlorella.

Practice- To cultivate Chlorella in the laboratory and observe its growth under controlled conditions.

UNIT-III: Introduction to Fungi
General Characteristics of Fungi, Ainsworth (1973) Classification, Thallus Organization and Nutrition in Fungi, Reproduction in Fungi (Asexual and Sexual), Heterothallism and Parasexuality, Ecological and Economic Importance of Fungi.
Practice- To examine the reproductive structures in fungi and bryophytes using microscopic techniques.

UNIT-IV: Biology of Selected Fungi
Occurrence, Structure, Reproduction and Life Cycle of: Mastigomycotina: Phytophthora, Zygomycotina: Rhizopus, Ascomycotina: Penicillium, Basidiomycotina: Puccinia, Occurrence, Structure and Reproduction of Lichens, Ecological and Economic Importance of Lichens.

Practice- To extract chlorophyll and carotenoids from algae and analyze their absorption spectra using a spectrophotometer.

UNIT-V: Biology of Bryophytes
General Characteristics of Bryophytes, Rothmaler (1951) Classification, Occurrence, Morphology, Anatomy, Reproduction and Life Cycle of Hepaticopsida, Marchantia, Anthocerotopsida: Anthoceros, Bryopsida: Funaria, General ACOunt on Evolution of Sporophytes in Bryophytes.

Practice- To identify different types of lichens and understand their role as bioindicators of air pollution.

Textbooks

1. Fritsch, F.E. (1935). *The Structure and Reproduction of Algae, Vol. I & II*. Cambridge University Press.
2. Alexopoulos, C.J., Mims, C.W., & Blackwell, M. (2007). *Introductory Mycology*. John Wiley & Sons.
3.

References

1. Lee, R.E. (2008). *Phycology (4th Edition)*. Cambridge University Press.
2. Van Den Hoek, C., Mann, D.G., & Jahns, H.M. (1996). *Algae: An Introduction to Phycology*. Cambridge University Press.

Web Links:

1. https://www.algaebase.org
2. https://www.ncbi.nlm.nih.gov/fungi
3. https://www.britishbryologicalsociety.org.uk
4. https://www.mycobank.org
5. https://sweetgum.nybg.org/science/virtual-herbarium

Vascular Plant

Course Code: 2509FS42

Semester-II	L	T	P	C
Course Outcomes:	2	0	2	4

At the end of the course, students will be able to:

CO1: Understand the general characteristics, classification, and life cycles of Pteridophytes and Gymnosperms, along with their ecological and economic importance.

CO2: Analyze the principles of plant taxonomy, including species concepts, taxonomic hierarchy, and classification systems.

CO3: Apply knowledge of descriptive plant taxonomy to identify and classify plant families based on morphological and anatomical characteristics.

CO4: Evaluate the role of anatomical, embryological, cytological, and phytochemical evidence in plant systematics.

CO5: Develop skills in using numerical taxonomy and phylogenetic systematics to understand the evolution and classification of angiosperms.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	1	-	1	-
CO2	2	-	2	3	-	-	-	2	-	2	-
CO3	3	-	3	2	-	-	-	2	-	1	-
CO4	3	-	2	3	-	-	-	2	-	1	-
CO5	2	-	2	3	-	-	-	2	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT-I: Pteridophytes

General characteristics of Pteridophyta, Smith (1955) classification, Occurrence, Morphology, Anatomy, Reproduction and Life History of Lycopsida (Lycopodium) and Filicopsida (Marsilea), Stelar Evolution in Pteridophytes, Heterospory and Seed Habit, Ecological and Economic Importance of Pteridophytes.

Practice- To examine the external morphology and internal structure of *Lycopodium* and *Marsilea* through sectioning and microscopic observation.

UNIT-II: Gymnosperms
General characteristics of Gymnosperms, Sporne (1965) classification, Occurrence, Morphology, Anatomy, Reproduction and Life History of Cycadopsida (Cycas) and Gnetopsida (Gnetum), Ecological and Economic Importance of Gymnosperms.

Practice- To study the external morphology, anatomy, and reproductive structures of *Cycas* and *Gnetum* using permanent slides and fresh specimens.

UNIT - III: Principles of Plant Taxonomy
Aim and Scope of Taxonomy, Species Concept, Taxonomic Hierarchy (Major and Minor Categories), Plant Nomenclature (Binomial System, ICBN Rules), Herbarium and Its Techniques (BSI Herbarium, Kew Herbarium, Digital Herbaria), Bentham and Hooker System of Classification, Phylogenetic Systematics (Primitive and Advanced Characteristics, Homology and Analogy, Parallelism and Convergence, Monophyly, Paraphyly, Polyphyly, Clades, Synapomorphy, Symplesiomorphy, Apomorphy), APG-IV Classification.

Practice- To collect, press, dry, and mount plant specimens for herbarium preparation and study plant identification techniques.

UNIT - IV: Descriptive Plant Taxonomy
Systematic Description and Economic Importance of the Following Families: Polypetalae: Annonaceae, Cucurbitaceae; Gamopetalae: Asteraceae, Asclepiadaceae;Monochlamydeae: Amaranthaceae, Euphorbiaceae: Monocotyledonae; Arecaceae, Poaceae

Practice- To identify and describe key taxonomic characteristics of *Annonaceae*, *Cucurbitaceae*, *Asteraceae*, *Asclepiadaceae*, *Amaranthaceae*, *Euphorbiaceae*, *Arecaceae*, and *Poaceae* using floral diagrams and floral formulae.

UNIT-V: Evidences for Plant Systematics
Anatomy and Embryology in Relation to Plant Systematics, Cytology and Cytogenetics in Relation to Plant Systematics, Phytochemistry in Relation to Plant Systematics, Numerical Taxonomy, Origin and Evolution of Angiosperms.

Practice- To examine the role of anatomy and embryology in plant classification by preparing and analyzing stem, root, and leaf sections of selected plant species.

Textbooks

1. Smith, G.M. (1955). *Cryptogamic Botany, Vol. II: Bryophytes and Pteridophytes*. McGraw-Hill.
2. Sporne, K.R. (1965). *The Morphology of Gymnosperms*. Hutchinson & Co.

Reference Books

1. Gifford, E.M., & Foster, A.S. (1989). *Morphology and Evolution of Vascular Plants* (3rd ed.). W.H. Freeman.
2. Stewart, W.N., & Rothwell, G.W. (1993). *Paleobotany and the Evolution of Plants* (2nd ed.). Cambridge University Press.

Web Links

1. https://www.mobot.org/MOBOT/research/APweb/
2. https://www.britannica.com/science/plant-taxonomy
3. https://www.jstor.org/journal/taxonomy
4. https://www.efloras.org/
5. https://www.tropicos.org/

Plant Anatomy and Embryology of Angiosperm

Course Code: 2509FS63 L T P C
Semester- III 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the structure, classification, and functions of meristematic and permanent tissues in plants.

CO2: Analyze anomalous secondary growth in plants and evaluate the economic importance of timbers.

CO3: Apply knowledge of anther and pollen biology to understand microsporogenesis, pollen viability, and germination.

CO4: Evaluate the processes of ovule development, fertilization, and endosperm formation in angiosperms.

CO5: Develop an understanding of embryogenesis, seed structure, seed dispersal mechanisms, and their applications in plant reproduction.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	1	-	1	-
CO2	3	-	2	2	-	-	-	2	-	1	-
CO3	2	-	3	2	-	-	-	2	-	2	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	2	2	-	-	-	2	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT-I: Tissues in Plants

Meristematic Tissues (Definition, Classification, Structure, Functions), Apical Meristems (Generalized Structure of Shoot Apex, Theories on Shoot Apical Meristem - Apical Cell Theory, Tunica-Corpus Theory, Histogen Theory), Permanent Tissues (Simple and Complex), Plant Secretory Tissues/Cells.

Practice- To study the structure and classification of meristematic and permanent tissues using prepared slides.

UNIT-II: Anomalous Growth in Plants
Tissue Systems (Epidermal, Ground, Vascular), Anomalous Secondary Growth in Root of Beta vulgaris, Anomalous Secondary Growth in Stems of Boerhaavia and Dracaena, Study of Timbers of Economic Importance (Teak, Red-Sanders, Rosewood), Applications of Anatomy in Plant Systematics, Forensics, and Pharmacognosy.

Practice- To observe and analyze anomalous secondary growth in *Beta vulgaris*, *Boerhaavia*, and *Dracaena* through sectioning and microscopy.

UNIT-III: Anther and Pollen
Anther (Structure and Functions of Anther Wall, Microsporogenesis, Callose Deposition and Its Significance), Pollen Wall Structure, MGU (Male Germ Unit) Structure, NPC System, Brief ACOunt of Palynology and Its Scope, Development of Male Gametophyte, Pollen Wall Proteins, Pollen Viability, Storage and Germination, Abnormal Features (Pseudomonads, Polyads, Massulae, Pollinia).

Practice- To examine the structure and function of anther walls, pollen grains, and pollen viability using staining techniques.

UNIT-IV: Ovules, Fertilization, and Endosperm
Structure and Types of Ovules, Megasporogenesis (Monosporic - Polygonum, Bisporic - Allium, Tetrasporic - Peperomia), Pollination (Self-Incompatibility, Basic Concepts, Methods to Overcome Self-Incompatibility - Mixed Pollination, Bud Pollination, Stub Pollination), Double Fertilization in Angiosperms (Process and Consequences), Perisperm, Endosperm (Types - Free Nuclear, Cellular, Helobial, Ruminate), Biological Importance of Endosperm.

Practice- To study different types of ovules, megasporogenesis, and endosperm formation in angiosperms using permanent slides.

UNIT-V: Embryogeny and Seeds
Embryogeny in Dicot (Capsella bursa-pastoris), Embryogeny in Monocot (Sagittaria sagittifolia), Seed Structure in Monocots and Dicots, Importance of Seeds and Seed Dispersal Mechanisms, Polyembryony and Apomixis (Introduction, Classification, Causes, Applications).

Practice- To analyze embryogenesis in dicots (*Capsella bursa-pastoris*) and monocots (*Sagittaria sagittifolia*) and observe seed structure and dispersal mechanisms

Textbooks

1. Esau, K. (2006). *Anatomy of Seed Plants* (2nd ed.). Wiley.
2. Fahn, A. (1990). *Plant Anatomy* (4th ed.). Pergamon Press.

References

1. Evert, R.F., & Eichhorn, S.E. (2012). *Raven Biology of Plants* (8th ed.). W.H. Freeman.
2. Cutler, D.F., Botha, T., & Stevenson, D.W. (2007). *Plant Anatomy: An Applied Approach*. Wiley-Blackwell.

Web Links

1. https://www.botany.org/
2. https://www.ncbi.nlm.nih.gov/pmc/
3. https://www.plantsystematics.org/
4. https://nptel.ac.in/courses/102103015/
5. https://www.mobot.org/MOBOT/research/APweb/

Plant Ecology, Biodiversity and Phytogeography

Course Code: 2509FS64 L T P C
Semester- IV 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental concepts of ecology, ecological factors, and plant adaptations in different environments.

CO2: Analyze the structure and functioning of ecosystems, including energy flow, food chains, food webs, and biogeochemical cycles.

CO3: Apply principles of biodiversity conservation, including in-situ and ex-situ conservation methods and legal frameworks like the Biodiversity Act 2002.

CO4: Evaluate the principles of phytogeography, biogeographical regions, vegetation types, and their relation to plant distribution.

CO5: Develop awareness of applied ecology, climate change, and the role of ecological indicators in sustainable development and conservation.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	3	-	-	-	2	-	1	1
CO2	3	-	2	2	-	-	-	2	-	1	-
CO3	2	-	2	2	3	-	-	2	-	1	1
CO4	2	-	2	3	-	-	-	2	-	1	-
CO5	2	-	2	2	2	-	-	3	-	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

Unit I: Fundamentals of Ecology

Concept and Scope of Ecology, Levels of Organization in Ecology, Ecological Factors (Abiotic and Biotic), Adaptations of Plants (Hydrophytes, Xerophytes, Halophytes, Epiphytes), Plant Succession (Types and Mechanisms - Primary and Secondary Succession).

Practice- To study abiotic and biotic ecological factors and analyze plant adaptations in different habitats.

Unit II: Ecosystem Ecology and Functioning
Concept and Components of an Ecosystem (Producers, Consumers, Decomposers), Energy Flow in Ecosystems, Food Chain, Food Web, Ecological Pyramids, Biogeochemical Cycles (Nitrogen, Carbon, Phosphorus).

Practice- To observe and analyze food chains, food webs, and energy flow in an ecosystem.

Unit III: Biodiversity and Conservation
Definition and Levels of Biodiversity (Genetic, Species, Ecosystem), Hotspots of Biodiversity in India, Causes of Biodiversity Loss, In-Situ and Ex-Situ Conservation, IUCN Red List Categories, Biodiversity Act 2002, Role of Botanical Gardens and Biosphere Reserves.

Practice- To identify biodiversity hotspots and assess plant diversity using quadrat and transect methods.

Unit IV: Phytogeography and Biomes
Principles of Phytogeography, Major Biogeographical Regions of India, Vegetation Types of India, Endemism and Its Types, Continental Drift Theory and Its Impact on Plant Distribution.

Practice- To study vegetation types and biogeographical regions of India using maps and specimen analysis.

Unit V: Applied Ecology and Climate Change
Ecological Indicators, Bioindicators and Their Role, Ecological Restoration, Climate Change and Its Impact on Vegetation, Global Warming and Greenhouse Effect, Sustainable Development and Environmental Policies.

Practice- To analyze the effects of climate change on vegetation and assess bioindicators in environmental monitoring**.**

Textbooks

1. Odum, E.P. (1971). *Fundamentals of Ecology*. W.B. Saunders.
2. Smith, R.L., & Smith, T.M. (2012). *Elements of Ecology*. Pearson.

References

1. Chapin, F.S., Matson, P.A., & Mooney, H.A. (2011). *Principles of Terrestrial Ecosystem Ecology* (2nd ed.). Springer.
2. Wilson, E.O. (1992). *The Diversity of Life*. Harvard University Press.

Web Links

1. https://www.worldwildlife.org/
2. https://www.iucnredlist.org/
3. https://www.cbd.int/
4. https://www.unep.org/

Cell Biology and Genetics

Course Code: 2509FS18 | L | T | P | C
Semester- V | 2 | 0 | 2 | 4
Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the structural organization of cells, differences between prokaryotic and eukaryotic cells, and the function of cell organelles.
CO2: Analyze the morphology and organization of chromosomes, including chromosomal aberrations and nucleosome structure.
CO3: Apply Mendelian and non-Mendelian genetic principles to understand inheritance patterns, linkage, and genetic mapping.
CO4: Evaluate the structure and function of DNA, gene expression, and regulation, including replication, transcription, and translation.
CO5: Develop an understanding of gene concepts, sex determination, population genetics, and the Hardy-Weinberg principle in evolutionary studies.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	3	-	2	2	-	-	-	2	-	2	-
CO3	3	-	2	2	-	-	-	2	-	2	-
CO4	3	-	3	2	-	-	-	3	-	2	-
CO5	2	-	2	3	-	-	-	3	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**1**
CO4	**2**	**1**
CO5	**2**	**1**

Unit-Wise Syllabus:

Unit-I: Cell and Its Organelles

Cell theory, Prokaryotic vs Eukaryotic Cells, Animal vs Plant Cells, Ultra-structure of Plant Cells, Ultra-structure of Cell Wall, Ultra-structure of Plasma Membrane and Theories on Its Organization, Polymorphic Cell Organelles (Plastids, Mitochondria), Ultra-structure of Chloroplast (Plastid DNA) and Mitochondria (Mitochondrial DNA).

Practice- To observe and analyze the ultrastructure of plant cells, cell walls, and organelles using microscopy and prepared slides.

Unit-II: Chromosomes
Prokaryotic vs Eukaryotic Chromosomes, Morphology of a Eukaryotic Chromosome, Euchromatin and Heterochromatin, Karyotype and Ideogram, Chromosomal Aberrations (Structural and Numerical Changes), Organization of DNA in a Chromosome (Nucleosome and Solenoid Models).

Practice- To prepare karyotypes and identify chromosomal aberrations in plant species.

Unit-III: Mendelian and Non-Mendelian Genetics
Mendel's Laws of Inheritance, Incomplete Dominance and Codominance, Multiple Allelism, Complementary, Supplementary, and Duplicate Gene Interactions (Plant-Based Examples), Linkage and Crossing Over, Chromosomal Mapping (2-Point and 3-Point Test Cross), Concept of Maternal Inheritance (Corren's Experiment on *Mirabilis jalapa*), Extrachromosomal Inheritance (Chloroplast and Mitochondrial Mutations), Epistasis, Lethal Alleles**.**

Practice- To study Mendelian inheritance using monohybrid and dihybrid crosses in plants.

Unit-IV: Structure and Function of DNA
Watson and Crick Model of DNA, DNA Replication (Semiconservative Method), Transcription (Types and Functions of RNA), Genetic Code, Translation Mechanism, Regulation of Gene Expression in Prokaryotes (Lac Operon), Transposons (Jumping Genes), DNA Repair Mechanisms.

Practice- To extract and analyze DNA using gel electrophoresis techniques.

Unit-V: Gene Concept and Sex Determination
Evolution of Gene Concept (Classical vs Molecular Concepts), Cis–Trans Complementation Test for Functional Allelism, Gene as a Unit of Function, Mutation, and Recombination, Patterns of Sex Determination in Plants, Sex Linkage, Allele and Genotype Frequencies, Hardy-Weinberg Law, Population Genetics and Evolution.

Practice- To determine allele and genotype frequencies in a given population and apply the Hardy-Weinberg principle.

Textbooks

1. Karp, G. (2013). *Cell and Molecular Biology: Concepts and Experiments* (7th ed.). Wiley.
2. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., & Losick, R. (2017). *Molecular Biology of the Gene* (7th ed.). Pearson.

References

1. De Robertis, E.D.P., & De Robertis, E.M.F. (2006). *Cell and Molecular Biology* (8th ed.). Lippincott Williams & Wilkins.

2. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., & Martin, K.C. (2016). *Molecular Cell Biology* (8th ed.). W.H. Freeman.

Web Links

1. https://www.ncbi.nlm.nih.gov/
2. https://www.genome.gov/
3. https://www.nature.com/subjects/genetics
4. https://www.nobelprize.org/prizes/medicine/
5. https://www.khanacademy.org/science/biology

Plant Physiology and Metabolism

Course Code: 2509FS19 | L | T | P | C
Semester- VI | 2 | 0 | 2 | 4
Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental concepts of plant-water relations, transport mechanisms, and transpiration processes.
CO2: Analyze the role of mineral nutrition, enzyme kinetics, and respiration pathways in plant metabolism.
CO3: Apply knowledge of photosynthesis, photorespiration, and carbon assimilation pathways to assess plant productivity.
CO4: Evaluate nitrogen and lipid metabolism, their biochemical pathways, and their significance in plant physiology.
CO5: Develop an understanding of plant growth regulators, stress physiology, and environmental adaptations in plants.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	-	-	2	-	1	-
CO2	2	-	3	2	-	-	-	2	-	1	-
CO3	2	-	3	2	-	-	-	2	-	2	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	2	3	-	-	-	2	-	2	1

-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

Unit-I: Plant-Water Relations and Transport Mechanisms
Water properties, diffusion, imbibition, osmosis, water potential, osmotic potential, pressure potential, absorption of water, lateral transport, ascent of sap, transpiration, stomatal structure, stomatal movement (K+ ion flux), mechanism of phloem transport, source-sink relationships, transpiration pull-cohesion theory, guttation, root pressure, anti-transpirants.

Practice- To study the effect of different environmental factors on transpiration using Ganong's potometer.

Unit-II: Mineral Nutrition, Enzymes, and Respiration
Macro and micro nutrients, deficiency symptoms, passive and active ion absorption, ion exchange, transport proteins, enzyme nomenclature, classification, properties, enzyme kinetics (Michaelis-Menten equation), coenzymes, co-factors, allosteric enzymes, aerobic and anaerobic respiration, glycolysis, Krebs cycle, oxidative phosphorylation, electron transport chain, ATP synthesis, Pentose Phosphate Pathway (HMP shunt), fermentation, cyanide-resistant respiration.

Practice- To determine the rate of photosynthesis under varying light intensities using the oxygen evolution method.

Unit-III: Photosynthesis, Photorespiration, and Carbon Assimilation
Photosynthetic pigments, absorption and action spectra, Red drop, Emerson enhancement effect, photosystems (PSI & PSII), photophosphorylation (cyclic and non-cyclic), electron transport, chemiosmotic theory, carbon assimilation pathways (C3, C4, CAM), Hatch-Slack pathway, Kranz anatomy, photorespiration (C2 cycle), factors affecting photosynthesis (light, CO_2, temperature, water, nutrients), CO_2 compensation point.

Practice- To observe enzyme activity (catalase and peroxidase) and study their role in plant metabolism.

Unit-IV: Nitrogen and Lipid Metabolism
Biological nitrogen fixation, nitrogen cycle, nitrate and ammonium assimilation, GS-GOGAT pathway, nitrogenase enzyme, leghemoglobin, lipid classification, fatty acids (saturated & unsaturated), triglyceride biosynthesis, β-oxidation, glyoxylate cycle, membrane lipids, phospholipids, lipid peroxidation, secondary metabolites derived from lipids (waxes, terpenoids, cutin, suberin).

Practice- To analyze seed germination and the effect of plant hormones on growth and development.

Unit-V: Plant Growth and Development, Hormones, and Stress Physiology
Growth phases, sigmoid growth curve, seed dormancy, seed germination, senescence, vernalization, photoperiodism, circadian rhythms, plant hormones (auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, jasmonates, strigolactones), stress physiology (drought, salinity, temperature, heavy metal stress), stress-induced gene expression, role of phytochrome and cryptochrome, flowering signals, florigen concept.

Practice- To evaluate the effects of abiotic stress (salt and drought) on plant growth and physiology.

Textbooks

1. Taiz, L., & Zeiger, E. (2010). *Plant Physiology*. Sinauer Associates.
2. Hopkins, W.G., & Huner, N.P.A. (2009). *Introduction to Plant Physiology*. Wiley.

References

1. Nobel, P.S. (2009). *Physicochemical and Environmental Plant Physiology* (4th ed.). Academic Press.
2. Raven, P.H., Evert, R.F., & Eichhorn, S.E. (2013). *Biology of Plants* (8th ed.). W.H. Freeman.

Web Links

1. https://www.plantphysiol.org/
2. https://nptel.ac.in/courses/102103015/
3. https://www.botany.org/
4. https://www.ncbi.nlm.nih.gov/
5. https://www.plantphysiology.org/

Minor Stream: Zoology

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS43	I	Principles of Ecology	FC	2		2	4	50	50	100	-
2509FS44	II	Animal Diversity-I Biology of Non-Chordates	FC	2		2	4	50	50	100	-
2509FS65	III	Animal Diversity-II Biology of Chordates	IC	2		2	4	50	50	100	-
2509FS66	IV	Embryology	IC	2		2	4	50	50	100	-
2509FS20	V	Animal Physiology: Life Sustaining Systems	AC	2		2	4	50	50	100	-
2509FS21	VI	Poultry Management (Poultry Farming)	AC	2		2	4	50	50	100	-
Total				**12**		**12**	**24**		**12**		

Principles of Ecology

L	T	P	C
2	0	2	4

Course Code: 2509FS43
Semester-I
Course Outcomes:

At the end of the course, students will be able to:

CO1: To have a general idea on ecology.
CO2: To learn about different levels of ecological organisation.
CO3: To know about different limiting factors of an environment.
CO4: To know the laws proposed to explain the effect of different factors on organisms.
CO5: To understand about the physical factors of an environment

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	2	-	-	-	1	-	1	-
CO2	2	-	1	3	-	-	-	1	-	1	-
CO3	2	-	2	2	-	-	-	2	-	1	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	2	2	-	-	-	2	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**1**	**-**
CO2	**1**	**-**
CO3	**1**	**-**
CO4	**1**	**-**
CO5	**1**	**-**

Unit-Wise Syllabus:

UNIT-I: Introduction to Ecology and Ecological Organization
Introduction to Ecology - interactions between organisms and their environment, categorized into biotic and abiotic factors. Levels of ecological organization include organisms, populations, communities, ecosystems, biomes, and the biosphere.

Practice- Study of biotic and abiotic factors in a local ecosystem.

UNIT-II: Laws of Limiting Factors in Ecology
Organism survival dependence on resource availability. Liebig's Law of the Minimum, Blackman's Law of Limiting Factors, and Shelford's Law of Tolerance- how limiting factors control biological processes and species distribution.

Practice- Measurement of soil pH and its effect on plant distribution.

UNIT-III: Physical Factors Influencing Ecology
Abiotic factors which species survival and ecological balance- Sunlight, water, temperature, wind, soil composition, and environmental disturbances affect ecosystem structure and organism adaptation.

Practice- Identification of different trophic levels in a food chain.

UNIT-IV: Ecosystem Structure and Function
Ecosystems - producers, consumers, and decomposers, forming food chains and food webs. Energy transfer- The 10% rule, and biogeochemical cycles (carbon, nitrogen, phosphorus, water) maintain ecosystem balance

Practice- Analysis of water quality and its impact on aquatic organisms.

UNIT-V: Biomes and Biosphere
Introduction to Biomes ,Classification as terrestrial (forests, grasslands, deserts, tundras) or aquatic (freshwater, marine). Biosphere integrated life with the lithosphere, hydrosphere, and atmosphere, influenced by climate change and conservation efforts.

Practice- Field study on ecological succession in a disturbed habitat.

Textbooks:

1. Basu, R.N. (2004). A Compendium of Terms in Ecology and Environment. Naya Udyog.
2. Chapman, R. L. and Reiss, M. J. (2000). Ecology - Principles & Application. Cambridge University Press.

Reference Books:

1. Krebs, C. J. (2001). Ecology. Benjamin Cummings.
2. Odum, E. P. and Barret, G. W. (2005). Fundamentals of Ecology. 5th Ed. Thompson Brooks Cole.

Web Links:
1. National Geographic – https://www.nationalgeographic.com/environment
2. Ecological Society of America – https://www.esa.org
3. BBC Bitesize on Ecology – https://www.bbc.co.uk/bitesize/subjects/z6fsgk7
4. Nature – Ecology & Evolution – https://www.nature.com/natecolevol/
5. Khan Academy: Ecology – https://www.khanacademy.org/science/biology/ecology

Animal Diversity-I Biology of Non-Chordates

L	T	P	C
2	0	2	4

Course Code: 2509FS44
Semester- II
Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the classification, structure, and adaptations of non-chordates.
CO2: Identify and describe various protozoan locomotion mechanisms.
CO3: Analyze the economic and ecological significance of non-chordates, including corals and earthworms.
CO4: Differentiate between various canal systems and polymorphic forms in lower invertebrates.
CO5: Understand the life cycles and parasitic adaptations of helminths.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	2	-	2	2	-	-	-	1	-	1	-
CO3	3	-	2	2	-	-	-	2	-	1	1
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	3	-	2	2	-	-	-	2	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**1**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT-I: Lower Invertebrates
Characteristics and classification of Protista, Porifera, Cnidaria, and Nemathelminthes, locomotion in Protozoa, the canal system in sponges, polymorphism in Hydrozoa, life history and parasitic adaptations of *Ascaris lumbricoides*.

Practice- Preparation of a Chart/Model of the Phylogenetic Tree of Life.

UNIT-II: Higher Invertebrates-I
Characteristics and classification of Platyhelminthes, Annelida, and Arthropoda, life history of *Taenia solium*, metamerism and coelom formation in annelids, vision in arthropods, insect metamorphosis.

Practice- Preparation of a Chart/Model of Five-Kingdom Classification

UNIT-III: Higher Invertebrates-II
Characteristics and classification of Mollusca, Echinodermata, and Hemichordata, concept of torsion in gastropods, the water vascular system in Asteroidea, structure and affinities of *Balanoglossus*.
Practice- Study of Polymorphism in Coelenterates using Charts

UNIT-IV: Vermiculture and Economic Zoology
Significance of vermiculture, species of earthworms used in vermicomposting, processing and economic importance of vermicompost, pearl formation in Pelecypoda and its commercial significance.

Practice- Study of Earthworm External Morphology

UNIT-V: Coral Reefs and Ecological Interactions
Formation of corals and coral reefs, their ecological importance, threats to coral ecosystems, role of non-chordates in maintaining ecological balance.

Practice- Observation of Nematodes from Soil or Rotten Fruits.

Textbooks:

1. Kotpal, R. L. (2012). *Modern Textbook of Zoology: Invertebrates*. Rastogi Publications.
2. Barnes, R. D. (1982). *Invertebrate Zoology*. Holt-Saunders.

Reference Books:

1. Hickman, C. P., Roberts, L. S., & Keen, S. L. (2017). *Animal Diversity*. McGraw-Hill.
2. Wallace, R. L., & Taylor, W. K. (2002). *Invertebrate Zoology: A Laboratory Manual*. Prentice Hall.

Web Links:
1. National Center for Biotechnology Information (NCBI): https://www.ncbi.nlm.nih.gov/
2. Animal Diversity Web: https://animaldiversity.org/
3. Encyclopedia of Life: https://eol.org/
4. Marine Species Identification Portal: http://species-identification.org/
5. Smithsonian National Museum of Natural History – Invertebrate Zoology: https://naturalhistory.si.edu/research/invertebrate-zoology

Animal Diversity-II Biology of Chordates

Course Code: 2509FS65
Semester- III

Course Outcomes:	L	T	P	C
At the end of the course, students will be able to:	2	0	2	4

CO1: Classify and explain the structural diversity of chordates.
CO2: Understand the adaptive features of fishes, amphibians, reptiles, birds, and mammals.
CO3: Compare locomotion, reproduction, and feeding mechanisms in chordates.
CO4: Explain the evolutionary significance and affinities of different chordate groups.
CO5: Analyze the anatomical adaptations of vertebrates in relation to their environment.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	1	-	1	-
CO2	3	-	2	2	-	-	-	2	-	1	-
CO3	3	-	2	2	-	-	-	2	-	1	-
CO4	2	-	1	3	-	-	-	2	-	2	-
CO5	3	-	2	2	-	-	-	2	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT-I: Protozoa and Classification of the Animal Kingdom
Whittaker's Five Kingdom concept and classification of the Animal Kingdom, general characters and classification of Protozoa, locomotion, nutrition, and reproduction in Protozoa.

Practice- Study of Chordate Classification Using Charts and Models – Identifying different classes of chordates with key characteristics.

UNIT-II: Porifera and Coelenterata
Classification of Porifera and Coelenterata, canal system in sponges, polymorphism in coelenterates, structure and significance of corals and coral reefs.

Practice- Comparative Study of Fish Scales – Observing different types of scales (placoid, cycloid, ctenoid) using slides.

UNIT-III: Parasitology and Helminths
Classification and adaptations of Platyhelminthes and Nemathelminthes, parasitic adaptations, life cycle and pathogenicity of *Ascaris lumbricoides*.

Practice- Observation of Amphibian and Reptilian Features – Comparing external features of frog, lizard, and snake specimens.

UNIT-IV: Arthropods and Annelids
Classification and general features of Arthropoda and Annelida, Peripatus and its affinities, arthropod vision, insect metamorphosis.

Practice- Bird Beak and Foot Adaptations – Studying various types of beaks and feet in birds and relating them to their feeding habits.

UNIT-V: Echinodermata and Hemichordata
Classification and general characteristics of Echinodermata and Hemichordata, the water vascular system in starfish, structure and affinities of *Balanoglossus*.

Practice- Mammalian Skull Identification – Examining and differentiating herbivore and carnivore skulls based on dentition.

Textbooks:

1. Barnes, R. D. (1987). *Invertebrate Zoology*. Saunders College Publishing.
2. Ruppert, E. E., Fox, R. S., & Barnes, R. D. (2003). *Invertebrate Zoology: A Functional Evolutionary Approach*. Brooks Cole.

Reference Books:

1. Brusca, R. C., & Brusca, G. J. (2003). *Invertebrates*. Sinauer Associates.
2. Hickman, C. P., Roberts, L. S., & Larson, A. (2018). *Integrated Principles of Zoology*. McGraw Hill.
3.

Web Links:
1. BBC Bitesize – Animal Adaptations – Overview of arthropod and mollusc adaptations.
2. Smithsonian National Museum of Natural History – Invertebrate diversity.
3. MarineBio Conservation Society – Information on mollusks, echinoderms, and coral reefs.
4. OpenStax Biology 2e – Free biology textbook covering invertebrate classification.
5. Zoological Society of London – Conservation insights on various invertebrate species.

Embryology
Semester IV
Minor Stream Courses (MSC)

L	T	P	C
2	0	2	4

Course Code: 2509FS66
Semester- IV
Course Outcomes:
At the end of the course, students will be able to:

CO1: Understand Early Developmental Processes – Explain fertilization, cell division, implantation, and early embryonic development.
CO2: Analyze Gastrulation and Germ Layer Differentiation – Describe the formation of the three germ layers and their derivatives.
CO3: Examine Organogenesis – Understand the development of major organ systems, including nervous, circulatory, urinary, and reproductive systems.
CO4: Evaluate Placental and Twin Development – Describe the formation of the placenta, trophoblast derivatives, and different types of twinning.
CO5: Assess Teratogenesis and Congenital Abnormalities – Identify teratogens and their effects on embryonic development.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	-	-	2	-	1	-
CO2	2	-	2	2	-	-	-	2	-	1	-
CO3	2	-	2	2	-	-	-	2	-	1	-
CO4	2	-	1	2	-	-	-	2	-	1	-
CO5	2	-	2	2	2	-	-	3	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**1**
CO3	**2**	**1**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT-I: Introduction to Embryology
Fundamental concepts of embryology, including cell division (mitosis and meiosis), the cell cycle, and the process of gametogenesis (spermatogenesis and oogenesis). The ovarian cycle, menstrual cycle, and the mechanisms of fertilization leading to the formation of the zygote.

Practice- Model Making of Embryonic Development Stages.

UNIT-II: Early Embryonic Development
The first three weeks of development, covering implantation, the formation of the bilaminar germ disc, the development of the amniotic cavity and yolk sac, and the process of gastrulation. Formation of the primitive streak, differentiation of the three germ layers, and neural tube development.

Practice- Study of Permanent Slides of Cell Division – Observe mitosis and meiosis in onion root tips or animal cells under a microscope.

Unit III: Organogenesis and Embryo Folding
Fate and derivatives of the three germ layers, the folding of the embryo, and the early stages of organ development. Formation of the nervous system, cardiovascular system, and other major structures.

Practice- Model or Chart of Gametogenesis – Create a simple model or chart depicting spermatogenesis and oogenesis.

Unit IV: Placenta, Trophoblast, and Twinning
Development and function of the trophoblast, the formation and role of the placenta, and different types of twinning (monozygotic and dizygotic). Abnormalities related to placental formation and twin development.

Practice- Developmental Stages of Placenta – Identify different types of placenta through charts, models, or preserved specimens.

Unit V: Development of Major Systems and Teratogenesis
Development of the circulatory system, fetal circulation, and the formation of the urinary, male, and female reproductive systems. teratogenesis, exploring congenital anomalies, their causes, and the effects of teratogens on embryonic development.

Practice- Effects of Environmental Factors on Embryo Development – Study the impact of temperature or chemical exposure on plant embryos (e.g., seed germination experiments).

Practical Work:
Textbooks:
1. Langman's Medical Embryology – T.W. Sadler
2. The Developing Human: Clinically Oriented Embryology – Keith L. Moore, T.V.N. Persaud

Reference Books:
1. Principles of Development – Lewis Wolpert
2. Human Embryology and Developmental Biology – Bruce M. Carlson

Web Links:

1. Embryology by UNSW – Detailed resources on human and comparative embryology.
2. Khan Academy: Embryology – Free video lectures on embryology concepts.
3. National Center for Biotechnology Information (NCBI) – Research articles and textbooks on developmental biology.
4. Human Embryology by Georgetown University – Online embryology courses and diagrams.
5. Visible Embryo – Interactive timeline of human development from fertilization to birth.

Animal Physiology: Life Sustaining Systems

Course Code: 2509FS20
Semester-V

Course Outcomes:	L	T	P	C
At the end of the course, students will be able to:	2	0	2	4

CO1: Understand the fundamental mechanisms of body functions and the biochemical basis of life processes in animals, particularly in humans.
CO2: Explain the structure, function, and metabolism of biomolecules such as carbohydrates, proteins, lipids, and nucleic acids.
CO3: Describe physiological processes at various levels of organization, from cellular functions to organ systems, and their role in maintaining homeostasis.
CO4: Analyze the biochemical pathways and their regulation in metabolism, enzymatic actions, and hormonal control in mammals.
CO5:Apply basic biochemical and physiological principles to understand health, diseases, and laboratory-based investigations in animal biology.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	-	-	2	-	1	-
CO2	2	-	3	2	-	-	-	2	-	1	-
CO3	2	-	2	2	-	-	-	2	-	1	-
CO4	2	-	3	2	-	-	-	3	-	2	-
CO5	2	-	3	2	2	1	-	3	-	2	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT-I: Physiology of Digestion
Structure and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorption of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Practice - Estimation of Salivary Amylase Activity – Study the effect of temperature and pH on enzyme activity.

UNIT-II: Physiology of Respiration
Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration.
Practice - Measurement of Lung Capacity – Using a balloon method to measure tidal volume and vital capacity

UNIT-III: Renal Physiology
Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance.
Practice - Urine Analysis – Detection of normal and abnormal constituents of urine (glucose, protein, pH)

UNIT-IV: Blood
Components of blood and their functions; Structure and functions of haemoglobin Haemostasis: Blood clotting system, Kallikrein - Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis Blood groups: Rh factor, ABO and MN.

Practice - Blood Group Identification – Performing ABO and Rh blood group tests using antisera

UNIT-V: Physiology of Heart
Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation.

Practice - Blood Pressure Measurement – Checking resting and post-exercise blood pressure using a sphygmomanometer

Textbooks:

1. Guyton & Hall. *Textbook of Medical Physiology*. Elsevier.
2. Sherwood, L. *Human Physiology: From Cells to Systems*. Cengage Learning.

Reference Books:

1. Ganong, W. F. *Review of Medical Physiology*. McGraw Hill.
2. Vander, A., Sherman, J., & Luciano, D. *Human Physiology: The Mechanisms of Body Function*. McGraw Hill.

Web Links:
1. Khan Academy - Human Physiology: https://www.khanacademy.org/science/health-and-medicine
2. National Center for Biotechnology Information (NCBI): https://www.ncbi.nlm.nih.gov/books

3. Physiology Web: https://www.physiologyweb.com/
4. OpenStax - Anatomy and Physiology:https://openstax.org/details/books/anatomy-and-physiology.

Poultry Management (Poultry Farming)

Course Code: 2509FS21
Semester- VI

Course Outcomes:	L	T	P	C
At the end of the course, students will be able to:	2	0	2	4

CO1: Understand the fundamentals of poultry farming and its economic importance.
CO2: Gain knowledge about poultry housing, management, and nutrition.
CO3: Identify and control common poultry diseases and health issues.
CO4: Learn proper egg handling, hatching, and chick rearing techniques.
CO5: Develop skills in maintaining farm hygiene and sustainable waste management.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	1
CO2	3	-	2	2	-	-	-	1	-	1	-
CO3	3	-	2	2	2	-	-	2	-	2	-
CO4	2	-	2	2	-	-	-	1	-	1	-
CO5	2	-	2	2	2	-	-	2	-	2	2

-Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**1**	**-**
CO2	**1**	**-**
CO3	**1**	**-**
CO4	**1**	**-**
CO5	**1**	**1**

Unit-Wise Syllabus:

UNIT-I: Introduction to Poultry Farming
Definition and significance of poultry farming, overview of the poultry industry in India, types of poultry houses and their designs, systems of poultry farming.

Practice - Identification of different poultry breeds and housing systems.

UNIT-II: Poultry Management
Management of chicks, growers, and layers, broiler management and feeding strategies, preparation of project reports for banking and insurance, economic aspects of poultry farming.

Practice - Demonstration of poultry feed formulation techniques.

UNIT-III: Poultry Nutrition and Health Management
Principles of poultry feeding, nutrient requirements at different growth stages, feed formulation and methods of feeding, poultry diseases including viral, bacterial, fungal, and parasitic infections, symptoms, control measures, and vaccination programs.

Practice - Examination of egg quality and hatching procedures.

UNIT-IV: Egg Production and Handling
Selection, care, and handling of hatching eggs, egg testing methods and hatching techniques, brooding and rearing of chicks, sexing of chicks.

Practice - Study of common poultry diseases and vaccination methods.

UNIT-V: Poultry Hygiene and Waste Management
Farm and water hygiene practices, sanitation measures in poultry farms, recycling of poultry waste, sustainable poultry farming.

Practice – Analysis of poultry farm hygiene and waste management practices.

Textbooks

1. Banerjee, G. C. *A Textbook of Animal Husbandry*. Oxford & IBH.
2. Panda, B. *Poultry Production and Management*. CBS Publishers.

Reference Books

1. North, M. O. *Commercial Chicken Production Manual*. Springer.
2. Bell, D. D., & Weaver, W. D. *Commercial Poultry Production Manual*. Kluwer Academic.

Web Links

1. Poultry Science Association – https://www.poultryscience.org
2. The Poultry Site – https://www.thepoultrysite.com
3. FAO Poultry Farming Guide – https://www.fao.org/poultry-production
4. Indian Poultry Industry Overview – https://www.agricoop.nic.in
5. Poultry Research Institute (ICAR) – https://www.icar.org.in

Minor Stream: Mathematics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS45	I	Differential Calculus	FC	2		2	4	50	50	100	-
2509FS46	II	Differential Equations	FC	2		2	4	50	50	100	DC
2509FS67	III	Group Theory	IC	2		2	4	50	50	100	-
2509FS68	IV	Ring Theory	IC	2		2	4	50	50	100	-
2509FS22	V	Introduction to Real Analysis	AC	2		2	4	50	50	100	DE
2509FS23	VI	Linear Algebra	AC	2		2	4	50	50	100	DE
Total				**12**		**12**	**24**	**12**	**12**		

Differential Calculus

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS45 L T P C
Semester- I 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Apply first and second derivative tests, analyze asymptotes, and use L'Hôpital's rule for limits.

CO2: Calculate volumes of solids using disk, washer, and cylindrical shells; find arc lengths and surface areas of revolution.

CO3: Sketch conics, convert between Cartesian and polar coordinates, and graph polar equations.

CO4: Analyze vector-valued functions, compute derivatives, integrals, arc lengths, and understand curvature and normal vectors.

CO5: Work with functions of several variables, compute partial derivatives, and identify extreme values and saddle points.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	3	2	-	-	-	2	-	1	-
CO2	3	-	3	2	-	-	-	2	-	1	-
CO3	2	-	2	2	-	-	-	2	-	1	-
CO4	3	-	3	2	-	-	-	3	-	2	-
CO5	3	-	3	2	-	-	-	2	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus

Unit I: Applications of Derivatives and Limits

First derivative test; Concavity and inflection points; Second derivative test; Curve sketching using first and second derivative tests; Limits at infinity; Horizontal asymptotes; Vertical asymptotes; Graphs with asymptotes; L'Hôpital's rule; Applications in business, economics, and life sciences; Hyperbolic functions; Higher-order derivatives; Leibniz rule and its applications to problems of the form eax+bsinx, eax+bcosx, (ax+b)n sinx, (ax+b)n cosx.

Practice - Plotting of graphs of function eax + b, log(ax + b), 1/(ax + b), sin(ax + b), cos(ax + b), |ax + b| and to illustrate the effect of a and b on the graph

Unit II: Applications of Definite Integrals

Reduction formulae and derivations for integrals of the form: ∫sin⁡(nx) dx,∫cos⁡(nx) dx,∫tan⁡(nx) dx,∫sec⁡(nx) dx,∫(log⁡x)n dx,∫sin⁡nxcos⁡mx dx.\int \sin(nx) \, dx, \int \cos(nx) \, dx, \int \tan(nx) \, dx, \int \sec(nx) \, dx, \int (\log x)^n \, dx, \int \sin^n x \cos^m x \, dx.∫sin(nx)dx, ∫cos(nx)dx, ∫tan(nx)dx, ∫sec(nx)dx, ∫(logx)ndx,∫sinnx cosmxdx. Volumes by slicing; Volumes of solids of revolution by the disk method; Volumes of solids of revolution by the washer method; Volume by cylindrical shells; Length of plane curves; Arc length of parametric curves; Area of surface of revolution.

Practice - Plotting the graphs of polynomials of degree 4 and 5, the derivative graph, the second derivative graph and comparing them

Unit III: Conics and Polar Coordinates

Techniques of sketching conics; Reflection properties of conics; Rotation of axes and second-degree equations; Classification of conics using the discriminant; Polar equations of conics; Graphing in polar coordinates.

Practice - Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid)

Unit IV: Vector-Valued Functions

Triple product; Introduction to vector functions; Operations with vector-valued functions; Limits and continuity of vector functions; Differentiation and integration of vector functions; Tangent and normal components of acceleration; Modeling ballistics and planetary motion; Kepler's second law.

Practice - Obtaining the surface of the revolution of curves

Unit V: Functions of Several Variables and Partial Derivatives

Functions of several variables: Graphs and level curves; Limits and continuity of multivariable functions; Partial derivatives and differentiability; The chain rule for multivariable functions; Directional derivatives and gradient vectors; Tangent plane and normal line; Extreme values and saddle points of multivariable functions.

Practice - Tracing of conics in cartesian coordinates/ polar coordinates

Text Books:

1. "Calculus: Early Transcendentals" by James Stewart
2. "Thomas' Calculus" by George B. Thomas, Maurice D. Weir, and Joel R. Hass

Reference Books:

1. "Differential Equations and Linear Algebra" by Stephen W. Goode and Scott A. Annin "Calculus: A Complete Course" by Robert A. Adams and Christopher Essex

2. "Introduction to Calculus and Analysis" by Richard Courant and Fritz John "Calculus: Concepts and Contexts" by James Stewar
3. "Mathematical Methods for Physics and Engineering" by K.F. Riley, M.P. Hobson, and S.J. Bence.

Web Links:

1. Khan Academy - Calculus
   https://www.khanacademy.org/math/calculus-1
2. Paul's Online Math Notes - Calculus I
   https://tutorial.math.lamar.edu/
3. Brilliant.org - Calculus Courses
   https://brilliant.org/courses/calculus/
4. Math StackExchange - Calculus Discussions
   https://math.stackexchange.com/questions/tagged/calculus
5. MIT OpenCourseWare - Calculus
   https://ocw.mit.edu/courses/mathematics/18-01-single-variable-calculus-fall-2010/

Differential Equations

(Common to

B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS46 L T P C

Semester- II 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Solve first-order linear differential equations and Bernoulli's equations using integrating factors and exact differential equations.

CO2: Solve first-order differential equations of non-first-degree and apply methods such as Clairaut's equation and orthogonal trajectories.

CO3: Solve higher-order linear differential equations with constant coefficients and apply polynomial operators to non-homogeneous equations.

CO4: Solve non-homogeneous linear differential equations with constant coefficients and determine particular integrals using various methods.

CO5: Solve higher-order linear differential equations with non-constant coefficients, including Cauchy-Euler and Legendre equations, using methods like variation of parameters.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	3	2	-	-	-	2	-	1	-
CO2	2	-	2	2	-	-	-	2	-	1	-
CO3	2	-	3	2	-	-	-	2	-	1	-
CO4	2	-	3	2	-	-	-	2	-	1	-
CO5	2	-	3	2	-	-	-	2	-	2	-

-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT I: Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integrating factors - Equations reducible to Exact Equations by Integrating Factors - i) Inspection Method ii) 1 Mx Ny iii) 1 Mx Ny

Practice - Solving First-Order Linear Differential Equations.

UNIT II: Differential Equations of first order but not of first degree
Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Practice - Solving Bernoulli's Differential Equation.

Unit III: Higher order linear differential equations
Solutions of homogeneous linear differential equations of order n with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators (i) ax Q(x) e = (ii) $Q(x) = Sin\ ax$ (or) $Cos\ ax$

Practice - Solving Higher-Order Linear Differential Equations with Constant Coefficients.

UNIT IV: Higher order linear differential equations (continued.)
Solution to a non-homogeneous linear differential equation with constant coefficients P.I. of $(D) = Q$ when $Q = bx\ k$ P.I. of $(D)y = Q$ when $Q = e\ axV$, where V is a function of x P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x

Practice - Solving Non-Homogeneous Higher-Order Linear Differential Equations.

UNIT V: Higher order linear differential equations with non-constant coefficients
Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters Activities Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving Sessions.

Practice - Solving Cauchy-Euler and Legendre Equations.

Text Books:
1. "Advanced Engineering Mathematics" by Erwin Kreyszig
2. "A Textbook of Differential Equations" by N. S. S. H. Rao

Reference Books:
1. "Theory of Ordinary Differential Equations" by Earl A. Coddington
2. "Differential Equations and Their Applications" by M. Braun

Web Links:
1. MIT OpenCourseWare - Differential Equations
   https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/
2. Khan Academy - Differential Equations
   https://www.khanacademy.org/math/differential-equations
3. Paul's Online Math Notes - Differential Equations
   https://tutorial.math.lamar.edu/Classes/DE/DE.aspx

4. Coursera - Ordinary Differential Equations (by UC Santa Barbara)
   https://www.coursera.org/learn/ordinary-differential-equations
5. EdX - Differential Equations for Engineers (by MIT)
   https://www.edx.org/course/differential-equations-for-engineers

Group Theory

(Common to

B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS67 L T P C

Semester- III 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the real number system, sequences, and their limits, and apply convergence tests to sequences.

CO2: Analyze infinite series, test their convergence, and apply relevant convergence criteria.

CO3: Study the properties of continuous functions, limits, and apply concepts of uniform continuity.

CO4: Understand differentiation, the Mean Value Theorems, and their applications to real-valued functions.

CO5: Grasp the concept of Riemann integration, test for integrability, and apply the Fundamental Theorem of Integral Calculus.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	3	-	3	2	-	-	-	2	-	1	-
CO3	3	-	3	2	-	-	-	2	-	1	-
CO4	3	-	3	2	-	-	-	2	-	1	-
CO5	3	-	3	2	-	-	-	2	-	2	-

-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT I: Groups

Binary operation; Algebraic structures; Semigroup; Monoid; Group definition and elementary properties; Finite and infinite groups; Examples of groups; Order of a group; Composition tables with examples.

Practice - Verification of Group Properties Using Binary Operations.

UNIT II: Subgroups
Definition of a subgroup; Inverse of a complex; Subgroup criterion; Criterion for the product of two subgroups to be a subgroup; Union and intersection of subgroups; Coset definition and properties; Index of a subgroup; Lagrange's Theorem.

Practice - Finding Subgroups and Cosets in Groups

UNIT III: Normal Subgroups
Definition of normal subgroup; Proper and improper normal subgroups; Hamilton group; Criterion for a subgroup to be a normal subgroup; Intersection of two normal subgroups; Subgroup of index 2 is a normal subgroup.

Practice – Investigating Normal Subgroups and Their Properties

UNIT IV: Homomorphisms
Quotient groups; Definition of homomorphism; Image of homomorphism; Elementary properties of homomorphism; Isomorphism; Automorphism; Kernel of a homomorphism; Fundamental theorem on homomorphisms and its applications.

Practice – Homomorphisms and Isomorphisms in Group

Unit V: Permutations and Cyclic Groups
Definition of permutation; Permutation multiplication; Inverse of a permutation; Cyclic permutations; Transposition; Even and odd permutations; Cayley's theorem; Definition of cyclic group; Elementary properties of cyclic groups; Classification of cyclic groups.

Practice – Permutations, Cyclic Groups, and Applications of Cayley's Theorem

Text Book:
1. "Modern Algebra" by A. R. Vasishtha and A. K. Vasishtha
2. "Abstract Algebra" by J. B. Fraleigh

Reference Books:
1. "Abstract Algebra" by J. B. Fraleigh
2. "Modern Algebra" by M. L. Khanna

Web Links:
1. Khan Academy - Abstract Algebra
   https://www.khanacademy.org/math/abstract-algebra
2. MIT OpenCourseWare - Group Theory
   https://ocw.mit.edu/courses/mathematics/18-100c-abstract-algebra-spring-2018/
3. Coursera - Group Theory and Symmetry (by University of Maryland)
   https://www.coursera.org/learn/group-theory-symmetry

4. Paul’s Online Math Notes - Group Theory
   https://tutorial.math.lamar.edu/Classes/AbstractAlgebra/AbstractAlgebra.aspx
5. YouTube - Abstract Algebra and Group Theory Playlist by Prof. Gilbert Strang
   https://www.youtube.com/playlist?list=PLK1A1QyPpXY4iD2Y5wQz5LDkq7Yl8o9uK

Ring Theory

(Common to

B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS68

Semester- IV

Course Outcomes: L T P C

At the end of the course, students will be able to: 2 0 2 4

CO1: Understand and apply the algebraic and order properties of real numbers, sequences, and their limits, including Cauchy's criterion and the Bolzano-Weierstrass theorem.

CO2: Analyze and test the convergence of infinite series, using tests like the P-test, Cauchy's nth root test, and Leibnitz's test for alternating series.

CO3: Study and apply the concepts of limits and continuity of real-valued functions, including uniform continuity and the combinations of continuous functions.

CO4: Understand and apply differentiation and the Mean Value Theorems, including Rolle's theorem, Lagrange's theorem, and Cauchy's mean value theorem.

CO5: Learn and apply the concepts of Riemann integration, including the Fundamental Theorem of Calculus, the Darboux theorem, and conditions for R-integrability.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	-	-	2	-	1	-
CO2	2	-	3	2	-	-	-	2	-	1	-
CO3	2	-	2	2	-	-	-	2	-	1	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	3	2	-	-	-	2	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT I: Real Numbers, Real Sequences

The algebraic and order properties of R; Absolute value and Real line; Completeness property of R; Applications of supremum property; Intervals. Sequences and their limits; Range and boundedness of sequences; Limit of a sequence and convergent sequence; Cauchy's criterion; Properly divergent sequences; Monotone sequences; Necessary and sufficient condition for

convergence of monotone sequences; Limit point of a sequence; Subsequences and the Bolzano-Weierstrass theorem; Cauchy Sequences; Cauchy's general principle of convergence.

Practice - Verification of Properties of Real Numbers and Sequences

UNIT II: Infinite Series
Introduction to series; Convergence of series; Cauchy's general principle of convergence for series; Tests for convergence of series; Series of non-negative terms; P-test; Cauchy's nth root test; D'Alembert's test; Alternating series; Leibnitz's test.

Practice - Convergence and Divergence of Infinite Series

UNIT III: Limit & Continuity
Real-valued functions; Boundedness of a function; Limits of functions; Some extensions of the limit concept; Infinite limits; Limits at infinity; Continuous functions; Combinations of continuous functions; Continuous functions on intervals; Uniform continuity.

Practice - Exploring Continuity and Limits of Real-Valued Functions

UNIT IV: Differentiation and Mean Value Theorems
The derivability of a function at a point and on an interval; Derivability and continuity of a function; Mean value theorems; Rolle's theorem; Lagrange's theorem; Cauchy's mean value theorem.

Practice - Application of Mean Value Theorems: Rolle's and Lagrange's Theorem

UNIT V: Riemann Integration
Riemann integral; Riemann integral functions; Darboux theorem; Necessary and sufficient conditions for R-integrability; Properties of integrable functions; Fundamental theorem of integral calculus; Integral as the limit of a sum; Mean value theorems.

Practice - Demonstrating Riemann Integration and the Fundamental Theorem of Calculus.

Text Books:
1. "An Introduction to Real Analysis" by Robert G. Bartle and Donald R. Sherbert
2. "Principles of Mathematical Analysis" by Walter Rudin

Reference Books:
1. "An Introduction to Real Analysis" by William F. Trench
2. "Real Analysis" by H.L. Royden

Web Links:

1. Khan Academy - Real Analysis
   https://www.khanacademy.org/math/calculus-1
2. MIT OpenCourseWare - Real Analysis
   https://ocw.mit.edu/courses/mathematics/18-100c-abstract-algebra-spring-2018/
3. Paul's Online Math Notes - Real Analysis
   https://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx
4. YouTube - Real Analysis Playlist by Prof. Gilbert Strang
   https://www.youtube.com/playlist?list=PLK1A1QyPpXY4iD2Y5wQz5LDkq7Yl8o9uK
5. Coursera - Real Analysis Courses
   https://www.coursera.org/courses?query=real%20analysis

Introduction to real analysis

(Common to
B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS22
Semester- V

Course Outcomes:	L	T	P	C
At the end of the course, students will be able to:	2	0	2	4

CO1: Understand the real numbers and real-valued functions.
CO2: Analyze the convergence of sequences and series, applying appropriate methods.
CO3: Test the continuity, differentiability, and Riemann integration of functions.
CO4: Understand the geometrical interpretation of the mean value theorems.
CO5: Apply the fundamental theorem of integral calculus.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	2	-	-	-	2	-	1	-
CO2	3	-	3	2	-	-	-	3	-	1	-
CO3	3	-	3	2	-	-	-	3	-	1	-
CO4	2	-	2	2	-	-	-	2	-	1	-
CO5	2	-	3	2	-	-	-	3	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**-**
CO2	**2**	**-**
CO3	**2**	**-**
CO4	**2**	**-**
CO5	**2**	**-**

Unit-Wise Syllabus:

UNIT I: Real Numbers, Real Sequences

The algebraic and order properties of R; Absolute value and the real line; Completeness property of R; Applications of the supremum property; Intervals. Sequences and their limits; Range and boundedness of sequences; Limit of a sequence and convergent sequences; The Cauchy's criterion; Properly divergent sequences; Monotone sequences; Necessary and sufficient conditions for convergence of monotone sequences; Limit point of a sequence; Subsequences and the Bolzano-Weierstrass theorem; Cauchy sequences; Cauchy's general principle of convergence.

Practice - Verification of Algebraic and Order Properties of Real Numbers

UNIT II: Infinite Series
Introduction to series; Convergence of series; Cauchy's general principle of convergence for series; Tests for convergence of series; Series of non-negative terms; P-test; Cauchy's nth root test; D'Alembert's test; Alternating series; Leibnitz test.

Practice - Convergence and Boundedness of Sequences

UNIT III: Limit & Continuity
Real-valued functions; Boundedness of a function; Limits of functions; Some extensions of the limit concept; Infinite limits; Limits at infinity; Continuous functions; Combinations of continuous functions; Continuous functions on intervals; Uniform continuity.

Practice - Testing the Convergence of Infinite Series

UNIT IV: Differentiation and Mean Value Theorems
The derivability of a function at a point and on an interval; Derivability and continuity of a function; Mean value theorems; Rolle's theorem; Lagrange's theorem; Cauchy's mean value theorem.

Practice - Exploring the Continuity and Differentiability of Real-Valued Functions

UNIT V: Riemann Integration
Riemann integral; Riemann integral functions; Darboux theorem; Necessary and sufficient conditions for R-integrability; Properties of integrable functions; Fundamental theorem of integral calculus; Integral as the limit of a sum; Mean value theorems.

Practice - Demonstrating Riemann Integration and the Fundamental Theorem of Calculus

Text Books:
1. "An Introduction to Real Analysis" by Robert G. Bartle and Donald R. Sherbert
2. "Elements of Real Analysis" by Shanthi Narayan and Dr. M.D. Raisinghania

Reference Books:
1. "Real Analysis: Modern Techniques and Their Applications" by Gerald B. Folland
2. "Real Mathematical Analysis" by Charles C. Pugh.

Web Links:
1. Khan Academy - Real Analysis
   https://www.khanacademy.org/math/calculus-1
2. MIT OpenCourseWare - Real Analysis
   https://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2008/
3. Coursera - Introduction to Real Analysis
   https://www.coursera.org/courses?query=real%20analysis

4. YouTube - Real Analysis Lectures by Prof. Shilpi Gupta
   https://www.youtube.com/watch?v=9sUxfSjr-6I
5. Paul's Online Math Notes - Real Analysis
   https://tutorial.math.lamar.edu/Classes/CalcII/RealAnalysis.aspx

Linear Algebra

(Common to

B.Sc. Forensic Science & B.Sc. Cyber Security and Digital Forensics)

Course Code: 2509FS23 L T P C

Semester- VI 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Learn multiple integrals as a natural extension of definite integrals to functions of two variables in the case of double integrals and three variables in the case of triple integrals.

CO2: Learn applications in terms of finding surface area by double integrals and volume by triple integrals.

CO3: Determine the gradient, divergence, and curl of a vector and understand vector identities.

CO4: Evaluate line, surface, and volume integrals.

CO5: Understand the relation between surface and volume integrals (Gauss's Divergence Theorem), the relation between line integrals and volume integrals (Green's Theorem), and the relation between line and surface integrals (Stokes' Theorem).

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	2	2	-	-	-	2	-	1	-
CO2	2	-	2	2	-	-	-	3	-	1	-
CO3	2	-	2	2	-	-	-	3	-	2	-
CO4	2	-	2	2	-	-	-	3	-	2	-
CO5	2	-	2	2	-	-	-	3	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	-
CO2	**2**	-
CO3	**2**	-
CO4	**2**	-
CO5	**2**	-

Unit-Wise Syllabus:

Unit –I REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of R - Absolute value and Real line - Completeness property of R - Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits -Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence -The Cauchy's criterion - properly divergent sequences - Monotone

sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence -Subsequence In the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

Practice - Verification of Algebraic and Order Properties of Real Numbers

Unit – II INFINITE SERIES

Introduction to series -convergence of series -Cauchy'sgeneralprincipleof convergencefor series tests for convergence of series - Series of non-negative terms - P-test - Cauchy's Nth root test - D'- Alembert'sTest-AlternatingSeries–Leibnitz Test.

Practice - Convergence and Boundedness of Sequences

Unit –III LIMIT & CONTINUITY

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion).Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

Practice - Testing the Convergence of Infinite Series

Unit – IV DIFFERENTIATION AND MEANVALUETHEORMS

The derivability of a function at a point and and on an interval - Derivability and continuity of a function -MeanvalueTheorems -Rolle'sTheorem,Lagrange's Theorem, Cauchy's Mean value Theorem

Practice - Exploring Continuity of Real-Valued Functions

Unit – V RIEMANN INTEGRATION

Riemann Integral - Riemann integral functions - Darboux theorem -Necessary and sufficient condition for R integrability - Properties of integrable functions - Fundamental theorem of integral calculus - integral as the limit of a sum - Mean value Theorems.

Practice - Application of Mean Value Theorems to Real Functions

Text Books

1. A Textbook of Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 43rd Edition
2. Vector Calculus by J. Marsden & A. Tromba, 6th Edition, Pearson

Reference Books

1. Vector Calculus by P.C. Matthews, Springer Verlag
2. Vector Analysis by Murray R. Spiegel, Schaum's Outline Series, McGraw-Hill

Web Links:

1. Khan Academy - Multivariable Calculus
2. MIT OpenCourseWare - Multivariable Calculus- https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/
3. Paul's Online Math Notes - https://tutorial.math.lamar.edu/classes/calciii/calciii.aspx
4. Coursera - Vector Calculus
5. YouTube - 3Blue1Brown - Linear Algebra and Calculus Series

Minor Stream: Cyber Forensics

Course Code	Sem	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2509FS47	I	Introduction to Cyber Forensics	FC	2		2	4	50	50	100	-
2509FS48	II	Mobile Forensics	FC	2		2	4	50	50	100	ICF
2509FS69	III	Digital Forensics	IC	2		2	4	50	50	100	ICF
2509FS11	IV	Multimedia and IoT Forensics	IC	2		2	4	50	50	100	MF
2509FS24	V	Cloud Security and Forensics	AC	2		2	4	50	50	100	DF
2509FS25	VI	Reverse Engineering & Malware Analysis	AC	2		2	4	50	50	100	CS & F
Total				**12**		**12**	**24**				

Introduction to Cyber Forensics

Course Code: 2509FS47 L T P C
Semester- I 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental concepts and scope of cyber forensics.
CO2: Explore various types of digital evidence and forensic methodologies.
CO3: Learn techniques for acquiring, analyzing, and preserving digital evidence.
CO4: Gain hands-on experience with forensic tools used in cyber investigations.
CO5: Understand the legal and ethical considerations in cyber forensic investigations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	3	2	-	-	2	-	1	1
CO2	3	-	3	3	2	1	1	3	-	2	1
CO3	2	2	3	2	2	3	1	3	2	2	1
CO4	2	3	3	2	1	2	2	3	2	2	2
CO5	2	1	2	2	3	3	3	2	1	1	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**2**
CO3	**2**	**2**
CO4	**2**	**1**
CO5	**1**	**2**

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Cyber Forensics

Definition, scope, and evolution of cyber forensics. Importance in cybersecurity and law enforcement. Types of cybercrimes: hacking, fraud, identity theft, cyberstalking, and cyber terrorism. Digital forensic investigation process: identification, collection, analysis, preservation, and presentation of digital evidence. Challenges in cyber forensics and ethical responsibilities of forensic investigators. Importance of cyber forensics expert in legal

Practice - Forensic imaging and data recovery

UNIT – II: Digital Evidence and Data Acquisition

Types of digital evidence: volatile and non-volatile data. Importance of evidence collection, preservation, and integrity verification. Chain of custody and forensic best practices. Forensic imaging and disk cloning techniques. Hashing algorithms (MD5, SHA) for integrity verification. Data acquisition methods: live and dead forensics. Forensic tools for disk imaging and analysis.

Practice - File system and forensic acquisition techniques

UNIT – III: Computer and Network Forensics
File system forensics: FAT, NTFS, EXT file structures and metadata analysis. Techniques for recovering deleted and hidden data. Windows and Linux artifact analysis: logs, registry entries, system files. Network forensics: packet sniffing, intrusion detection, log analysis. Email forensics: header analysis, tracking email origins, identifying phishing attempts. Tools for forensic analysis of networks and systems.

Practice - Email header analysis for cybercrime investigations

UNIT – IV: Mobile and Memory Forensics
Mobile forensics methodologies for Android and iOS. Data extraction from SIM cards, SD cards, and cloud backups. Analysis of call logs, messages, and application data. Memory forensics: RAM analysis, identifying malicious processes, detecting hidden malware. Anti-forensic techniques and challenges in mobile investigations. Forensic tools for mobile data extraction and memory analysis.

Practice - Mobile forensic data extraction and analysis

UNIT – V: Legal and Ethical Aspects of Cyber Forensics
Cyber laws and regulations: Information Technology (IT) Act 2000 (Digital India Act, 2023), GDPR, HIPAA. Admissibility of digital evidence in court. Best practices for forensic investigations and reporting. Privacy issues, data protection laws, and compliance standards. Ethical responsibilities of forensic professionals. Emerging trends in cyber forensics: AI-driven analysis, cloud forensics, and blockchain-based investigations.

Practice - Legal documentation and forensic report writing

Textbooks:
1. "Digital Forensics and Cyber Crime" – Springer, ISBN: 978-3319255111
2. "Guide to Computer Forensics and Investigations" – Cengage Learning, ISBN: 978-1285060033

Reference Books:
1. "Incident Response & Computer Forensics" – McGraw-Hill Education, ISBN: 978-0071798686
2. "Digital Evidence and Computer Crime" – Academic Press, ISBN: 978-0123742681

Web Links:
1. National Institute of Standards and Technology (NIST) Forensics Guide
2. Volatility Framework for Memory Forensics
3. https://www.sans.org/profiles/sans-dfir/
4. https://www.geeksforgeeks.org/cyber-forensics

5. https://www.eCOuncil.org/train-certify/computer-hacking-forensic-investigator-chfi/

Mobile Forensics

Course Code: 2509FS48 L T P C
Semester- II 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand mobile device architecture, security mechanisms, and vulnerabilities.
CO2: Perform mobile forensic investigations using industry-standard tools and methodologies.
CO3: Extract, analyze, and interpret mobile data, including encrypted and deleted files.
CO4: Utilize forensic methodologies for Android, iOS, and other mobile platforms.
CO5: Apply legal and ethical principles in handling mobile forensic evidence and ensuring its admissibility in court.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	3	-	-	-	2	-	2	1
CO2	2	3	2	2	2	1	1	3	2	2	2
CO3	2	2	2	2	3	2	2	3	2	2	2
CO4	2	3	2	2	2	1	1	3	2	2	2
CO5	2	-	3	2	3	3	3	2	1	1	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**1**
CO3	**2**	**1**
CO4	**2**	**2**
CO5	**2**	**3**

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Mobile Forensics

Introduction to mobile forensics: definition, importance, and challenges. Mobile device components: hardware and software architecture, file systems, and storage mechanisms. SIM card forensics: structure, security features, data storage, and evidence retrieval. Mobile forensic challenges: encryption, anti-forensic techniques, and cloud-based storage. Mobile forensic evidence extraction process and best practices for securing, preserving, and documenting mobile evidence.

Practice - Mobile device forensic imaging using Cellebrite UFED, Oxygen Forensics, and Autopsy.

UNIT – II: Android Forensics

Android OS architecture: Linux kernel, libraries, Dalvik/ART runtime, application framework, and app layer. Android security mechanisms: sandboxing, application permissions, secure inter-process communication, and encryption. Android file system structure: EXT, YAFFS, F2FS. Android forensic setup and pre-data extraction techniques. Screen lock bypassing methods and gaining root access. Data extraction techniques: manual, logical, physical, and file system acquisition. Android app analysis: malware detection, reverse engineering apps, and forensic analysis of chat applications (WhatsApp, Telegram, Signal).

Practice - Logical and physical extraction of data from Android and iOS devices.

UNIT – III: iOS Forensics

iOS architecture and security model: Secure Boot, Data Protection, Keychain, File System (APFS, HFS+). iOS acquisition methods: logical, file system, and physical extraction. Jailbreaking techniques and their forensic implications. Extraction of unencrypted and encrypted backups from iTunes and iCloud. iOS forensic artifacts: analyzing SQLite databases, timestamp interpretation, and recovering deleted records. Investigating iOS application data, including social media and cloud storage apps.

Practice - Analysis of mobile forensic artifacts, including call logs, messages, and geolocation data.

UNIT – IV: Mobile Data Recovery and Analysis

Potential evidence stored in mobile devices: call logs, messages, browsing history, multimedia files, GPS data, and cached data. Mobile malware analysis: detecting and analyzing malicious applications. Network-based mobile forensics: call detail records (CDR), IP logs, and Wi-Fi forensic investigations. Data recovery techniques: forensic imaging, file carving, and deleted data recovery. Forensic tools for mobile data extraction and analysis: Cellebrite UFED, Magnet AXIOM, Belkasoft Evidence Center, Oxygen Forensics, MOBILedit, and Autopsy.

Practice - Data recovery and forensic analysis of deleted files, including SQLite records.

UNIT – V: Legal and Ethical Aspects of Mobile Forensics

Legal frameworks and compliance for mobile forensics: IT Act 2000 (Digital India Act, 2023), GDPR, HIPAA, CCPA. Rules of evidence: admissibility, authenticity, integrity, and reliability. Chain of custody and forensic documentation best practices. Privacy concerns and ethical challenges in mobile forensics investigations. International standards and guidelines for mobile forensic investigations. Case studies of mobile forensic investigations in cybercrime, financial fraud, and corporate espionage.

Practice - Reverse engineering Android applications and investigating mobile malware.

Textbooks:

1. Eoghan Casey, *Handbook of Digital Forensics and Investigation*, Academic Press, ISBN: 978-0123742674
2. Andrew Hoog, *Android Forensics: Investigation, Analysis, and Mobile Security for Google Android*, Syngress, ISBN: 978-1597496513

Reference Books:

1. Rohas Nagpal, *Mobile Device Forensics: A Guide to Evidence Collection, Analysis, and Presentation*, Springer, ISBN: 978-3030873276
2. Satish Bommisetty, *Learning Android Forensics*, Packt Publishing, ISBN: 978-1783288983

Web Links:

1. https://csrc.nist.gov/publications/detail/sp/800-101/rev-1/final
2. https://www.sans.org/cyber-security-courses/mobile-device-forensics/
3. https://www.magnetforensics.com/mobile-forensics/
4. https://www.cellebrite.com/en/mobile-forensics/
5. https://www.sans.org/cyber-security-courses/smartphone-forensic-analysis-in-depth/

Digital Forensics

Course Code: 2509FS69 L T P C
Semester- III 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the fundamental principles of computer forensics and investigative methodologies.
CO2: Gain expertise in data acquisition techniques, forensic imaging, and evidence validation.
CO3: Apply forensic tools and techniques to analyze and document digital crime scenes.
CO4: Develop skills in live memory forensics, data recovery, and hidden file detection.
CO5: Conduct email investigations and network forensics to trace cybercriminal activities.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	3	2	-	-	2	-	2	1
CO2	2	2	3	2	2	3	1	3	2	2	1
CO3	2	3	3	2	2	3	2	3	2	2	2
CO4	2	2	3	2	2	2	2	3	2	2	2
CO5	2	2	3	2	3	2	3	3	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**3**	**1**
CO2	**2**	**2**
CO3	**2**	**1**
CO4	**2**	**1**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT – I: Computer Forensics and Investigative Procedures

Introduction to computer forensics and its significance in cyber investigations; Forensic investigation process and systematic methodologies; Data recovery techniques, forensic workstations, and software tools; Setting up a forensic laboratory: Certification requirements, physical setup, and essential forensic equipment.

Practice - Creating forensic images of storage devices using tools like FTK Imager and Autopsy.

UNIT – II: Data Acquisition and Evidence Collection

Digital evidence storage formats and acquisition techniques; Imaging and cloning methodologies, RAID data acquisition, and remote network acquisitions; Contingency planning for forensic imaging; Validating forensic data acquisition and ensuring chain of custody; Tools for forensic imaging and acquisition.

Practice - Analyzing live memory dumps using Volatility and Redline.

UNIT – III: Crime Scene Processing and Forensic Tools
Search, collection, and preservation of digital evidence from crime scenes; Preparation, isolation, storage, verification, documentation, and reporting in digital forensics; Overview of forensic hardware and software tools, selection criteria, and evaluation of forensic toolkits; Incident response and handling digital crime scene scenarios.

Practice - Investigating email headers, tracing IP addresses, and analyzing attachments for hidden data.

UNIT – IV: Forensic Data Analysis and Validation Techniques
Software forensic analysis techniques: Data carving, compression analysis, and hidden data recovery; Graphics file forensics: Image recognition, recovery, and analysis; Live memory forensics: RAM analysis, volatile data extraction, and malware detection; Validating forensic processes and ensuring evidentiary integrity in court proceedings.

Practice - Recovering deleted files using tools like PhotoRec and Foremost.

UNIT – V: Email and Network Forensics
Email investigations and forensic methodologies; Role of email in cybercrimes and fraud investigations; Email headers, metadata analysis, and tracing origins of emails; Server-side and client-side email analysis; Specialized email forensic tools and techniques for retrieving deleted or hidden email data.

Practice - Capturing and analyzing network traffic using Wireshark for forensic investigations.

Textbooks:
1. Harlan Carvey – "Windows Forensic Analysis"
2. Debra Littlejohn Shinder – "Scene of the Cybercrime"

Reference Books:
1. Nelson, Phillips & Steuart – "Guide to Computer Forensics and Investigations"
2. Brian Carrier – "File System Forensic Analysis"

Web Links:
1. https://web-app.usc.edu/ws/soc_archive/soc/syllabus/20141/31945.pdf
2. https://www.bfh.ch/dam/jcr:d2dfc57e-fd2d-4db4-8bb0-06cb11bfb77f/study-guide-cas-digital-forensics-cyber-investigation-advanced-bfh.pdf
3. https://www.researchgate.net/publication/323798367_Advances_in_Digital_Forensics_Frameworks_and_Tools_A_Comparative_Insight_and_Ranking
4. https://www.sans.org/cyber-security-courses/advanced-digital-forensics-incident-response-threat-hunting/

Multimedia and IoT Forensics

Course Code: 2509FS11 L T P C
Semester- IV 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the principles and challenges of multimedia and IoT forensics.
CO2: Analyze and authenticate images, videos, and audio for forensic investigations.
CO3: Perform forensic acquisition and analysis of IoT devices and networks.
CO4: Identify security vulnerabilities in multimedia and IoT ecosystems.
CO5: Apply legal and ethical considerations in multimedia and IoT forensic investigations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2	3	3	-	-	2	-	-	1
CO2	1	1	3	2	2	3	1	2	-	-	1
CO3	1	2	3	2	-	2	-	3	1	-	-
CO4	1	-	2	3	2	-	-	3	1	2	-
CO5	1	1	1	1	3	2	3	3	2	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**1**
CO3	**2**	**1**
CO4	**2**	**1**
CO5	**2**	**3**

Unit-Wise Syllabus:

UNIT – I: Introduction to Multimedia Forensics

Fundamentals of multimedia forensics, importance in cybersecurity, sources of multimedia evidence, challenges in multimedia data analysis. Digital image forensics: image acquisition, metadata analysis, EXIF data extraction, image tampering detection, and steganalysis techniques. Video forensics: video format analysis, frame-level examination, detecting compression artifacts, and video authentication techniques. Audio forensics: speech signal processing, noise reduction, speaker identification, and deepfake detection.

Practice - Image metadata extraction and forensic analysis using EXIF tools.

UNIT – II: Image, Video, and Audio Forensic Techniques

Techniques for detecting forged images and videos, copy-move forgery, resampling detection, and AI-driven manipulation detection. Analysis of image compression techniques (JPEG, PNG) and

their forensic significance. Deepfake and synthetic media analysis using machine learning tools. Audio authentication methods, watermarking, spectrogram analysis, and voice morphing detection. Case studies on real-world multimedia forensics investigations.

Practice - Deepfake detection and forensic analysis of AI-generated multimedia.

UNIT – III: IoT Forensics and Security Challenges
Introduction to IoT forensics, forensic challenges in IoT environments, architecture of IoT devices, IoT communication protocols (MQTT, CoAP, Zigbee, LoRaWAN). IoT device acquisition methods, extracting data from smart devices, logs, and network traffic. Identifying and analyzing IoT-related threats such as botnets (Mirai), unauthorized access, and data tampering. Securing IoT networks and forensic best practices.

Practice - IoT device data extraction and network traffic analysis.

UNIT – IV: IoT Data Acquisition and Analysis
Live and dead acquisition techniques for IoT devices, firmware extraction, chip-off and JTAG techniques, forensic analysis of IoT-generated logs, network packet analysis of IoT communications, cloud-based IoT forensics, and forensic analysis of smart home devices (CCTV cameras, smart assistants, wearable devices). Challenges of encrypted IoT communication and potential solutions.

Practice - Firmware analysis and reverse engineering of IoT devices.

UNIT – V: Legal and Ethical Aspects, Case Studies, and Future Trends
Legal frameworks governing multimedia and IoT forensics, digital evidence handling, admissibility in court, and chain of custody. Compliance with GDPR, NIST, and ISO standards for IoT and multimedia forensics. Case studies on multimedia-based cybercrimes (deep fake frauds, misinformation campaigns) and IoT security breaches. Emerging trends in AI-driven multimedia authentication and blockchain-based forensic solutions for IoT security.

Practice - Audio forensic analysis and voice authentication.

Textbooks:
1. *Practical IoT Forensics* – Dale Josephh.
2. *Deep Learning for Social Media Data Analytics* – Usha Batra, Pramod Kumar.

Reference Books:
1. *Multimedia Forensics and Security* – Li, Chang-Tsun.
2. *Digital Image Forensics: There is More to a Picture than Meets the Eye* – Husrev Taha Sencar, Nasir Memon.

Web Links:
1. https://www.nist.gov/itl/iad/multimedia-forensics
2. https://deepware.ai/

3. https://www.researchgate.net/publication/366570127_IoT_with_Multimedia_Investigation_A_Secure_Process_of_Digital_Forensics_Chain-of-Custody_using_Blockchain_Hyperledger_Sawtooth
4. https://www.mdpi.com/1424-8220/24/16/5210
5. https://scispace.com/pdf/digital-forensic-challenges-in-internet-of-things-iot-1zscj46w.pdf

Cloud Security and Forensics

Course Code: 2509FS24	L	T	P	C
Semester- V	2	0	2	4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand cloud computing architectures, security risks, and deployment models in forensic investigations.

CO2: Implement identity and access management controls to secure cloud environments..

CO3: Apply encryption, auditing, and compliance strategies to protect forensic data in the cloud.

CO4: Conduct forensic investigations in cloud infrastructures, analyzing logs and digital evidence.

CO5: Address privacy challenges in cloud-based forensics, ensuring compliance with regulatory frameworks.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	2	3	3	2	-	2	-	-	2
CO2	2	-	2	2	2	2	2	3	-	-	2
CO3	2	-	2	2	2	3	3	3	-	-	2
CO4	2	2	2	2	2	2	3	3	1	1	2
CO5	1	-	3	2	2	3	2	2	1	1	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**1**
CO2	**2**	**2**
CO3	**2**	**1**
CO4	**2**	**1**
CO5	**2**	**1**

Unit-Wise Syllabus:

UNIT – I: Fundamentals of Cloud Security

Overview of cloud computing, its evolution, and role in forensic investigations. Cloud service models (IaaS, PaaS, SaaS) and deployment types (public, private, hybrid, and community clouds). Multi-tenancy and shared responsibility models. Security design, architecture, and risks in cloud computing. Key security frameworks for cloud environments.

Practice - Configuring and analyzing security settings in cloud platforms (AWS, Azure, GCP) for forensic readiness.

UNIT – II: Identity and Access Management in Cloud Security
Authentication and authorization techniques in cloud platforms, including Single Sign-On (SSO) and Multi-Factor Authentication (MFA). Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC) in forensic investigations. Identity provisioning, key management, and securing virtualized environments. Hypervisor security concerns and best practices for access control in forensic applications.

Practice - Implementing encryption techniques for securing forensic data in cloud storage.

UNIT – III: Data Security and Compliance in Cloud Forensics
Threat landscape in cloud environments, data security challenges, and mitigation techniques. Encryption methods for securing forensic data in the cloud. Secure storage, data retention policies, and digital evidence integrity. Auditing and compliance frameworks (GDPR, HIPAA, ISO 27001) in forensic investigations. Cloud security protocols, federated identity management, and risk assessment strategies.

Practice - Performing forensic analysis on cloud logs from AWS CloudTrail and Azure Security Center.

UNIT – IV: Forensic Investigations in Cloud Environments
Cloud forensic framework, challenges, and digital evidence handling in cloud-based investigations. Cloud log analysis, forensic data acquisition, and incident response. Investigative techniques for cloud crime, chain of custody management, and legal considerations. Forensic tools for cloud analysis: AWS CloudTrail, Azure Security Center, FTK, and Autopsy. Threat intelligence in cloud forensics and case studies on cloud security breaches.

Practice - Setting up and managing Identity and Access Management (IAM) policies, including MFA implementation

UNIT – V: Privacy, Security, and Governance in Cloud Forensics
Privacy concerns in cloud computing, regulatory standards (GDPR, CCPA), and legal implications. Data protection measures, privacy-preserving technologies, and governance frameworks in cloud environments. IoT security and cloud forensics, challenges in forensic data extraction from IoT devices. Incident response strategies for cloud-based attacks and forensic analysis of compromised cloud infrastructure.

Practice - Simulating cloud security incidents and applying forensic investigation techniques.

Textbooks:

1. *Handbook of Big Data and IoT Security* – Ali Dehghantanha & Kim-Kwang Raymond Choo
2. *Cloud Storage Forensics: Investigating Data Remnants in the Cloud* – David Cowen

Reference Books:

1. *Cloud Security and Privacy* – Tim Mather, Subra Kumaraswamy, & Shahed Latif
2. *Securing the Cloud: Cloud Computer Security Techniques and Tactics* – J.R. Winkler

Web Links:

1. https://www.cadosecurity.com/wiki/what-is-cloud-based-forensics
2. https://www.techtarget.com/searchsecurity/tip/Cloudcomputing-forensics-techniques-for-evidence-acquisition
3. https://cs-coe.iisc.ac.in/wp-content/uploads/2020/07/Cloud-forensics.pdf
4. https://www.coursera.org/learn/cloud-security-basics
5. https://docs.aws.amazon.com/security/

Reverse Engineering & Malware Analysis

Course Code: 2509FS25 L T P C
Semester- VI 2 0 2 4

Course Outcomes:

At the end of the course, students will be able to:

CO1: Demonstrate proficiency in reverse engineering principles and methodologies.
CO2: Analyze Windows internals and identify anti-reversing techniques.
CO3: Perform static and dynamic analysis of malware samples.
CO4: Utilize debugging tools for in-depth malware behavior analysis.
CO5: Detect, mitigate, and defend against advanced malware attacks.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	3	3	2	-	-	2	-	3	1
CO2	2	-	3	3	2	-	-	3	-	3	1
CO3	1	2	3	2	2	2	2	3	1	2	1
CO4	1	2	3	2	1	2	2	2	1	2	1
CO5	1	2	3	2	3	2	2	2	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	**2**	**2**
CO2	**2**	**1**
CO3	**2**	**2**
CO4	**2**	**1**
CO5	**2**	**2**

Unit-Wise Syllabus:

UNIT – I: Introduction to Reverse Engineering

Introduction to x86 and x64 architecture, CPU registers, memory segmentation, stack operations, and instruction sets. Data movement, function invocation, and execution flow analysis. Understanding disassembly and assembly language basics. Introduction to debugging tools such as IDA Pro, OllyDbg, and Ghidra.

Practice - Creating a malware using Kali Linux

UNIT – II: Windows Internals & Anti-Reversing Techniques

Windows OS architecture and kernel fundamentals. Windows API functions, memory management, and process/thread execution. Obfuscation techniques: Code packing, encryption, polymorphism, and metamorphism. Anti-reversing methods: Debugger detection, sandbox evasion, and runtime obfuscation. Deep web, dark net, and underground hacking markets related to malware distribution.

Practice - Reverse engineering simple binaries using Ghidra and IDA Pro

UNIT – III: Malware Analysis Techniques & Classifications
Introduction to malware types: Virus, worm, trojan, rootkits, ransomware, spyware, keyloggers, and backdoors. Malware lifecycle, attack vectors, and evasion techniques. Introduction to malware analysis approaches: Basic vs. advanced, static vs. dynamic analysis. Setting up virtualized environments for malware analysis using tools like VirtualBox and VMware.

Practice - Identifying packed and obfuscated malware samples.

UNIT – IV: Static Malware Analysis & Reverse Engineering
Basic static analysis: File hashing, metadata extraction, and identifying packed binaries. Understanding the Portable Executable (PE) file format, sections, and imports/exports. Extracting strings, detecting obfuscation, and unpacking techniques. Advanced static analysis: x86 disassembly, instruction set analysis, Windows API calls, and registry manipulation. Identifying malicious behaviors in Windows programs.

Practice - Debugging and analyzing malware behavior using OllyDbg/WinDbg.

UNIT – V: Dynamic Malware Analysis & Advanced Techniques
Basic dynamic analysis: Safe execution in controlled environments, process monitoring (Process Explorer, Process Monitor), registry snapshots (Regshot), network simulation, and packet analysis (Wireshark). Advanced dynamic analysis: Debugging malware with OllyDbg, IDA Pro, and WinDbg. Exploring malware persistence mechanisms: DLL injection, process hollowing, rootkit behaviors, and API hooking. Case studies of real-world malware and countermeasures.

Practice - Capturing and analyzing malware-infected network traffic with Wireshark.

Textbooks:

1. "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" – Michael Sikorski & Andrew Honig, No Starch Press, ISBN: 978-1593272906
2. "The IDA Pro Book: The Unofficial Guide to the World's Most Popular Disassembler" – Chris Eagle, No Starch Press, ISBN: 978-1593272890

Reference Books:

1. "Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code" – Michael Hale Ligh, Wiley, ISBN: 978-0470613030
2. "Reversing: Secrets of Reverse Engineering" – Eldad Eilam, Wiley, ISBN: 978-0764574818

Web Links:

1. https://malwareunicorn.org/
2. https://hex-rays.com/
3. https://practicalmalwareanalysis.com/
4. https://www.wireshark.org/docs/
5. https://www.e-spincorp.com/malware-analysis-techniques/