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SECTION 1

Program Educational Objectives, Program Outcomes and Program Specific Outcomes

The PEOs are **broad statements** that describe the career and professional accomplishments that the program is preparing its graduates to achieve in few years subsequent to receiving the degree. The PEO's of the forensic science program are as follows:

PEO 1:-CU forensic graduates will be well prepared for successful careers in the profession or in research & innovation at an industry and/or in government in one or more of discipline of forensic science and /or sub disciplines of forensic science.

PEO 2:- CU forensic graduates will make skilled in implementing current and emerging technologies and software practices for detection, analyses, and evaluation of forensic evidence.

PEO 3:-CU forensic graduates will be successful in leading the multidisciplinary teams with professional competencies to extend his experiences, abilities and dexterities in scientific investigations to give unbiased and firm scientific opinions in the courts.

PEO 4:-CU forensic graduates will serve the society not solely as forensic expert but as a contributor towards healthy, secure and vibrant society by making people alert about various methods adopted by the criminals for committing the crimes.

PEO 5:-CU forensic graduates will be successful in higher education in forensic science or criminology, if pursued.

Program Outcomes (POs) are **attributes of the graduates**of theprogramme that are indicative of the graduates' ability and competence to work as a forensic scientist upon graduation. Program Outcomes are statements that describe what students are expected to know or be able to do by the time of graduation. They must relate to knowledge and skills that the students acquire from the programme. The achievement of all outcomes indicates that the student is well prepared to achieve the program educational objectives down the road. The following 12 POs have been chosen by the Forensic science

department of Chandigarh University. The Forensic Science Department curriculum atCU has been designed to fully meet all the 12 Program Outcomes:

PO 1:Apply the knowledge of forensic and its different specializations to identify the modus operandi of criminals and investigate complex crimes (Forensic knowledge).

PO 2:Demonstrate team leadership skills through ability to set directions and teamwork skill for achieving the desired goals (Individual and team work).

PO 3:Apply reasoning within the conceptualknowledge to serve as an expert with integrity and high professional ethics that can deliver clear, objective and unbiased opinions ((Ethics).

PO 4:Communicate effectively to direct and guide interdisciplinary team members (Communication).

PO 5:Function effectively to communicate and express himself in the society with learning zeal and to deliver clear and firm eye witness in any proceeding that may be referred in future in similar cases (sustainability).

PO 6:Recognize and execute research based methods including targeted experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions for combating the crime (Conduct investigations of complex problems).

PO 7:Apply selected knowledge to work on complex analytical instruments so as to present accurate and complete data in reports based on good scientific practices and validated methods (Modern tool usage).

PO 8:Stay abreast of new findings and researches and along with lifelong learning in the field (Life-long Learning).

PO 9:Create and Innovate ideas that can lead to a powerful breakthrough in criminal and civil investigations (Design/development of solutions).

PO 10:Function effectively to serve the society not solely as forensic professional but as a contributor towards healthy, secure and vibrant society by making people alert about various methods adopted by the criminals for committing the crimes (Forensic scientists and society).

PO 11:Enhance and adopt new skills for future employability in teaching and research through seminar, internship. (Adoption of new skill for future employment)

PO 12:Function effectively to serve the society not solely as forensic professional but as a contributor towards healthy, secure and vibrant society by making people alert about various methods adopted by the criminals for committing the crimes (Forensic scientists and society).

Program Specific Objectives (PSOs) are **specific statements that describe the professional career accomplishment that the program is designed. The PSO's of the B. Sc. Forensic science** program are as follows:

PSO 1:-Graduate will able to develop critical thinking and reasoning abilities required during handling and interpretation of diverse evidences like digital, chemistry, toxicological, biological, documents, audio/videos, dermatoglyphics etc.

PSO 2:-Graduate will able to employ the techniques during criminal investigations that are economically viable and savvy to regional, national and global crime related problems benefitting respective organization and the profession.

PSO 3:- Graduate will able to detect and opine on the evidences recovered from homicidal, accidental and suicidal cases that may involve exhibit of dermatoglyphics, digital, anthropological, photographic etc. in front of judiciary or criminal justice system

SECTION 2

Scheme for B. Sc. Forensic Science Batch 2021

Annexure -1

BREAK-DOWN OF CREDITS

Course Type	Credits	%age	Recommended %age
Core Courses	76	57%	50-55%
Elective Courses (PE+OE)	15	11%	8-10%
Ability Enhancement Courses	24	18%	8-10%
Skill Enhancement Courses	8	6%	8-10%
Project Work/Dissertation (can be complimented by an Empaneled Certification or Choice based Electives)	9	7%	8-10%
Value Added Courses	At least one per semester		

Total Credits= 132					
Semester/Course category	**PC**	**PE**	**AE**	**SE**	**Project/Dissertation**
I	15		5		
II	18		2		
III	13		8		
IV	14		1	4	
V	8	9	8		3
VI	8	6		4	6
Total Credit	76	15	24	8	9
Total %age (round-off)	57	11	18	6	7

Module-I (+2 Medical)

Semester-I														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-111	Introduction to Forensic Science	3	0	0	3	3	Core	20	20	60				100
21FST-112	Crime and Society	3	0	0	3	3	Core	20	20	60				100
21SHT-119	Inorganic Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FST-114	Biodiversity-I (Protozoa to Annelida)	2	0	0	2	2	Core	20	20	60				100
21FSH-115	Cryptogamic Botany-I	2	0	2	3	4	Core	20	20	60	40	20	40	200
21SHP-125	Chemistry Lab- I	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCH-105	Communication Skills-Theory	2	0	2	3	4	Ability Enhancement	20	20	60	40	20	40	200
21UCT-101	Design Thinking and Creativity for Innovation	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-103	Life Skills and Mentoring-1*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-121	General Proficiency-I (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**23**								
Cumulative Credit					**20**									

Module-II (+2 Non-Medical)

Semester-I														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-111	Introduction to Forensic Science	3	0	0	3	3	Core	20	20	60				100
21FST-112	Crime and Society	3	0	0	3	3	Core	20	20	60				100
21SHT-119	Inorganic Chemistry-I	3	0	0	3	5	Core	20	20	60	40	20	40	200
21FSH-116	Electricity & Magnetism	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-117	Calculus, Algebra & Trigonometry	2	0	0	2	2	Core	20	20	60				100
21SHP-125	Chemistry Lab- I	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCH-105	Communication Skills-Theory	2	0	2	3	4	Ability Enhancement	20	20	60	40	20	40	200
21UCT-101	Design Thinking and Creativity for Innovation	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-103	Life Skills and Mentoring-1*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-121	General Proficiency-I (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0

Total Credit	**20**	**23**									
Cumulative Credit	**20**										

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.

Module-I (+2 Medical)

Semester-II														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-151	Criminalistics-I	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21FSH-152	Fingerprints Examination	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21SHT-122	Inorganic Chemistry- II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FST-154	Biodiversity-II (Arthropoda to Hemichordata)	2	0	0	2	2	Core	20	20	60				100
21FSH-155	Cryptogamic Botany-II	2	0	2	3	4	Core	20	20	60	40	20	40	200
21SHP124	Chemistry Lab –II	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCT-102	Academic Research Paper Writing and IPR	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-104	Life Skills and Mentoring-2*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-122	General Proficiency-II (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**25**								
Cumulative Credit					**40**									

Module-I (+2 Non-Medical)

Semester-II														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-151	Criminalistics-I	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21FSH-152	Fingerprints Examination	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21SHT-122	Inorganic Chemistry- II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FSH-156	Waves & Optics	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-157	Ordinary Differential Equations	2	0	0	2	2	Core	20	20	60				100
21SHP124	Chemistry Lab –II	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCT-102	Academic Research Paper Writing and IPR	1	0	0	1	1	Ability Enhancement	20	20	60				100

Module-I (+2 Medical)

Semester-III

Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-201	Criminalistics-II	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FST-202	Ethics in Forensic Science	3	0	0	3	3	Ability Enhancement	20	20	60				100
21SHT-120	Organic Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP219	Chemistry lab –III	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-204	Diversity and Systematic of Gymnosperms	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-205	Biodiversity (Chordates)	2	0	0	2	2	Core	20	20	60				100
21UCT-201	Entrepreneurship	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-203	Life Skills and Mentoring-3*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-221	General Proficiency-III (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-202	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-201	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**21**	**25**								
Cumulative Credit					**61**									

Module-I (+2 Non-Medical)

Semester-III														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-201	Criminalistics-II	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FST-202	Ethics in Forensic Science	3	0	0	3	3	Ability Enhancement	20	20	60				100
21SHT-120	Organic Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP219	Chemistry lab –III	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-207	Quantum Physics	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-208	Mechanics (Statics & Dynamics)	2	0	0	2	2	Core	20	20	60				100
21UCT-201	Entrepreneurship	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-203	Life Skills and Mentoring-3*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-221	General Proficiency-III (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0

21TDT-202	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-201	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**21**	**25**								
Cumulative Credit					**61**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.
Student will select total of 3 Credits from the Ability Enhancement Basket.

Module-I (+2 Medical)

Semester-IV														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-251	Questioned Document Examination	3	0	4	5	7	Core	20	20	60	40	20	40	200
21FSH-252	Forensic Photography	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-217	Organic Chemistry II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP221	Chemistry Lab-IV	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-254	Development and Reproduction in Flowering Plants	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-255	Animal Physiology	2	0	0	2	2	Core	20	20	60				100
21UCT-202	Ethics and Gender Equality*	1	0	0	0	1	Ability Enhancement	20	20	60				100
21UCT-204	Life Skills and Mentoring-4*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-222	General Proficiency-IV (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-282	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-281	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**22**	**29**								
Cumulative Credit					**83**									

Module-I (+2 Non-Medical)

Semester-IV														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-251	Questioned Document Examination	3	0	4	5	7	Core	20	20	60	40	20	40	200
21FSH-252	Forensic Photography	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-217	Organic Chemistry II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP221	Chemistry Lab-IV	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-256	Physics of Atoms &Molecules	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-257	Probability and Statistics	2	0	0	2	2	Core	20	20	60				100
21UCT-202	Ethics and Gender Equality*	1	0	0	0	1	Ability Enhancement	20	20	60				100
21UCT-204	Life Skills and Mentoring-4*	0	1	0	0	1	Ability Enhancement	100						100

21GPT-222	General Proficiency-IV (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-282	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-281	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**22**	**29**								
Cumulative Credit					**83**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.

For 10+2 Medical/Non-Medical

Semester-V														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-301	Forensic Psychology	3	0	0	3	3	Ability Enhancement	20	20	60				100
21FSH-302	Forensic Ballistics	3	0	2	4	5	Core	20	20	60	40	20	40	200
21SHT-123	Physical Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP-320	Chemistry Lab-V	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FST-###	Program Elective Basket-I/III	3	0	0	3	3	Elective	20	20	60				100
21FST-###	Program Elective Basket-II/IV	3	0	0	3	3	Elective	20	20	60				100
21***-***	Open Elective**	3	0	0	3	3	Elective	20	20	60				100
21FSI-308	Institutional/ Industrial training (Summer)	0	0	0	3	0	Project				45		55	100
21UCT-205	Environmental Science, Waste and Disaster Management	2	0	0	2	2	Ability Enhancement	20	20	60				100
Total Credit					**25**	**24**								
Cumulative Credit					**108**									

Note:**The course code for Open elective will be selected from University Open Elective Basket.
Student should select at least one value added subject per semester from the basket.
Student will select total of 3 Credits from the Ability Enhancement Basket.

For 10+2 Medical/Non- Medical

For 10+2 Medical/Non- Medical

Semester-VI														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-351	Computer Forensics	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FSH-352	Forensic Microscopy	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-218	Physical Chemistry-II	3	0	0	3	0	Core	20	20	60	40	20	40	200

21SHP-321	Chemistry Lab- VI	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FST-###	Program Elective Basket- V	3	0	0	3	3	Elective	20	20	60				100
21FST-###	Program Elective Basket- VI	3	0	0	3	3	Elective	20	20	60				100
21FSR-362	Project	0	0	4	6	4	Project				45		55	100
Total Credit					**24**	**25**								
Cumulative Credit					**132**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.

Ability Enhancement Basket-I

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21TDP-201	Soft Skills (TPP)	0	0	2	1	2	Ability Enhancement				40	20	40	100
21TDT-202	Aptitude (TPP)	0	2	0	2	2	Ability Enhancement	20	20	60				100

Ability Enhancement Basket-**II**

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21TDP-281	Soft Skills (TPP)	0	0	2	1	2	Ability Enhancement				40	20	40	100
21TDT-282	Aptitude (TPP)	0	2	0	2	2	Ability Enhancement	20	20	60				100

List of Program Electives I (Botany) for 5TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-309	Plant Anatomy	3	0	0	3	3	Elective	20	20	60				100
21 FST-310	Plant Growth, Development and Biotechnology	3	0	0	3	3	Elective	20	20	60				100
21FST-311	Analytical Techniques in Plant Sciences	3	0	0	3	3	Elective	20	20	60				100
21FST-312	Plant Breeding	3	0	0	3	3	Elective	20	20	60				100

List of Program Electives II (Zoology) for 5TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-313	Development Biology	3	0	0	3	3	Elective	20	20	60				100
21FST-314	Comparative Anatomy of Vertebrates	3	0	0	3	3	Elective	20	20	60				100
21FST-315	Human Genetics	3	0	0	3	3	Elective	20	20	60				100
21FST-316	Evolution and Animal Ecology	3	0	0	3	3	Elective	20	20	60				100

List ofProgram Electives III (Physics) for 5TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-317	Condensed Matter Physics	3	0	0	3	3	Elective	20	20	60				100
21FST-318	Astrophysics	3	0	0	3	3	Elective	20	20	60				100
21FST-319	Optoelectronics	3	0	0	3	3	Elective	20	20	60				100
21FST-320	Nuclear & Particle Physics	3	0	0	3	3	Elective	20	20	60				100

List of Program Electives IV (Mathematics) for 5TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-321	Introduction to Partial Differential Equations	3	0	0	3	3	Elective	20	20	60				100
21FST-322	Probability and Statistics	3	0	0	3	3	Elective	20	20	60				100
21FST-323	Modern Algebra	3	0	0	3	3	Elective	20	20	60				100
21FST-324	Basic Numerical Methods	3	0	0	3	3	Elective	20	20	60				100

List of Program Elective Basket-V for 6TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-354	Elements of Forensic Biology	3	0	0	3	3	Elective	20	20	60				100
21FST-355	Elements of Forensic Toxicology	3	0	0	3	3	Elective	20	20	60				100
21FST-356	Elements of Forensic Chemistry	3	0	0	3	3	Elective	20	20	60				100
21FST-357	Elements of Forensic Serology	3	0	0	3	3	Elective	20	20	60				100

List of Program Elective Basket-VIfor 6TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-358	Elements of Forensic Anthropology	3	0	0	3	3	Elective	20	20	60				100
21FST-359	Elements of Forensic Medicine	3	0	0	3	3	Elective	20	20	60				100
21FST-360	Elements of Forensic DNA typing	3	0	0	3	3	Elective	20	20	60				100
21FST-361	Elements of Wildlife Forensic	3	0	0	3	3	Elective	20	20	60				100

Open Elective offered by the Department

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSO-306	Fundamentals of Forensic Science	3	0	0	3	3	Elective	20	20	60				100

Value added Courses:

	Course Name	L	T	P	C		Course Type	Theory Assessment	Practical Assessment	Total

Course Code						C H		IA	MTA	ETA	CA	MTA	ETA	
21FSV-101	Forensic Science and Society	2	0	0	0	2	Value added	20	20	60				100
21FSV-102	Forensic Science as tool for Law enforcement agencies	2	0	0	0	2	Value added	20	20	60				100
21FSV-103	Forensic investigation of Accident cases	2	0	0	0	2	Value added	20	20	60				100
21FSV-104	Economic Offences	2	0	0	0	2	Value added	20	20	60				100
21FSV-105	Digital Forensics	2	0	0	0	2	Value added	20	20	60				100
21FSV-106	Introduction to Biometry	2	0	0	0	2	Value added	20	20	60				100
21FSV-107	Handwriting Identification and Recognition	2	0	0	0	2	Value added	20	20	60				100

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SYLLABUS

B. Sc. Forensic Science

(BATCH: 2021-24)

SECTION 3

Semester wise Syllabi

Semester I
Module-I (+2 Medical)

Semester-I														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-111	Introduction to Forensic Science	3	0	0	3	3	Core	20	20	60				100
21FST-112	Crime and Society	3	0	0	3	3	Core	20	20	60				100
21SHT-119	Inorganic Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FST-114	Biodiversity-I (Protozoa to Annelida)	2	0	0	2	2	Core	20	20	60				100
21FSH-115	Cryptogamic Botany-I	2	0	2	3	4	Core	20	20	60	40	20	40	200
21SHP-125	Chemistry Lab- I	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCH-105	Communication Skills-Theory	2	0	2	3	4	Ability Enhancement	20	20	60	40	20	40	200
21UCT-101	Design Thinking and Creativity for Innovation	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-103	Life Skills and Mentoring-1*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-121	General Proficiency-I (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**23**								
Cumulative Credit					**20**									

Module-II (+2 Non-Medical)

Semester-I														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-111	Introduction to Forensic Science	3	0	0	3	3	Core	20	20	60				100
21FST-112	Crime and Society	3	0	0	3	3	Core	20	20	60				100
21SHT-119	Inorganic Chemistry-I	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FSH-116	Electricity & Magnetism	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-117	Calculus, Algebra & Trigonometry	2	0	0	2	2	Core	20	20	60				100
21SHP-125	Chemistry Lab- I	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCH-105	Communication Skills-Theory	2	0	2	3	4	Ability Enhancement	20	20	60	40	20	40	200
21UCT-101	Design Thinking and Creativity for Innovation	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-103	Life Skills and Mentoring-1*	0	1	0	0	1	Ability Enhancement	100						100

21GPT-121	General Proficiency-I (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**23**								
Cumulative Credit					**20**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FST-111	Introduction to Forensic Science	3	0	0	3	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

This course begins with the basics of Forensic Science that involves its history, need, scope, significance and principles. The students are then introduced about the different types of forensic evidences, forensic report, recent trends and the administration and organizational set ups of Forensic establishments in India as well as in Abroad.

b) **Course Objectives**

1. To give an exposure to the students about the basics of Forensic Science, it's laws and principles.
2. To familiarize the students about the different types of evidences involved in forensic investigations and about the presentation of forensic report in the court.
3. To give knowledge to the students about various Forensic laboratories and Academic centers of Forensic Science.

c) Course Outcomes

On completion of this course, the students are expected to learn-

CO1	The History and laws of Forensic Science
CO2	The different type of evidences and their Investigation procedure
CO3	The divisions in a forensic science laboratory and the working of the forensic establishments

d) Syllabus

Unit-1	**Basics of Forensic Science : History, Need, Scope, Laws & Principles**	**Contact Hours: 15**
Chapter 1.1	Definition, History and Development of Forensic Science, Divisions of forensic science, Scope and Need of Forensic Science in Present Scenario. **Self-study: Dr. Ruxton Case**	
Chapter 1.2	Law of Exchange (Locard's Exchange Principle), Law of Individuality, Law of Comparison, Law of Progressive Changes and Law of Probability. **Self-study: Ted Bundy Case**	
Chapter 1.3	Role and duties of Forensic Scientist, Applications and Significance of Forensic Investigation in Civil and Criminal Cases. **Self-study: The Night Stalker Case**	
Unit-2	**Forensic Evidences & Forensic Report: Physical, Biological and Chemical Evidences, Tool marks and Trace Evidences**	**Contact Hours: 15**

Chapter 2.1	Definition & Importance of physical, biological & chemical evidences, collection and examination of Evidences in civil and criminal cases. **Self-study: Neeraj Grover Murder Case**	
Chapter 2.2	Location, Collection & Evaluation of various types of Tool Marks & Trace Evidences (Paint, Soil, Glass, Detective Dyes, GSR etc.) **Self-study: Uses of Detective dyes**	
Chapter 2.3	Forensic Expert, Forensic Report, Formats of Forensic Report, Court Testimony, Pre-Court Preparations & Court appearance, Examination in chief, Cross Examination and Re-examination, Ethics in Forensic Science **Self-study: Admissibility of Opinion of Forensic Expert in court**	
Unit-3	**Forensic Laboratories, Academic Centers and Recent trends**	**Contact Hours: 15**
Chapter 3.1	Administration and Organizational Setup of DFSS, CFSL, GEQD, SFSL, RFSL. **Self-study: History of GEQD**	
Chapter 3.2	Organizational setup and Hierarchy of MFSL, FPB, NICFS, CDTS, NCRB, BPR&D **Self-study: Hierarchy of CFSL**	
Chapter 3.3	Recent Trends in Forensic Science: Forensic Genetics, Environmental Forensic, Geo-Forensics, Bioterrorism, Biometrics in Personal Identification **Self-study: Importance of Forensic Science in criminal Investigations**	

e) Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

f) Reference Books:

1. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
2. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**

Total Marks	100

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	2	2		3	2	2	2	2	3
CO2	3	1	2	1	2	1	2	2		2	2	3	1	2	3
CO3	3	2	2	2	1	1	3	3		3	2	3	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-112	Crime and Society	3	0	0	3	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

This course begins with the study of crime, its characteristics, types, sociological aspect and present scenario of crime in India. The students are then introduced to the basics of criminology, criminal behavior and different theories of criminal behavior, relation of crime and society, causes, impact, consequences of crime, criminal justice system, detection and prevention of crime.

b) **Course Objectives**

1. To familiarize the students with basics of criminology and criminal behavior.
2. To give knowledge to the students about Causes, Impact, consequences, prevention of Crime and its relation with Society.
3. To learn the students about Criminal Justice system and different agencies involved in crime detection.

c) Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Crime characteristics, types and criminological perspective
CO2	Basics of criminology and criminal behavior
CO3	Relationship between crime and society , Sociology aspect and present scenario

d) Syllabus

Unit-1	**Introduction to Crime: Characteristics, Classification, Sociological aspect and Present Scenario**	**Contact Hours: 15**
Chapter 1.1	Definition of crime, history and development, victimology, criminological perspective **Self-study: Causes of crimes**	
Chapter 1.2	Characteristics of crime, classification of crimes: atrocity, seriousness, motive, statistical, situational & systematic. White collar crime, professional crime, organized crime, Hate crimes. **Self-study: Trends of crime in India**	
Chapter 1.3	Sociological aspect of Crime in society, Crime rate and present scenario of crime in India. **Self-study: Relation between Money and Crime**	
Unit-2	**Criminal and Theory of Criminal Behavior**	**Contact Hours: 15**
Chapter 2.1	Definition of criminal, classification of criminals, Criminal profiling	

	Self-study: The concept of accused and criminal	
Chapter 2.2	Introduction of criminal behavior, Deviant behavior, Modus Operandii, Investigative Strategy **Self-study: Identification of criminal intent in an individual**	
Chapter 2.3	Classical and non-classical theories: Biological theories, physiological theories, psychogenic theory and sociological theories **Self-study: History of concept of criminal behavior**	
Unit-3	**Causes, Impact , prevention of Crime and it's relation with Society**	**Contact Hours: 15**
Chapter 3.1	Causes of crime, Impact and Consequences of crime on society **Self-study: Role of education in society**	
Chapter 3.2	Relationship between crime and society, Is Crime a social problem? Social change and crime, Psychological Disorders and Criminality **Self-study: Impact of modernization on criminal activities**	
Chapter 3.3	Detection of Crime, Different agencies involved in crime: Police, Medico-legal expert, Judicial officers, Prevention of crime, Criminal Justice System **Self-study: Role of media: social media, TV shows, Movies etc. on society and crime**	

e) Text Books:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).

f) Reference Books:

1.R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).
3. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014)

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
9.	Assignment*	10 marks	1 per Unit	10 marks	

10.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
11.	Quiz	4 marks for each quiz	20per Unit	4 marks	
12.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
13.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
14.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
15.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
16.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	3	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	2	3	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21SHT119	Inorganic Chemistry –I	3	0	0	3	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE		21SHP-125					
ANTI-REQUISITE							

a. Course Description:

The course deals with the detailed study of atomic structure. The students are then introduced to the molecular orbital diagrams of various molecules, hybridization concepts. They are also introduced with s and p blocks of periodic table.

b. Course Objectives:

The Course attempts to address the specific topics relevant to Chemistry.The focus is on the basic concepts with introduction of some advanced topics and applications in the area of chemistry.

c. Course Outcomes

CO1	Understand the terminologies related to fundamentals of atomic structure and chemical bonds .
CO2	Illustrate various types of chemical bondings in different chemical compounds.
CO3	Understand the various concepts of molecular structures and their geometries
CO4	Analyze the trends in properties of elements out there in periodic table
CO5	Evaluate the properties related to s and p block elements in periodic table
CO6	Creating new ideas for structural determination and chemical bonding in day today chemistry

d. Syllabus

Unit-1	Atomic Structure & Chemical Bonding	Contact Hours: 15
Atomic structure	What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and $\psi 2$, Significance of quantum numbers, orbital angular momentum and quantum numbers *ml* and *ms*. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (*ms*). Rules for filling electrons in various orbitals, Hund's rule, Pauli's exclusion principle, Aufbau rule Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Heisenberg's uncertainty principle, De-Broglie hypothesis, Photoelectric effect.	
Chemical Bonding	General characteristics of ionic bond. Importance of lattice energy and solvation energy in stability and solubility of ionic compound. Born–Haber cycle and its applications. Polarizing power and polarizability. Fazan's rules; ionic character in covalent compound. Dipole moment and percentage ionic character. Valence bond theory (Heitler-London approach), shapes of some molecules and ions. $SnCl_2$, XeF_4, BF_4^-, PF_6^-	

	, $SnCl_6^{-2}$.Valence shell electron pair repulsion(VSEPR) theory to H_3O^+, SF_4, ClF_3,ICl^-_2,ICl^-_4,SO^{-2}_4, linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements **Self study - Structure and Bonding , Dative bonding .Strong chemical bonds Intermolecular bonding**

Unit-2	**Molecular structure and Physical Properties of elements**	**Contact Hours: 15**
Molecular Orbital Theory	MO approach: Rules for LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations. MO treatment of homonuclear (elements and ions of 1st and 2nd row) and heteronuclear (BO, CN, CO^+, NO^+, CO, HCl), diatomic molecules, bond order, magnetic character.	
General Trends in Physical Properties of Elements	General trends in physical properties of alkali metals and alkaline earth metals (Ionization energy, metallic character, reducing character, flame coloration, photoelectric effect), diagonal relationships, solvation and complexation tendencies of alkali and alkaline earth metals, functions of alkali and alkaline earth metals in bio systems. General trends in physical properties of p-block elements (Ionization energy, metallic character, reducing character, oxidation states).	
Formation of Oxides, hydroxides and hydrides.	Diagonal relationship of boron with silicon, Formation of hydrides (diborane, borazine), formation of oxides, hydroxides and halides. Ability to form complexes, allotropy, and tendency towards multiple bonding. Formation of oxides. **Self study – Orbital theory , Trends in periodic table , Variation of properties in periodic table**	

Unit-3	**p-Block elements –I**	**Contact Hours: 15**
Introduction of p-block Elements	Oxidation states, multiple bonding, formation of oxides and oxyacids (preparation, properties and chemical structure). Oxidation states, atomicity and elemental states, multiple bond formation, allotropy, Formation of oxides and oxyacids (preparation, properties and chemical structure). Formation of oxides and oxoacids (preparation, properties and chemical structure). Interhalogens, pseudo halogens and polyhalides.	
Noble Gases	Chemical properties of the noble gases; preparation, chemical properties and structure of Xenon diflouride, Xenon tetraflouride, Xenon Oxyflouride, Xenon hexafluoride, Xenon oxytetraflouride, Xenon dioxyflouride, Xenon trioxide, Clatherates. **Self study :** Trends in p block **,** Behaviour of nobel gases . Utility of inert gases .	

a) Text Books:

T1: Lee, JD.2014.Concise Inorganic Chemistry, 5th ed., Wiley Blackwell.

T2: Puri, Sharma and Kalia. 2009. Principles of Inorganic Chemistry, Reprint 2014, Milestone Publisher and Distributers.

T3: Khopkar, SM. 2009. Basic Concepts of Inorganic Chemistry, Reprint 2014, New Age International Publishers.

T4: Jauhar SP. 2014. Modern Approach to Inorganic Chemistry, Modern Publishers.

b) Reference Books:

R1: Cotton, FA; Wilkinson, G. and Gaus, PL. 2014Advanced Inorganic Chemistry, 6th Ed. Wiley Publishers.

R2: Miessler, G. and Tarr, A. Reprint 2015. Inorganic Chemistry, 3rd ed., Mc Graw Hill Publishers.

R3: Doaglas. B., McDaniel D. and Alexander, I. 1994.Concepts of Models of Inorganic Chemistry.3rd Ed., John Wiley& Sons.

R4: Shriver, DE; Atkins, CH. 2010.Inorganic Chemistry. 5th edition, Oxford University Press.

c) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	2	2	2	1	2	3	3	--
CO2	3	3	2	3	2	2	1	2	2	2	1	2	3	2	-
CO3	3	3	3	2	1	1	2	1	2	1	2	2	2	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21FST-114	Biodiversity-I (Protozoa to Annelida)	2	0	0	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the basic phylum that is protozoa and proceeds to the higher phylum till annelid including Porifera, Coelenterate, Platyhelminthes and Aschelminths. Course also includes study of at least one specimen in detail from each phylum.

b) Course Objectives

1. The Course attempts to acquaint students with the general characters and classification of Protozoa to Annelida and the affinities between different groups.

c) Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Assess appropriate information about protozoans and poriferans in order to analyze and create cohesive and persuasive concepts.
CO2	Assess information and problems related to coelenterates and Platyhelminthes and apply those strategies for alleviation to analyze, create and propose designed concepts.
CO3	Infer knowledge about aschelminths and annelids and apply that knowledge to create new ideas.
CO4	Described the general biology of few selected non-chordates useful to mankind.
CO5	Understand the basics of systematics by learning the diagnostic and general characters of various groups
CO6	Ability to love and understand the fascinating world of invertebrates

d) Syllabus

Unit-1	**Protozoa and porifera**	**Contact Hours: 10**
Chapter 1.1	General characteristics and classification up to orders of Phylum protozoa; Detailed study of the following animal types: Protozoa: *Amoeba proteus, Paramecium caudatum*. **Self-study: General characteristics of Phylum protozoa**	
Chapter 1.2	Kappa particles in *P. aurelia*). *Plasmodium vivax.* General characteristics and classification up to orders of phylum Porifera. Detailed study of the *Sycon*. **Self-study: Importance of Phylum protozoa in daily living**	
Unit-2	**Coelenterate and Platyhelminthes**	**Contact Hours: 10**
Chapter 2.1	General characteristics and classification upto orders of phylum coelenterate. Detailed study of the *Obelia.* **Self-study: Basics of classification system**	
Chapter 2.2	General characteristics and classification upto orders of phylum Platyhelminthes. Detailed study of the following animal types: *Fasciola, Taenia*. **Self-study: Growth requirements of phylum Platyhelminthes**	
Unit-3	**Aschelminths and Annelida**	**Contact Hours: 10**
Chapter 3.1	General characteristics and classification upto orders of phylum Aschelminths. Detailed study of *Ascaris*. **Self-study: Life cycle of Aschelminths**	

Chapter 3.2	General characteristics and classification upto orders of phylum Annelida. Detailed study of the *Pheretima* (Earthworm). **Self-study: Parasitic adaptations in Helminths**

e) Text Books:

T1 Jorden, EL.2001. Invertebrate Zoology, 4th Ed., S. Chand Publishers.

T2 KotpalRL. 2009. Modern Text Book of Zoology: Invertebrate, 10th Ed., Rastogi Publications.

f) Reference Books:

R1Hyman, LH .1955. Invertebrates,5th Ed, Mcgraw Hill.

R2Verma, PS. 2005. A Manual of Practical Zoology: Invertebrate,3rd Ed., S. Chand Publishers.

R3LalSS.2009. Practical Zoology Invertebrate ,2ndEd., Rastogi Publications.

R4Dhami&Dhami.1983. Text Book of Zoology ,4thEd., Pardeep Publications.

R5Aggarwal, VK .2011. Zoology for Degree Students ,5th Ed., S. Chand Publications.

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
17.	Assignment*	10 marks	1 per Unit	10 marks	
18.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
19.	Quiz	4 marks for each quiz	20per Unit	4 marks	
20.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
21.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
22.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
23.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
24.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0

CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
CO5	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
CO6	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
5	Course Code- 21FSH-115	Cryptogamic Botany-I	2	0	2	4	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the introduction to cryptography algae and fungi. Then students are made aware about the detailed study about morphology, anatomy and lifecycle of algae and fungi.

b) Course Objectives

1. The Course attempts to acquaint the students about the morphology, biology and importance of prokaryotes, eukaryotes, algal organisms, fungal organisms and lichens.

c) Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Evaluate the modern trends adopted in classification and diversification of algal plant kingdom including simplest group of viruses and bacteria.
CO2	Assess about heterotrophic and autotrophic modes of nutrition in the plant kingdom and study of genera that comes under a common family on the basis of various characters studied.
CO3	Conclude about different groups of fungi on the basis of habit, habitat and structural characters.
CO4	Gain knowledge about the general aspects of lichens.

d) Syllabus

Unit-1	**General account ofCyanobacteria and Fungi**	**Contact Hours: 20**
Chapter 1.1	General introduction; General account of Cyanobacteria, Detailed study of *Oscillatoria.* **Self-study: General characteristics of Cyanobacteria**	
Chapter 1.2	General characters, important features and classification by different mycologists, and economic importance of Fungi. **Self-study: Fritsch system of classification**	
Experiment 1.1	To collect different algal material from neighboring areas.	
Experiment 1.2	Study of the genera included under algae: *Volvox, Oedogonium, Vaucheria, Ectocarrpus* and *Batrachospermum*	
Experiment 1.3	To study morphological features of *Chara.*	
Unit-2	**Algae**	**Contact Hours: 20**
Chapter 2.1	General characters, important features and life history of Chlorophyceae–*Volvox, Oedogonium*, *Coleochaete*. **Self-study: Medical use of Chlorophyceae**	
Experiment 2.1	Study of crustose, foliose and fruiticose lichen thalli	

Experiment 2.2	To collect some diseased plants from surrounding and identify the disease. Observe disease symptoms of collected material	
Chapter 2.2	General characters, important features and life history of Xanthophyceae–*Vaucheria*;Phaeophyceae–*Ectocarpus, Sargassum*; Rhodophyceae–*Batrachospermum*. **Self-study: Difference between Xanthophyceae and Phaeophyceae**	
Experiment 2.3	Study of genera of Fungi through specimens/Slides: *Agaricus*, *Morchella, Mucor and Saccharomyces.*	
Unit-3	**Fungi and Lichen**	**Contact Hours: 20**
Chapter 3.1	Important features and life history of *Albugo*(White rust of crucifers: *Albugo candida*), Mastigomycotina–*Pythium*. **Self-study: Economic importance of Algae**	
Experiment 3.1	To prepare a slide of fungal material collected from stale bread	
Chapter 3.2	Important features and life history of *Phytophthora;* Zygomycotina–*Mucor,* Ascomycotina–*Saccharomyces, Eurotium. Peziza;* Basidiomycotina– *Ustilago, Puccinia, Agaricus;* Deuteromycotina–*Cercospora. Colletotrichum*). **Self-study: A general account on Lichens**	
Experiment 3.2	To cut section of gills of *Agaricus*. Observation its anatomy under microscope.	
Experiment 3.3	To cut transverse section and vertical section of Pileus of *Agaricus* an observe it under microscope.	

e) Text Books:

T1Sharma, PD.2001. The Fungi, 4th Ed., Rastogi Co., Meerut.
T2 Black, JG. 1999. Microbiology – Principles and Explorations,5th Ed., John Wiley & Sons. Inc. Singapore.
T3Vashishta, BR; Sinha, AK and Singh, VP. 2011. Botany for Degree Students-Algae, 5th Ed., S. Chand Publisher, New Delhi.
T4Lab Manuals of Botany
T5Bendre, A and Kumar, A. 1990-91. Practical Botany, 2nd Ed., Rastogi Publications, Meerut.
T6Fukui, K and Nakayama, S. 1996. Plant Chromosomes Laboratory Methods, 3rd Ed., CRC Press, Boca Raton, Florida

f) Reference Books:

R1Alexopolus, CJ; Mims, CW and Blackwell, M. 1996. Introductory Mycology. 2nd Ed., John Willey & Sons. Inc., Singapore.
R2Clitton, A. 1958. Introduction to Bacteria. 1st Ed., McGraw Hills & Co., New York.
R3Deacon, JW. 1997. Modern Mycology, 3rd Edition, Blackwell Science, Ltd. U.K.
R4Dube, HC.1990. An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
R5Harris, NandOparka, KJ. 1994. Plant Cell Biology: A Practical Approach, 1st Ed., IRL Press at Oxford University Press, Oxford, UK.
R6Sharma, AK and Sharma, A. 1999. Plant Chromosomes: Analysis Manipulation and Engineering, 1st Ed., Harwood Academic Publishers, Australia.

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1
CO4	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
6	Course Code- 21SHP-125	Chemistry Lab- I	0	0	2	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE		21SHT119					
ANTI-REQUISITE							

a. Course Description

The course begins with the study of different radicals, understand, and apply appropriate information about identification, classification to analyze the presence of a radical in a salt. Further the presence of a functional group can also be experimentally identified.

b. Course Objectives

To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory. The practical work has been designed to give hands on experience of various analytical techniques.

c. Course Outcomes

CO1	Understand the radicals and their classification and analysis and identification of the cations and anions in a given salt.
CO2	Understand and apply appropriate knowledge about elements to detect different elements (N, S and halogens).
CO3	Understand and apply appropriate knowledge about functional groups and identify their presence in compounds.

d. Syllabus

Unit-1	Semi-micro analysis of mixtures	Contact Hours: 5
Identification of cations and anions	Detection/identificationsof the given radicals in a mixture- **Cations:** NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+ **Anions:** CO_3^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, F^-.	
Unit-2	**Detection of Elements**	**Contact Hours: 5**
Detection of N, S	Detection of elements (N, S and halogens).	
Unit-3	**Detection of Functional Groups**	**Contact Hours: 5**
Detection of functional groups	Detection of alcohol, phenol, carboxylic, carbonyl, esters, carbohydrates, amines, nitro and amide in simple organic compounds and preparing their derivatives.	

e. Textbooks / Reference Books

T1: Svehla, G. and Sivasankar, B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Edition, Pearson
T2: Bassett, J; Denney, RC; Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th ed., Orient Longman.
T3: Ahluwalia and Agrawal, R. 2000. Comprehensive Practical Organic Chemistry, University Press.
R1: Vogel, AI; Tatchell AR; Furnis, BS; Hannaford, AJ and Smith, PWG. 1989. Vogel's Text Book of Practical Organic Chemistry, 5th Edition, Pubs: ELBS.

f. Assessment Pattern - internal and external

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

g. Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Practical worksheet (in journal category) and class room learning	20 marks for each experiment	8-10 Experiments	40 marks	Depending upon the no. of experiments
2	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments
3	Discussion Forum/ Short digital assignment/ Journal to submit design	4 marks for each task	1 per semester	4 marks	
4	Presentation	-------		Non graded Engagement Task	
5	Attendance and BB Engagement score	-------		4 marks	End semester

h. CO-PO-PSO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	2	2	2	1	2	3	3	--
CO2	3	3	2	3	2	2	1	2	2	2	1	2	3	2	-
CO3	3	3	3	2	1	1	2	1	2	1	2	2	2	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
7	Course Code- 21UCH-105	Communication Skills-Theory	2	0	2	4	UC-AE
PRE-REQUISITE		Studied English Language up to senior secondary					
CO-REQUISITE		Communication Skills Lab					
ANTI-REQUISITE							

a. Course Description

The course provides a strong foundation in English grammar and equips the students with the fundamentals of the language in LSRW skills. English proficiency is achieved by focusing on socio-linguistic usage. It introduces basic business communication with special emphasis on effective business correspondence and digital content writing.

In the lab, the course focuses on the enhancement of listening comprehension and speaking fluency in everyday situations by focusing on some essential grammar, vocabulary, and pronunciation. It will assist students to cultivate soft skills like time management, stress management and enhance self awareness through SWOC analysis shaping them to become better team players.

b. Course Objectives

The Course aims to:

1. Augment students overall communication and interpersonal skills by making them realize the importance of good oral and written English Language in professional life.
2. Enrich their reading capability with special emphasis on expanding vocabulary and grammatical formations.
3. Build exceptional speaking, reading and writing skills by correcting grammatical errors and pronunciation through practice.
4. Enhances soft skills by fostering self awareness, confidence and a positive attitude in students' ability to communicate effectively in English.

c. Course Outcomes

CO1	Apply non-verbal and soft skills effectively to attain expertise in Listening, Speaking, Reading and Writing Skills (LSRW Skills).
CO2	Apply correct contextual and comprehensible written text and speech in a wide range of communication situations.
CO3	Demonstrate linguistic competence while speaking and writing through accuracy in grammar, intonation, pronunciation and vocabulary.
CO4	Evaluate information as critical readers, speakers and writers applying ethics in communication and being sensitive in cross cultural communication.
CO5	Create original short compositions, in the form of paragraph writing, business correspondence, blogs etc. using logical support and argument.

d. Syllabus

Unit-1	**Business Communication**	**Contact Hours: 20**
Business Communication	Meaning, importance, process, models and types, barriers to effective communication, verbal and non-verbal communication, Techniques for building LSRW Skills and Case Study	
Reading Skills	Reading Comprehension	
Writing	Paragraph writing, note making and note taking	
Grammar	Parts of Speech, articles, modal verbs	
Vocabulary	Word formation - Prefixes, suffixes and compounds, homonyms, homophones, homographs	
Self Study	Vocabulary Building, Usage of homonyms, homophones, homographs	
Soft Skills Lab	Self Awareness- Personal attributes, SWOC Analysis	
Speaking Skills	Art of Public Speaking- just a minute, extempore, news discussion	
Non-Verbal Skills	Positive body language, posture, gestures, symbols and signs	
Phonetics	Classification of Speech Sounds, Vowel sounds, Introduction to phonetic symbols	
Unit-2	**Business Correspondence**	**Contact Hours: 20**
Ethics in Communication	Significance, Factors, Dilemmas in Ethical Communication, Case Study	
Writing	Précis writing, leave application, permission letter, business letters - sales, request, order, inquiry, acknowledgement, complaint and collection letters, memorandum writing, office order, circular, various types of notice writing.	
Grammar	Tenses, concord (subject-verb agreement), punctuation	
Vocabulary	One-word substitutes, synonyms, antonyms	
Self Study	Vocabulary Building - Usage of synonyms, antonyms	
Soft Skills Lab	Goal Setting, Time Management	
Verbal Skills	Art of self introduction, extempore, cross talk, news discussion	
Non-Verbal Skills	Personal appearance and grooming	
Phonetics	Vowel Sounds, Consonant Sounds.	
Unit-3	**Digital Content Writing**	**Contact Hours: 20**
Cross-Cultural Communication	Significance, elements, cultural context and barriers to Cross Cultural Communication, Case Study	

Writing	Summarizing, creative writing, digital content writing (blogs and websites), email writing, proofreading
Grammar	Narration, voice, transformation and correction of sentences
Vocabulary	Collocations, idioms
Self Study	Vocabulary Building - Usage of Collocations, idioms
Soft Skills Lab	Stress Management, Team Building
Speaking Skills	Greetings, Complementing and Inviting, Making Requests, Group discussion
Phonetics	Diphthongs Sounds, Stress & Intonation rules and practice

e. Textbooks / Reference Books

TEXT BOOKS

T1 Raman, M. and Sharma, S; Technical Communication - Principles and Practice, Oxford University Press (2019), New Delhi

REFERENCE BOOKS

R1 Lesikar R.V., Petit J.D., Business Communication, Tata McGraw (2016), New Delhi.

R2 Chaturvedi, P.D. and Chaturvedi, Business Communication, Pearson Education (2017), New Delhi

R3 Murphy, R., Elementary Grammar, Cambridge University Press (2017), UK

R4 Murphy, R., Essential Grammar in Use, 5th Edition Cambridge University Press (2018), UK

R5 Hewing, Martin, English Grammar (Intermediate Level), Cambridge University Press (2017), UK

R6 Sethi, J., Dhamija, P.V., A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi (2015).

R7 Roach P., English Phonetics and Phonology: A Practical Course (English), Cambridge University Press, 4th Edition (2016), UK

R8 O'Connor, J. D. Better English Pronunciation, 2nd Edition, Cambridge University Press, (2012), UK

R9 Hornby, A.S. Oxford Advanced Learners Dictionary of Current English, 8th Edition, Oxford University Press (2019), UK

f. Assessment Pattern - Internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Examination**	**Continuous Assessment**	**Mid Term Assessment**	**End Term Examination**
Marks	20	20	60	40	20	40
Total Marks	100			100		
Weightage	75%			25%		

Internal Evaluation Component

Sl No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks (Graded/Non-Graded)
1	Assignment*	12 marks of each assignment	One Per Unit	4 marks	Graded

2	Surprise Test - case study	8 marks for each test	One per Unit	4 marks	Graded
3	Quiz	4 marks of each quiz	2 per Unit	4 marks	Graded
4	Mid-Semester Test	20 marks for one MST.	2 per semester	20 marks	Graded
5	Blog Writing	8 marks	1 per semester	4 Marks	Graded
6	Homework - Creative Writing –Poetry/Short story / Article Writing	NA	1 Per Semester	2 Marks	Graded
7	Discussion Forum	NA	One per Chapter	Non Graded: Engagement Task	Non- Graded
8	Class Participation	NA	NA	2 marks	
9	Practical - Class room Learning and Performance	20 marks for each activity	10 activities	40 marks	Marks Breakup Content – 7 Fluency -5 Speech -3 Post Lab Quiz -5
10	Mid - Term Test - Lab	20 marks	1 per semester	20 marks	After the completion of 5 activities Rubrics Content – 7 Fluency -5 Speech -3 Write –up of Content -5

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Hybrid (HYB)	Ability Enhancement Category University Core (UC)	Graded	Theory Examination

g. CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										3		
CO2										3		
CO3										3		
CO4								1		3		
CO5										3		

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
8	Course Code- 21FSH-116	Electricity & Magnetism	2	0	2	4	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a. Course Description

The course begins with thestudy of vector calculus and electrostatics. The students are the introduced to Capacitors and Dielectrics and Magnetism.The course further emphasizes on the concept of the essential concepts of Poisson and Laplace equations and method of electrical images.

b. Course Objectives

1. The course attempts to address the specific topics relevant to Physics.
2. The focus is on the basic concepts with introduction of some advanced topics and applications in Physics.

c. Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Describe and explain the concept of Vector Calculus.
CO2	Apply it to Electrostatics, electric field, Gauss's law and Electric potential alongwith their applications.
CO3	Learn, apply and formulate the concepts and mathematical relations of Capacitors and Dielectrics, Magnetism, sources of magnetic fields.
CO4	Applications of the Capacitors and Dielectrics.
CO5	Describe and formulate the important Poisson and Laplace equations and method of electrical images.
CO6	Learn about essential concepts of magnetic field induction and different types of magnetic materials.

d. Syllabus

Unit-1	**Vectors Calculus and electric potential**	Contact Hours: 15
Chapter 1.1	Gradient, Divergence, curl and their physical significance, Laplacian in rectangular, cylindrical and spherical coordinates Vector Integration, Line, and surface and volume integrals of Vector fields, **Self-study: Gauss's theorem of electrostatics**	
Experiment 1.1	To study the error analysis by the measurements of length (or diameter) using verniercaliper, screw gauge and travelling microscope. To determine the value of g by Bar Pendulum.	

Chapter 1.2	Gauss-divergence theorem and Stoke's theorem of vectors (statement only), Properties of Electric Charges, Coulomb's Law, Electric Field, Electric field due to continuous charge distribution, Electric field lines, Motion of charge particle in uniform electric field **Self-study: Applications of Gauss theorem**	
Experiment 1.2	To determine the height of a building using a Sextant.	
Chapter 1.3	Electric potential and potential difference, Electric Potential energy, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. **Self-study: Plane charged sheet and charged conductor**	
Experiment 1.3	To determine the Moment of Inertia of a Flywheel.	
Unit-2	**Capacitance, Dielectrics and magnetism**	Contact Hours: 15
Chapter 2.1	Capacitance of an isolated spherical conductor, Parallel plate, spherical and cylindrical condenser, series and parallel combination of capacitors, energy stored in capacitor **Self-study: Gauss's Law in magnetism**	
Experiment 2.1	To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.	
Chapter 2.2	Capacitor with dielectrics, electric dipole in an electric field, an atomic description of dielectrics **Self-study: Biot-Savart's law & its applications**	
Experiment 2.2	To study the series and parallel LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor	
Chapter 2.3	Magnetic field and forces, Motion of charged particle in a uniform magnetic field, magnetic force acting on a current acting conductor, torque on a current loop in a uniform magnetic field, Hall Effect. **Self-study:Magnetic force between two parallel current carrying conductors**	
Experiment 2.3	To determine the capacitance of a capacitor using flashing and quenching of neon flash lamp.	
Unit-3	**(Electrodynamics, Induction and electromagnetic waves)**	Contact Hours: 15
Chapter 3.1	Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates, Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet. Current and current density, equation of continuity, Microscopic form of Ohm's Law and conductivity, Failure of ohm's law **Self-study: Ohm's Law and conductivity**	
Experiment 3.1	To study the motion of a spring and calculate (a) Spring Constant (b) Value of g.	
Chapter 3.2	Behavior of various substances in magnetic field, Definition of M and H and their relation to free and bound currents, Permeability and susceptibility and their interrelationship**,** Specific Charge, Balllistic Galvanometer **Self-study: Orbital motion of electrons**	
Experiment 3.2	**To determine the (a) Charge Sensitivity (b) Current Sensitivity of a Ballistic Galvanometer**	

Chapter 3.3	Equation in free space, Boundary conditions. **Self-study: Diamagnetism**
Experiment 3.3	To compare capacitances using De-Sauty's bridge.
Experiment 3.4	Measurement of dielectric constant of a given sample.

e. Textbooks / Reference Books

T1Serway, AR; Jewett, WJ. 2010. Physics for Scientists and Engineers, 8th Ed., Cengage Learning, Canada.

T2 Griffiths, DJ. 2012. Introduction to Electrodynamics, 4th Ed., PHI Learning Private Limited, New Delhi.

T3 Mathur, DS. 2000. Mechanics, 3rd Ed., S. Chand and Company Limited, New Delhi.

T4Hayt, HW. 2011. Engineering Electromagnetics, 8th Ed., Tata McGraw Hill, Noida.

f. REFERENCE BOOKS

R1 Mahajan, AS. and Rangwala, AA. 2001. Electricity and Magnetism, 1st Ed., Tata McGraw Hill, Noida.

R2 Tayal, DC. 1988. Electricity and Magnetism, 2nd Ed., Himalaya Publishing House, Mumbai.

R3 Sadiku, ON; Matthew. 2007. Elements of Electromagnetic, 3rd Ed., Oxford, New York

g. Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h. CO-PO-SO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1
CO4	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO5	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO6	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
9	Course Code- 21FST-117	Calculus, Algebra & Trigonometry	2	0	0	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a. Course Description

This course covers the fundamentals of Advance Calculus:Double and Triple integrals, Change of Order and Change of Variables in Multiple integrals, Curve tracing of Cartesian and other curves,Partial Differentiation and its applications in Maxima Minima, the concept of Matrices and its properties, and also gets knowledge about Cayley's Hamilton theorem and its applications.

b. Course Objectives

The focus is on the basic concepts of Vector Calculus with some advanced topics and applications in the area of Mathematics. This course presents a rigorous treatment of fundamental concepts in Advance Calculus. To introduce students to the fundamentals of Multiple integrals and understanding the concept of Curve Tracing, the course objective is to understand the concept of Partial Differentiation and its applications, in particular the Maxima and Minima of Two Variables

c. Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Understand the concept of multiple integrals.
CO2	Apply the concept of double integrals to find the area
CO3	Derive Eulers theorem for Partial Differentiation.
CO4	Remember the concept of Matrices and its properties.
CO5	Explain and apply Cayley's Hamilton theorem and get knowledge about its applications.
CO6	Apply the concept of De'Moivre's theorem and its applications

d. Syllabus

Unit-1	Multiple Integrals &Curve Tracing	Contact Hours: 10
Chapter 1.1	Double &Triple integral, Double integral for Polar Curves, Change of order of Integration, Change of Variables. Asymptotes, Multiple points, Tests for concavity and convexity, points of inflexion, Tracing of curves in Cartesian, parametric and polar forms. **Self-study: Partial Differentiation and Euler's theorem**	

Chapter 1.2	Vector differentiation, Gradient, Divergence and Curl with their properties and its application, irrotaional and Solenoidal vectors **Self-study: Composite Functions of Single and Two Variables**	
Unit-2	**Matrix and De Moivre's theorem**	**Contact Hours: 10**
Chapter 2.1	Hermitian and skew-Hermitian matrices, linear dependence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence. Theorems on consistency of a system of linear equations (both homogeneous and non-homogeneous). **Self-study: Eigen-values and Eigen-vectors**	
Chapter 2.2	De Moivre's theorem, application of De Moivre's theorem including primitive nth root of unity. Expansions of sin nθ, cos nθ , $\sin^n\theta$, $\cos^n\theta$. **Self-study: Summation of series including Gregory Series**	
Unit-3	**Solution of cubic and biquadratic equations**	**Contact Hours: 10**
Chapter 3.1	Relation between roots and coefficients of general polynomial equation in one variable. **Self-study: The concept of exponential and logarithmic**	
Chapter 3.2	Transformation of equations, Descarte's rule of signs.Solution of cubic equation (Cardon method). Biquadratic equations, Fararri Method. **Self-study: Hyperbolic functions of a complex variable**	

e. Textbooks / Reference Books

TEXTBOOKS

T1Thomas and Finney, Calculus and Analytical Geometry, 9th Edition,Addison Wesley. ISBN: 978-0201531749, 1995

T2 Narayan, Shanti and Mittal, P. K., Differential Calculus,S. Chand & Co., 13th Ed., New Delhi, ISBN: 9788121904711, 2006.

f. REFERENCE BOOKS

R1H. Anton H., Bivens I. and Davis S.,Calculus, John Willey and Sons,2nd Ed.,ISBN 9788126569519, 2002.

R2Spiegel, Murray R., Theory and Problems of Advanced Calculus, Edition 1st, Schaum's Outline Series, New York.ISBN: 9780070602298, 1963.

g. Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks

1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h. CO-PO-SO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1
CO4	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO5	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO6	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
10	Course Code- 21UCT101	Design Thinking and creativity for Innovation	0	0	0	1	UC
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION

Design Thinking and creativity for Innovationis a 15-hour course. The program as envisaged will be conducted on a virtual platform. There will be 10 modules, each of 1 hour 30 min making up the course. the entire program will be interactive with hands-on participation by the students. The course will cobble together powerpoint presentations, videos, role plays and games.

COURSE OBJECTIVES

The objective of the workshop is to introduce people to the criticality of design thinking in today's scenario. Innovate or perish.

COURSE OUTCOMES

On completion of this course, the students will able to get each participant to be competent enough to cobble together their own design thinking team.

COURSE CONTENTS — **Total Contact Hours: 15**

	Module	
Mod. 1	**Creativity, Lateral Thinking and the 6 Hats** Elements of creativity and Lateral Thinking, idea generation techniques, the Six Hats approach to lateral thinking, how it helps in human centred designing	**1 and 1/2 hours**
Mod. 2	**Design Thinking - An Overview** Introduction, how it helps, concept of exploring and solving problems, elements of product / service and business model generation, the 5 step process, combining with Lean and Agile processes	**1 and 1/2 hours**
Mod. 3	**Design Thinking - Case Studies** Case studies in creativity and design thinking from products, services and business model genre	**1 and 1/2 hours**
Mod. 4	**Empathise** Developing empathy, learning the Q/A patterns and role play	**1 and 1/2 hours**
Mod. 5	**Define** An extension of the previous format with extended role plays and true problem identification and defining of problem	**1 and 1/2 hours**
Mod. 6	**Ideate**	**1 and 1/2 hours**

	Based on multiple definitions from the previous sessions brainstorming and brainwriting exercises to generate numerous ideas	
Mod. 7	**Prototype** Building a virtual or real prototype (subject to budget constraints)	**1 and 1/2 hours**
Mod. 8	**Test** Testing and feedback and return to ideation or redefining	**1 and 1/2 hours**
Mod. 9	**Assignment** Compete - the entire process with at least 2 teams	**1 and 1/2 hours**
Mod. 10	**Test** Debrief the teams from the previous session and rate the participants; could include a written test if required.	**1 and 1/2 hours**

The Design Thinking Workshop will consist of 3 sections:

1. Lateral Thinking and Exercises

Creativity and its elements

6 hat approach

Lateral Thinking exercises

Brainstorming

2. Design Thinking & Disruptive Innovation

The process from empathise - define - ideate- prototype - test

Creating personas

Radical collaboration

Idea selection

Alpha model

Rejection and cycling back

3. Innovation exercises

Feel with 5 senses

Defining Customer journey and product life cycle

Brainwriting

Role storming

Reverse thinking

Each section will cover 1 and 1/2 hours and will include power point presentations, videos and interactive exercises. The workshop is for 6 hours. On a face2face programme the workshop can be conducted in one day. On the virtual platform it must be spread over 3 days at least (1 and 1/2 hours each day)

Mode of Evaluation: The performance of students is evaluated as follows:

	Design Thinking and creativity for Innovation	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Workshop (WS)	Ability Enhancement Category University Core (UC)	Graded	MCQ based

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
11	Course Code- 21UCT-103	Life Skills and Mentoring-1	0	1	0	1	UC-MNG
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION	
The course will help you increase your self-awareness, set and pursue meaningful goals, and develop positive personal qualities such as self-esteem, self- discipline, and self-motivation, awareness healthy life style	
COURSE OBJECTIVES	
1	**Self-Development Skills –** Students develop skills that help them to transact the skill of self-awareness, to enhance self-esteem and self-confidence.
2	**Healthy Lifestyle–** To increase one's knowledge and awareness about the healthy eating, exercise and active mind
3	**Value Inculcation –** To show sensitivity, and understand others' perspectives.
COURSE OUTCOMES	
On completion of this course, the students will able to	
21UCT103.1	Make use of self- awareness to regulate one's own thinking and learning
21UCT103.2	Demonstrate positive self- esteem and self -confidence when working with others
21UCT103.3	Analyze the benefits of a healthy lifestyles associated with healthy physical and mental health and develop the coping skills for adjustment
21UCT103.4	Develop empathy to change behaviour and build better relationships.
TEXT BOOKS	
REFERENCE BOOK	

R1	Emma M. Jones: Self Awareness: Being Honest With Yourself	**2020**
R2	Brian Tracy: The Power of Self-Confidence: Become Unstoppable, Irresistible, and Unafraid in Every Area of Your Life	**2012**
R3	Adolescence and Life Skills Commonwealth Youth Programme Asia Centre, Tata Mc Graw- Hill	**2003**

COURSE CONTENTS		**Total Contact Hours:12**
Unit I	**Know and Understand Yourself**	**6 Hour**
Chapter 1	**Self-Awareness:** Definition of self-awareness, Recognizing one's own attitude, feelings, motives, strengths, The areas of self-awareness, How to develop self-awareness	**2 Hour**
Chapter 2	**Self Confidence**: Understanding self-confidence, benefits self-confidence, characteristics of self-confidence, how to build self- confidence	**2 Hour**
Chapter 3	**Self Esteem**-Definition of self-esteem, assessing one's own worth, How to develop self esteem	**2 Hour**

Unit 2	**Self-Care**	**4 Hour**
Chapter 4	**Healthy eating, hygiene and Exercise**- Why are healthy eats habits are important, why to make healthy food choices, how to improve and change eating habits, importance of sleep and exercise	**2 Hour**
Chapter 5	**Healthy Mind with Yoga and Dealing with Homesickness**-Benefits of Yoga (Physical and Mental) techniques to Keep your mind active, , Managing stress during exams, meditation, tips to deal with homesickness	**2 Hour**
Unit 3	**Values**	**2 Hour**
Chapter 6	**Empathy:** Understanding empathy, how to develop empathy, assessing your empathy	**2 Hour**

Mode of Evaluation: The performance of students is evaluated as follows:

	Life Skills and Mentoring	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

CO-PO Mapping

	PO1Engineering Knowledge	**PO2 Problem analysis**	**PO3 Design/development of solutions**	**PO4Conduct investigations of complex problems**	**PO5 Modern tool usage**	**PO6 The engineer and society**	**PO7 Environment and sustainability**	**PO8 Ethics**	**PO9 Individual or team work**	**PO10 Communication**	**PO11 Project management and finance**	**PO12 Life-long Learning**
21UCT103.1	-	-	-	-	-	-	-	-	2	1	-	3
21UCT103.2	-	-	-	-	-	1	-	-	2	1	-	3
21UCT103.3	-	-	-	-	-	3	-	-	2	1	-	3
21UCT103.4	-	-	-	-	-	3	-	3	2	1	-	3

1=addressed to small extent | 2= addressed significantly | 3=major part of course

Syllabus Designed By	**Approved By**
Navneet Kaur (E7283)	**Director, Students Welfare**

SEMESTER II

Module-I (+2 Medical)

Semester-II														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-151	Criminalistics-I	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21FSH-152	Fingerprints Examination	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21SHT-122	Inorganic Chemistry- II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FST-154	Biodiversity-II (Arthropoda to Hemichordata)	2	0	0	2	2	Core	20	20	60				100
21FSH-155	Cryptogamic Botany-II	2	0	2	3	4	Core	20	20	60	40	20	40	200
21SHP124	Chemistry Lab –II	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCT-102	Academic Research Paper Writing and IPR	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-104	Life Skills and Mentoring-2*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-122	General Proficiency-II (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**25**								
Cumulative Credit					**40**									

Module-I (+2 Non-Medical)

Semester-II														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-151	Criminalistics-I	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21FSH-152	Fingerprints Examination	3	0	3	4.5	6	Core	20	20	60	40	20	40	200
21SHT-122	Inorganic Chemistry- II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21FSH-156	Waves & Optics	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-157	Ordinary Differential Equations	2	0	0	2	2	Core	20	20	60				100
21SHP124	Chemistry Lab –II	0	0	2	1	2	PC	-	-	-	40	20	40	100
21UCT-102	Academic Research Paper Writing and IPR	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-104	Life Skills and Mentoring-2*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-122	General Proficiency-II (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
Total Credit					**20**	**25**								
Cumulative Credit					**40**									

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSH-151	Criminalistics-I	3	0	3	6	PC
PRE-REQUISITE		10+2 Sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a. Course Description

This course begins with the basics of Forensic Science that involves crime, crime scene investigation and collection and analysis of Physical evidences. The students are then introduced about the different types of forensic evidences such as paint, glass, building materials and other miscellaneous evidences recovered from crime scene.

b. Course Objectives

1. To give an exposure to the students about the basics of Forensic Science investigations.
2. To familiarize the students about the different types of evidences involved in forensic investigations.
3. To give knowledge to the students about the collection, preservation and examination of evidences like paint, glass, building material etc.

c. Course Outcomes

After Studying the course, student will get to know

CO1	The crime scene and its importance in forensic investigation.
CO2	The type of different evidences present at crime scene.
CO3	The examination of paint, glass and other materials.

d. Syllabus

Unit-1	Crime Scene Investigation	Contact Hours: 22
Chapter 1.1	Types of crime scene, Understanding and purposes of crime scene examination, First responding officers.	
Experiment 1.1	To study the given crime scene with respect to Forensic Investigation	
Chapter 1.2	Protection of the crime Scene, documentation of Crime scene, methods of search for physical clue materials, Reconstruction of Crime scene	
Experiment 1.2	To perform sketching or drawing of crime scene for recording of crime scene.	
Chapter 1.3	Physical Evidences; Definition, their classification, collection, packing and transportation, chain of custody.	
UNIT 2	**Examination of Glass and Paint**	**Contact Hours: 22**
Chapter 2.1	Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.	

Experiment 2.1	To study the different type of glass samples.	
Experiment 2.2	To analyze and compare the given samples of glass, to form an opinion.	
Chapter 2.2	Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.	
Experiment 2.3	To study and compare the given paint samples.	
Experiment 2.4	To study the layers of paint flakes/chips.	
UNIT 3	**Building Materials and Miscellaneous Clue Materials**	**Contact Hours: 22**
Chapter 3.1	Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material	
Experiment 3.1	To study the given sample of cement for determination of adulterants.	
Chapter 3.2	Analysis of cement mortar and cement concrete and stones. Forensic examination of electrical appliances/installations.	
Experiment 3.2	To study the given mortar, concrete and stone samples.	
Chapter 3.3	Examination of strings/ropes, Fibers, Threads and fabrics, Wires/cables, Seals, Counterfeit coins.	
Experiment 3.3	To study the given thread, rope and fiber samples.	

e. Textbooks Books

Barak G. (1998), Integrative Criminology, Ashgate Pub Ltd.
Adler F. (5th Edition) (2004), Criminology, McGraw-Hill.
Reid S.T. (12th Edition) (2008), Crime and Criminology, Oxford University Press, USA.
Johnson E.H. (4th Edition) (1978), Crime, Correction and Society, Dorsey Press.
Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
Bodziak W.M (1989), Footwear Impression Evidence, Elsevier Science Publishing Co. New York.
Sharma B.R. (1974), Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
Lundquest and Curry (1963), Forensic Science, Thomas, Illinosis, USA.

f. Reference Books

Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.
Kirk (1953), Criminal Investigation, Interscience Publisher Inc. New York.
Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.
Warlow T. and Warlow T.A (1996) Forensic Examination of Glass and Paint CRC Press.
Lewis Peter Rhys Forensic Materials Engineering CRC press
Franck D and Franck H. (2013) Forensic Engineering Fundamentals. CRC press

g. Assessment Pattern - internal and external

The performance of students is evaluated as follows:

	Theory	**Practical**

Components	Internal Assessment	Mid Term Assessment	End Term Assessment	Continuous Assessment (CAE)	Mid Term Assessment	End Term Assessment
Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
9.	Assignment*	10 marks	1 per Unit	10 marks	
10.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
11.	Quiz	4 marks for each quiz	20per Unit	4 marks	
12.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
13.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
14.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
15.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
16.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h. CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	3	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	2	3	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FSH-152	Fingerprints Examination	3	0	3	6	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

d) Course Description

The Course aims to provide students with brief overview of the various sections of importance of fingerprint as the most infallible means of identification, its classification system and other impressions importance in linking criminal to crime scene.

e) Course Objectives

1. The Course attempts to address the specific topics relevant to Fingerprints.
2. The focus is on the developing, examining and handling of fingerprint evidences.

f) Course Outcomes

CO1	Fingerprint division of and Forensic Science Lab.
CO2	Student will able to produce the basic concepts of Forensic Fingerprint Examination.
CO3	Student will able to identify correct fingerprint, its handling and preservation for further representation.

g) Syllabus

Unit-1	History and Classification of finger Prints	Contact Hours: 22
Chapter 1.1	History and development of finger prints as a science for personal, identification, Finger Prints Bureau. **Self-study: Base study in which fingerprint led to punishment**	
Experiment 1.1	How to procure fingerprints & method of taking fingerprints manually (rolled & plain).	
Experiment 1.2	To identify different fingerprint patterns.	
Chapter 1.2	Pattern types, pattern area, Henry system of classification (Primary to tertiary and key classification) extension of Henry system searching of finger prints, classification system, single digit classification system. **Self-study: Why fingerprints are Unique?**	
Experiment 1.3	To carry out ten digit classification of fingerprints.	
Chapter 1.3	Palm prints, Sole prints; Importance, classification and examination. **Self-study: Lip prints and Ear prints**	

Experiment 1.3	To identify core and delta.	
Unit-2	**Chance Finger Prints**	**Contact Hours: 22**
Chapter 2.1	Latent prints, plastic prints, causes, composition of sweat. Development of latent finger prints: Conventional methods as fluorescent powder, magnetic powder. **Self-study: Latest methods used for fingerprint development**	
Experiment 2.1	To carry out ridge tracing and ridge counting.	
Chapter 2.2	Fuming —methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, enhancement of latent prints. **Self-study: Contribution of Prof. (Dr.) Henry Lee**	
Experiment 2.2	To investigate physical methods of fingerprint detection.	
Chapter 2.3	Application of laser technologies, metal deposition method. Biological methods of development of latent prints on skin. **Self-study: Touch DNA**	
Experiment 2.3	To investigate chemical methods of fingerprint detection.	
Unit-3	**Systematic approach to latent print processing**	**Contact Hours: 22**
Chapter 3.1	Latent print processing, preserving and lifting of finger prints. **Self-study: Formation of fingerprints**	
Experiment 3.1	Sole prints comparison and their lifting from the scene of crime.	
Chapter 3.2	Photography of Finger Prints, comparison of finger prints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics. **Self-study: Genetics and fingerprints**	
Experiment 3.2	Palm prints comparison and their lifting from the scene of crime.	
Chapter 3.3	Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement. **Self-study: Importance of Fingerprint**	
Experiment 3.3	To investigate chemical methods of fingerprint detection on paper.	

h) Text Books:

1) David R. Ashbaugh (1999), Quantitative and Qualitative Friction Ridge Analysis, CRC Press.
2) E. Roland Menzel (Second Edition) (1999), Fingerprint Detection with Loseres, Marcel Dekker, Inc.
3) Cowger and James F. (1993), Friction Ridge skin: Comparison and Identification of Fingerprints, Elsevier New York, CRC Press London.
4) Cummins and Midlo (1943), Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics, The Blakiston office London.
5) Cherril, F.R. (1954), TheFinger Prints. System at Scotland Yard, Her Majestuy's office, London.
6) Wentworth and Wilder (1957), Personal Identification, Richard. G. Badger. Boston.
7) Mehta, M. K. (1980), Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd. Bombay.
8) Moenssens (1975), Finger Prints Techniques, Chitton Book Co., Philadelphia, New York.
9) Allison H.C.(1st Edition) (1973) Personal Identification, Holbrook Press.

10) Chatterjee S.K. and Hague R.V. (1988), Fingerprints or Dactyloscopy and Ridgeoscopy.
11) E. Ronald Menzel (1997), A manual of Fingerprint Identification: Finger Print Detection with Lasers.

i) Reference Books:

1) H.C. Lee, R.E. Gaensslen and S.R. Ramotowski (3rd Edition) (2013), Advances in Fingerprint Technology, CRC Press, Boca Raton.
2) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), Fingerprints and Other Ridge Skin Impression (International Forensic Science and Investigation Series), CRC Press, Boca Raton.
3) B.C. Bridges, Vollmer A. and M. Monir (2002), Criminal Investigation Practical Finger Printing, Thumb Impressions, Hand Writing, Expert Testimony, Opinion Evidence, Allahabad University Book Agency.
4) Daluz H.M (2015), Fingerprint Analysis Laboratory Workbook, CRC Press..

j) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
17.	Assignment*	10 marks	1 per Unit	10 marks	
18.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
19.	Quiz	4 marks for each quiz	20per Unit	4 marks	
20.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
21.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
22.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
23.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
24.	Attendance and Engagement Score on BB	NA	NA	2 marks	

k) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	2	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	2	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21SHT-122	Inorganic Chemistry-II	3	0	0	3	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the theoretical study of d- block elements, f- block elements, composite materials and coordination chemistry. The students are then introduced to the nomenclature and stereochemistry of coordination compounds, valence bond theory, its applications and limitations.

b) Course Objectives

1. To give an exposure to the students the basic concepts and specific concepts relevant to chemistry.
2. To serve as a foundation to analyze problems in on the basic concepts with introduction of some advanced top-ics and applications in the area of chemistry.

c) Course Outcomes

CO1	Understand about the d-block elements and their general trends in Periodic Table.
CO2	Compare the characteristics of d-block and f-block series.
CO3	Determine the magnetic moment and magnetic susceptibilities of metal complexes.
CO4	Illustrate the concept of Composite Materials and their applications in daily life.
CO5	Translate the concept of Coordination Compounds, their stereochemistry and applications.
CO6	Apply the theories to calculate the stabilisation energy, to know the geometry and hybridisation of metal complexes.

d) Syllabus

Unit-1	d-Block Elements	Contact Hours: 15
Introduction of Transition Elements	General group trends with special reference to variable valency, ability to form complexes and stability of various oxidation states (Latimer diagram) for Mn, Fe and Cu. Characteristic properties of d-block elements. Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for characterization of 3d-metal complexes. **Self study topic: Types of Magnetic Behaviour.**	
Unit-2	**Chemistry of f-Block elements and Composites Materials**	**Contact Hours: 15**

Lanthanides and Actinides	Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation techniques. Electronic configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U. **Self study topic: Complex formation property of f-block elements.**	
Composite Materials	Definition, constitution, reinforcement, functions of reinforcement, types of reinforcements, matrix, functions of matrix, types of matrices, interface, and classification based upon types of reinforcements, based upon types of matrices, applications of composite materials. Advantages and disadvantages of composite materials.	
Unit-3	**Coordination Chemistry**	**Contact Hours: 15**
Introduction Transition Metal Complexes	Nomenclature of coordination compounds, stereochemistry of compounds with coordination no. 4 and 6, valence bond theory, Applications and limitations of transition. Chelate effect, polynuclear complexes, labile and inert complexes. Magnetic moment, application of magnetic moment data for 3d-metal complexes. **Self study topic: Some examples of VBT.**	
Valence Bond Theory and Crystal Field Theory	Valence bond theory and its limitations. A brief outline of stability of metal complexes, stability constant and factors affecting the stability, Substitution reactions of square planar complexes (trans effect), Crystal field theory: Octahedral symmetry. Crystal field stabilization energy (CFSE); Crystal field effect for weak and strong fields. **Self study topic: Calculation of CESE of different systems.**	

e) Text Books:

T1: Svehla, G and Sivasankar B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Ed., Pearson.

T2: Bassett, J; Denney, RC; Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative Inorganic Analysis (revised), 4th Ed., Orient Longman.

T3: Puri, Sharma and Kalia. 2009. Principles of Inorganic Chemistry, Reprint 2014, Milestone Publisher and Distributers

T4: Khopkar, S M. 2009. Basic Concepts of Inorganic Chemistry, Reprint 2014, New Age International Publishers

f) Reference Books:

R1: Khosla BD; Garg VC and Gulati A. 2002. Senior Practical Physical chemistry, 4th Ed., R Chand and company

R2: Sambrook, J and Russell, D. 2001. Molecular Cloning: A laboratory manual by, 3rd Ed., CSHL press.

R3: Cotton, FA; Wilkinson, G and Gaus, P.L. 2014.Advanced Inorganic Chemistry, 6th Ed. Wiley Publishers.

R4: Miessler, G. andTarr, A. Reprint 2015, Inorganic Chemistry, 3rd ed., Mc Graw Hill Publishers

R5: Doaglas, B; McDaniel, D and Alexander, I. 1994.Concepts of Models of Inorganic Chemistry. 3rd Ed., John Wiley& Sons.

R6: Shriver, DE; Atkins, PW and Langford, CH. 2010. Inorganic Chemistry, 5th edition, Oxford University Press

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
25.	Assignment*	10 marks	1 per Unit	10 marks	
26.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
27.	Quiz	4 marks for each quiz	20per Unit	4 marks	
28.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
29.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
30.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
31.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
32.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	3	-	-	-	-	-	-	-	3	-	3	-
CO2	-	3	-	3	-	-	-	-	3	-	-	3	-	3	-
CO3	3	3	2	3	2	-	-	-	3	-	-	3	-	3	-
CO4	3	3	2	3	--	1	1	-	-	1	1	3	-	3	-
CO5	-	3	-	3	-	-	-	-	-	-	-	3	-	3	-
CO6	-	3	-	3	2	-	-	-	3	-	-	3	-	3	-
Average	3	3	2	3	2	1	1	-	3	1	1	3	-	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	**Course Code- 21FST-154**	Biodiversity-II (Arthropoda to Hemichordata)	2	0	0	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

i) Course Description

The course begins with the largest phylum that is arthropods and proceeds to the higher phylum till hemichordate including Mollusca, Echinodermata. Course also includes study of at least one specimen in detail from each phylum.

j) Course Objectives

To acquaint students with the general characters and classification of Arthropoda to Hemichordates and the affinities between different groups.

k) Course Outcomes

On completion of this course, the students are expected to learn;

CO1	Evaluate appropriate information about arthropods from various sources to analyze and create cohesive and persuasive concepts.
CO2	Assess information related to molluscs in order to formulate strategies for mitigation in future scenarios.
CO3	Summarize knowledge about echinoderms and hemichordates and apply that knowledge to create new ideas at a local and global levels
CO4	Described the social life and economic importance of insects.
CO5	Learn the evolution, hierarchy and classification of different classes of non-chordates
CO6	Getting an overview of typical examples in each phyla

l) Syllabus

Unit-1	**Arthropoda**	**Contact Hours: 10**
Chapter 1.1	General characteristics and classification up to orders of arthropoda. **Self-study: Importance of Arthropoda**	
Chapter 1.2	Detailed study of the following animal types: *Periplaneta* (cockroach), Prawn and Social organizations in insects (honey bee and termite). **Self-study: Social organization in Flies**	
Unit-2	**Mollusca**	**Contact Hours: 10**
Chapter 2.1	General characteristics and classification up to orders of Mollusca. Detailed study of the *Pila*. **Self-study: Common features among Mollusks**	
Unit-3	**Echinodermata and Hemichordata**	**Contact Hours: 10**

Chapter 3.1	General characteristics and classification up to orders of Echinodermata, Detailed study of the following animal types: *Asterias (*Starfish) and Echinoderm larvae. **Self-study: Affinities of Hemichordates with Non-Chordates**
Chapter 3.2	General characteristics and classification upto orders of Hemichordata, Detailed study of the following animal types *Balanoglossus: External* characters and affinities**.** **Self-study: Affinities of Hemichordates with Chordates**

m) Text Books:

T1 Jorden, EL.2001. Invertebrate Zoology, 4th Ed., S. Chand Publishers.

T2 KotpalRL. 2009. Modern Text Book of Zoology: Invertebrate, 10th Ed., Rastogi Publications.

n) Reference Books:

R1 Hyman, LH .1955. Invertebrates,5th Ed, Mcgraw Hill.

R2 Verma, PS. 2005. A Manual of Practical Zoology: Invertebrate,3rd Ed., S. Chand Publishers.

R3 LalSS.2009. Practical Zoology Invertebrate ,2ndEd., Rastogi Publications.

R4 Dhami&Dhami.1983. Text Book of Zoology ,4thEd., Pardeep Publications.

R5 Aggarwal, VK .2011. Zoology for Degree Students ,5th Ed., S. Chand Publications.

o) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
33.	Assignment*	10 marks	1 per Unit	10 marks	
34.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
35.	Quiz	4 marks for each quiz	20per Unit	4 marks	
36.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
37.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
38.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
39.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
40.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
CO5	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
CO6	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
5	Course Code- 21FSH-155	Cryptogamic Botany-II	2	0	2	4	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with introduction about morphology, anatomy and lifecycle of bryophytes. The students are then introduced to various pteridophytes along with their morphology, anatomy and reproductive cycles.

b) Course Objectives

To acquaint the students about the morphology, biology and importance of bryophytes, and pteridophytes.

c) Course Outcomes

On completion of this course, the students are expected to;

CO1	summarize about the bryophytes on the basis of morphological characters, economic importance and evolution of the simplest group of plant kingdom that is bryophytes
CO2	evaluate about general characters of Pteridophytes and their affinities with other groups. On the basis of morphological and anatomical characters.
CO3	conclude about evolution of stellar system in Fern-allies and Ferns and about their life cycle patterns found in Pteridophytes.
CO4	To train students in basis of bryophytes, pteridophytes and genetics and their basic and advance techniques.
CO5	To give practical training on basic biology and genetics experiments.
CO6	To equip the students with practical knowledge in microscope, staining techniques, section cutting and identification of specimens.

d) Syllabus

Unit-1	**Bryophyta**	Contact Hours: 15
Chapter 1.1	Bryophyta: General characters, Amphibians of Plant Kingdom, alternation of generations; External morphology, internal structures, reproduction and life cycles of *Marchantia* (Hepaticopsida);	
Experiment 1.1	Morphological study of *Marchantia* i) Thallus ii) Antheridiophore iii) Archegoniophore iv) Gemma cups	
Chapter 1.2	*Anthoceros* (Anthocerotopsida); *Funaria* (Bryopsida).	
Experiment 1.2	Morphological study of *Anthoceros*: i) Thallus with sporophyte	

Chapter 1.3	Evolution of sporophytes in Bryophytes. Economic importance of bryophyte	
Experiment 1.3	Morphological study of *Funaria*: i) Thallus structure	
Experiment 1.4	Study through temporary slides: *(i)* Rhizoids and scales of *Marchantia* (ii) Rhizoids of *Anthoceros*	
Unit-2	**Pteridophyta-I**	**Contact Hours: 15**
Chapter 2.1	Pteridophyta:general characters, alternation of gereration, Affinities of Pteridophytes with other group of plants;	
Experiment 2.1	Study through permanent slides: *i)* L.S. Sporogonium of *Marchantia* *ii)* L.S. Anthrediophore of *Marchantia* *iii)* L.S. Archegoniophore of *Marchantia* *iv)* L.S. Mature sporogonium of *Anthoceros* *v)* L.S. Male receptacle of *Funaria* *vi)* L.S. Female receptacle of *Funaria* vii) L.S. Capsule of *Funaria*	
Chapter 2.2	External morphology, internal structures, reproduction and life cycles of Psilopsida (*Rhynia*);	
Experiment 2.2	Morphological study of *Selaginella:* i) Thallus ii) Sporangiferous spike	
Chapter 2.3	External morphology, internal structures, reproduction and life cycles of Lycopsida (*Lycopodium, Selaginella*).	
Experiment 2.3	Morphological study of *Lycopodium*: i) Plant body ii) *Strobilii*	
Unit-3	**Pteridophyta-II**	**Contact Hours: 15**
Chapter 3.1	External morphology, internal structures, reproduction and life cycles in Sphenopsida (*Equisetum*) and Pteropsida (*Pteris* and*Marsilea*) – developmental stages are excluded.	
Experiment 3.1	Study through permanent slides: i) L.S. Strobilus of *Selaginella* *i)* T.S. Strobilus of *Selaginella* *ii)* L.S. Strobilus of *Lycopodium* *iii)* L.S. Strobilus of *Equisetum* *iv)* T.S. Strobilus of *Equisetum* *v)* T.S. Stem of *Equisetum*	
Chapter 3.2	External morphology, internal structures, reproduction and life cycles in Pteropsida (*Pteris* and*Marsilea*) – developmental stages are excluded.	
Experiment 3.2	Study of karyotypes from dividing root tip cells and pollen grains.	
Chapter 3.3	Evolution of stellar system in Fern-allies and Ferns.	
Experiment 3.3	1. Cytological examination of special types of chromosomes from slides/photographs: a) bar body b) lampbrush c) polytene chromosomes	

e) Text Books:

T1 Vasishta, PC. 1996.Bryophyta, 3rd Ed., S. Chand & Co. Ltd., New Delhi.
T2 Vasishta, PC. 2000. Pteridophyta.2nd Ed., S. Chand & Co. Ltd., New Delhi.
T3 Sharma, OP. 2011. Diversity of Microbes and Cryptogams-Algae. 2nd Ed., Tata McGraw Hill, New Delhi.
T4 Vashishta, BR; Sinha, AK and Singh, VP. 2011. Botany for Degree Students-Algae. 2nd Ed., S. Chand Publisher, New Delhi.
T5Kashyap, SR. 1972. Liverworts of the Western Himalayas, 1st Ed., Panjab University,Chandigarh,India.

f) Reference Books:

R1 Kumar, HD. 1999. Introductory Phycology,2nd Ed., Affiliated East West Press Ltd., New Delhi.
R2 Parihar, NS. 1996. Biology and Morphology of Pteridophytes, 1st Ed., Central Book Depot., Allahabad.
R3 Rashid, A. 1998. An Introduction to Bryophyta,2nd Ed., Vikas Pub. House Pvt. Ltd., New Delhi.
R4 Rashid, A. 1999. An Introduction to Pteridophyta,3rd Ed., Vikas Publ. House, Pvt.Ltd., New Delhi.
R5 Sharma, OP. 2001. Text Book of Pteridophytes, 2nd Ed., MacMillan India Ltd.
R6 Sporne, KR.1991. The Morphology of Pteridophytes, 2nd Ed., B. I. Publishing Pvt. Ltd., Bombay.
R7 Singh, RS. 1998. Plant Diseases.1st Ed., Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

h) Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
41.	Assignment*	10 marks	1 per Unit	10 marks	
42.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
43.	Quiz	4 marks for each quiz	20per Unit	4 marks	
44.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
45.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
46.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
47.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
48.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0

CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
CO5	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
CO6	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
6	Course Code- 21SHP124	Chemistry Lab –II	0	0	2	2	PC
PRE-REQUISITE							
CO-REQUISITE		21SHT122					
ANTI-REQUISITE							

a. Course Description

The course begins with the study of various methods to prepare various complexes. It also includes study of titration methods. This course also provides knowledge about the colloids and viscosity.

b. Course Objectives

To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory. The practical work has been designed to give hands on experience of various analytical techniques used in chemistry

c. Course Outcomes

Students will be able to:

CO1	Understand the concept of titrations and apply that knowledge to find out the strengths of various solutions with different titrimetric analysis.
CO2	Understand the metal complexes and apply appropriate knowledge to synthesize various metal complexes in lab.
CO3	Calculate the surface tension, viscosity and refractive index of liquid of various solvents.

d. Syllabus

Unit-1	Titrimetric analysis	Contact Hours: 10
Experiment 1.1	Preparation of N/20 Oxalic acid, M/20 $KMnO_4$, N/20 HCl, N/20 NaOH and M/20 Sulphuric acid solutions.	
Experiment 1.2	Estimation of Fe (II) ions by titrating with $K_2Cr_2O_7$.	
Experiment 1.3	Estimation of Cu (II) ions iodometrically by titrating with $K_2Cr_2O_7$.	
	Determination of the strength of given $K_2Cr_2O_7$ solution with N/20 sodium thiosulphate solution. **Self-Study: mole concept**	
Unit-2	**Synthesis of Complexes**	**Contact Hours: 10**
Experiment 2.1	Preparation of Ni-DMG complex, $[Ni(DMG)_2]^{2+}$.	

Experiment 2.2	Preparation of copper tetra-ammine complex. $[Cu(NH_3)_4]SO_4$.	
Experiment 2.3	Estimation of the Mg in the given Mg-EDTA complex using Eriochrome Black-T indicator **Self-Study: coordination complex**	
Unit-3	**Surface tension and viscosity**	**Contact Hours: 10**
Experiment 3.1	1. Determination of the surface tension of a liquid or a dilute solution using a stalagmometer and study of effect of surfactant on the surface tension of a liquid.	
Experiment 3.2	2. Determination of coefficient of viscosity of a liquid or dilute solution using an Ostwald's viscometer.	
Experiment 3.3	Determination of the refractive indices of given liquids (water, acetone, methanol, ethyl acetate, cyclohexane) by Abbe's refractometer and calculate their specific refractions **Self-Study: Surface tension,viscosity,refrective index**	

e. Textbooks / Reference Books

T1. : Svehla, G and Sivasankar B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Ed., Pearson.

T2: Bassett, J; Denney, RC; Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative Inorganic Analysis (revised), 4th Ed., Orient Longman.

Reference Books

R1 : Khosla BD; Garg VC and Gulati A. 2002. Senior Practical Physical chemistry, 4th Ed., R Chand and company
R2: Sambrook, J and Russell, D. 2001. Molecular Cloning: A laboratory manual by, 3rd Ed., CSHL press

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

g. Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Practical worksheet (in journal category) and class room learning	20 marks for each experiment	8-10 Experiments	40 marks	Depending upon the no. of experiments

2	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments
3	Discussion Forum/ Short digital assignment/ Journal to submit design	4 marks for each task	1 per semester	4 marks	
4	Presentation	-------		Non graded Engagement Task	
5	Attendance and BB Engagement score	-------		4 marks	End semester

h. CO-PO-PSO Mapping

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	3	-	-	-	-	2	-	-	-		3	
CO2	3	3	-	3	2	3	-	-	-	-	-	2		3	
CO3	3	3	1	3	2	3	-	-	1	1	3	-		3	
Average	3	3	1	3	2	3	-	-	1	1	3	1		3	

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
7	Course Code- 21FSH-156	Waves & Optics	2	0	2	4	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the basic of Simple harmonic wave , wave equation and energy transport and superposition of wave and formation of beat and Lissajous figure and nature of light and basic of young double slit experiment ,type of interference and diffraction .

Course Objectives

The course focus is on the basic concepts with introduction of some advanced topics and applications in the area of Physics.

Course Outcomes

On completion of this course, the students are expected to;

CO1	Understanding of Plane and Spherical Waves and analyze the formation of Longitudinal and Transverse wave
CO2	Evaluate the velocity of wave in various mode and concept of superposition of two harmonic waves to derive standing wave equation and formation of Lissajous figure and Melde's Experiment
CO3	Understand and apply knowledge of transverse magnification of a spherically refracting surface to evaluate Lagrange and Helmholtz laws of magnification reflection and refraction phenomena
CO4	Analyze Huygens Principle of secondary wavelets, coherent light and Division of Amplitude and Division of Wavefront and derive its applications
CO5	Apply the concept of Fresnel's diffraction to analyze half-period Zones for Plane Wave, Rectilinear Propagation of Light and draw diffraction pattern due to Straight Edge, Rectangular Aperture (Slit), Small Circular Aperture and an Opaque Circular Dis
CO6	Derive intensity relation of Fraunhofer diffraction by diffraction due to a Single Slit, a double Slit and evaluate resolving power for plane transmission grating

Syllabus

Unit-1	Waves	Contact Hours: 15
Chapter 1.1	Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation, Pressure of a Longitudinal Wave, Energy Transport, Intensity of Wave	

Experiment 1.1	To study the error analysis by the measurements of length (or diameter) using verniercaliper, screw gauge and travelling microscope. To determine the value of g by Bar Pendulum.	
Chapter 1.2	Velocity of Transverse Vibrations of Stretched Strings, Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound. Laplace's Correction.	
Experiment 1.2	To determine g by Kater'sPendulam.	
Chapter 1.3	Standing (Stationary) Waves in a String : Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes wrt Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment.	
Experiment 1.3	To determine the height of a building using a Sextant.	
Experiment 1.4	To determine the Moment of Inertia of a Flywheel.	
Unit-2	**Wave Optics and Interference**	**Contact Hours: 15**
Chapter 2.1	Nature of Light :- Theories of Light, Electromagnetic Nature of Light, Definition of a Wave Front, Propagation of a Wave Front, Huygens Principle of Secondary Wavelets, Coherent light	
Experiment 2.1	To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses	
Chapter 2.2	Division of Amplitude and Division of Wavefront, Young's Double Slit Experiment, Lloyd's Mirror and Fresnel's Biprism. Phase Change on Reflection :Stoke's treatment, Interference in Thin Films	
Experiment 2.2	To study the series and parallel LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor.	
Chapter 2.3	Newton's Rings : Measurement of Wavelength and Refractive Index ,Michelson's Interferometer	
Experiment 2.3	To determine the capacitance of a capacitor using flashing and quenching of neon flash lamp.	
Unit-3	**Fresnel diffraction andFraunhofer diffraction**	**Contact Hours: 15**
Chapter 3.1	Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate, Comparison of a Zone plate with a Convex lens, Diffraction due to Straight Edge, Rectangular Aperture (Slit), Small Circular Aperture and an Opaque Circular Disc.	
Experiment 3.1	To study the motion of a spring and calculate (a) Spring Constant (b) Value of g.	
Chapter 3.2	Diffraction due to (1) a Single Slit, (2) a Double Slit and (3) a Plane Transmission Grating,	
Experiment 3.2	To determine the (a) Charge Sensitivity (b) Current Sensitivity of a Ballistic Galvanometer	
Chapter 3.3	Rayleigh's criterion of resolution, Resolving Power and Dispersive Power of a Plane Diffraction Grating	
Experiment 3.3	Measurement of dielectric constant of a given sample.	

Text Books:

T1 D. Kleppner, J. Robert Kolenkow, An Introduction to Mechanics, McGraw-Hill, 1973.
T2 F. Crawford, Waves: Berkeley Physics Course (Sie), Tata McGrawHill, 2007
T3 F. A. Jenkins and H. E. White, Fundamentals of Optics, McGraw- Hill, 1976
T4A. Ghatak, Optics, Tata McGraw Hill, 2008
T5 Lab Manuals of Physics, Department of Applied Physics, Physics Group.

Reference Books:

R1 E. Hecht and A R Ganesan, Optics, Pearson Education, 2002.

R2 A. Al-Azzawi, Light and Optics: Principles and Practices, CRC Press, 2007.

R3 A. K. Ghatak& K. Thyagarajan. Contemporary Optics, Plenum Press, 1978

R4 Rashid, A. 1999. An Introductio to Pteridophyta,3rd Ed., Vikas Publ. House, Pvt.Ltd., New Delhi.

R5Arora, CL. 1995. B.Sc Practical Physics, 19th Ed., S. Chand Publications.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
49.	Assignment*	10 marks	1 per Unit	10 marks	
50.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
51.	Quiz	4 marks for each quiz	20per Unit	4 marks	
52.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
53.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
54.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
55.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
56.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CO3	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
CO4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

CO6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
8	Course Code- 21FST-157	Ordinary Differential Equations	2	0	0	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the study of the concept of formation of Differential Equations. Get knowledge about different types of differential equation and its applications. The course further emphasizes on the series solutions of Differential Equations.

Course Objectives

This course presents a rigorous treatment of fundamental concepts in Ordinary Differential Equations. To introduce students to the fundamentals of mathematical theory and writing mathematical formulation, the course objective is to understand the axiomatic foundation of the Differential Equations.

Course Outcomes

On completion of this course, the students are expected to;

CO1	Remember the concept of different types of derivative.
CO2	Explain and illustratevarious types of differential equations.
CO3	Derive various type of differential equations and solving related problems.
CO4	Analyses the solutions of differential equations.
CO5	Analysis the fundamentals of series solutions of ODE and solve related problems.
CO6	Examine the problem of ODE to apply in industry problem.

Syllabus

Unit-1	**First order differential equations**	**Contact Hours: 10**
Chapter 1.1	Differential equation, separable differential equations, Homogeneous differential equations, equations reducible to Homogenous differential equations.	
Chapter 1.2	Solution of Exact differential equations and its various types Linear differential equations and equations reducible to linear differential equations.	
Unit-2	**Series solution of Differential equation**	**Contact Hours: 10**
Chapter 2.1	Solution of Linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients and with variable coefficients.	
	Method of Variation of Parameters. Linear non-homogeneous differential equations with variable coefficient.	

Unit-3	Solution of cubic and biquadratic equations	Contact Hours: 10
Chapter 3.1	Regular point, Ordinary point, Singular point, Power Series method, Frobeniusmethod, Generating function	
Chapter 3.2	Bessel, Legendre and Bessel Equations, Legendre and Bessel functions and their properties , recurrence relations, orthogonality, Rodrigue's formula.	

Text Books:

T1Piaggio H.T.H., An ElementryTreatise on Differential equations, Barman Press.
T2 Jain R.K. and Iyengar S.R.K., Advanced Engineering Mathematics,Narosa Publishing House.
T3Ross S.L, Differential Equation, Edition 3rd, Willey Publication.

Reference Books:
R1Zafar Ahsan, Differential Equations and Their Applications, Edition 2nd, Prentice-Hall of India Pvt. Ltd. New Delhi, 2001.
R2Verma, R.S. and Shukla, K. S. 2000, Text Book on Trigonometry, 3rd Edition, Pothishala Pvt. Ltd., Allahabad, 2000.
R3 Bronson Robert, Theory of differential Equation, Edition 4th, Schaum's Series, 2001.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
57.	Assignment*	10 marks	1 per Unit	10 marks	
58.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
59.	Quiz	4 marks for each quiz	20per Unit	4 marks	
60.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
61.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
62.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
63.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
64.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CO3	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
CO4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO5	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
CO6	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
9	Course Code- 21UCT-104	Life Skills and Mentoring-2	0	1	0	1	UC-MNG
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION	
This course will provide students with effective self-management skills that will enable students to develop the needed disciplines that help bridge the gaps between goals and accomplishment and learning effective ways to resist peer pressure and drug abuse	
COURSE OBJECTIVES	
1	**Personal Self-Management Skills**–Enabling Student to Learn and demonstrate a set of practical skills such as time management, Decision making, problem solving and handling conflicts
2	**Resistance Skills –** To help students in identifying the right decisions and make them believe in themselves to value your opinion over and above and increase the awareness of the dangers of misuse and abuse of drugs and negative Peer Pressure
3	**Value Inculcation –** Understanding the importance of human dignity and Treating other people with dignity
COURSE OUTCOMES	
On completion of this course, the students will able to	
21UCT104.1	Demonstrate self-management skills by identify the importance of time management Decision Making and Problem Solving Skills
21UCT104.2	Build resistance skills to handle negative peer pressure
21UCT104.3	Analyzing the decision making process and reinforcing resistance to drug abuse
21UCT104.4	Appraise human dignity serves as a basis for promoting human rights, peaceful coexistence and a democratic society.
TEXT BOOKS	
REFERENCE BOOK	
R1	Getting Things Done: The Art of Stress-Free Productivity- by David Allen **2002**
R2	Thinking, Fast and Slow By Daniel Kahneman **2013**

COURSE CONTENTS		Total Contact Hours: 12
Unit I	**Managing Yourself**	**6 Hour**
Chapter 1	**Time Management:** Understanding Time Management, Awareness of time wasters, Tips for Time Management, Benefits of Time Management	**2 Hour**

Chapter 2	**Decision making:**Understanding of decision making, Effective decision making, Process of decision making	**2 Hour**
Chapter 3	**Problem solving:** Problem solving: nature and scope, process of developing problem solving skill, development of interventions	**2 Hour**
Unit 2	**Resistance Skills**	**4 Hour**
Chapter 4	**Peer Pressure:** Understanding peer pressure; Peer pressure and our brain; Influence of peer pressure and Decision Making; Managing peer pressure	**2 Hour**
Chapter 5	**Say no to Drugs:**Types of drugs, causes of addiction, sign of troubles, behavioral signs of drug abuse, Prevention	**2 Hour**
Unit 3	**Values**	**2 Hour**
Chapter 6	**Human Dignity:** Understanding Human Dignity; Fundamental rights of a person	**2 Hour**

CO-PO Mapping

	PO1Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning
21UCT104.1	-	-	-	-	-	-	-	-	1	1	-	3
21UCT104.2	-	-	-	-	-	-	-	-	1	1	-	3
21UCT104.3	-	-	-	-	-	2	-	-	1	1	-	3
21UCT104.4	-	-	-	-	-	3	-	3	1	1	-	3

1=addressed to small extent | 2= addressed significantly | 3=major part of course

Syllabus Designed By	**Approved By**
Chief counsellor	**Director, Students Welfare**
Ms. Navneet Kaur (E7283)	**Prof. (Dr.) Arvinder Singh Kang**

Mode of Evaluation: The performance of students is evaluated as follows:

	Life Skills and Mentoring	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

SEMESTER III

Module-I (+2 Medical)

Semester-III														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-201	Criminalistics-II	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FST-202	Ethics in Forensic Science	3	0	0	3	3	Ability Enhancement	20	20	60				100
21SHT-120	Organic Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP219	Chemistry lab –III	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-204	Diversity and Systematic of Gymnosperms	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-205	Biodiversity (Chordates)	2	0	0	2	2	Core	20	20	60				100
21UCT-201	Entrepreneurship	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-203	Life Skills and Mentoring-3*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-221	General Proficiency-III (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-202	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-201	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**21**	**25**								
Cumulative Credit					**61**									

Module-I (+2 Non-Medical)

Semester-III														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-201	Criminalistics-II	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FST-202	Ethics in Forensic Science	3	0	0	3	3	Ability Enhancement	20	20	60				100
21SHT-120	Organic Chemistry-I	3	0	2	4	5	Core	20	20	60	40	20	40	200
21SHP219	Chemistry lab –III	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-207	Quantum Physics	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-208	Mechanics (Statics & Dynamics)	2	0	0	2	2	Core	20	20	60				100
21UCT-201	Entrepreneurship	1	0	0	1	1	Ability Enhancement	20	20	60				100
21UCT-203	Life Skills and Mentoring-3*	0	1	0	0	1	Ability Enhancement	100						100

21GPT-221	General Proficiency-III (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-202	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-201	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**21**	**25**								
Cumulative Credit					**61**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.
Student will select total of 3 Credits from the Ability Enhancement Basket.

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSH-201	Criminalistics-II	3	0	2	5	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

This course begins with the basics of Forensic Science that involves different types of forensic evidences like tool marks, soil, tire marks, and their importance in road accident cases. Then the rail accident investigation, significance of forensic in sports will be discussed.

Course Objectives

1. To give an exposure to the students about the basics of tool marks, soil, tire marks and other evidences recovered in accident cases.
2. To familiarize the students about the different types of evidences that can be recovered in rail accident cases and about the presentation of forensic report in the court.
3. To give knowledge to the students about various Forensic laboratories testing related to food adulteration and voice identification.

Course Outcomes

On completion of this course, the students are expected to learn-

CO1	The importance of tool marks, tire marks and soil samples.
CO2	The Investigation procedure for different type of accidents.
CO3	The divisions in a forensic science laboratory that deals with food adulteration and voice identification.

Syllabus

Unit-1	Tool marks, tire marks and soil	Contact Hours: 25
Chapter 1.1	Tool marks: Importance, location, nature, collection and evaluation. **Self-study: Bite marks**	
Experiment 1.1	To study about the process of formation of tool marks.	
Experiment 1.2	To study the process of collection of tool marks.	
Experiment 1.3	To examine the given samples of tool marks on different surfaces.	

Chapter 1.2	Soil: Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence. **Self-study: Different layers of earth surface**	
Experiment 1.4	To examine the given samples of soil for their composition using microscope.	
Experiment 1.5	To determine the type of soil using chemical methods.	
Chapter 1.3	Track marks: Importance, nature, location, collection and evaluation. **Self-study: High speed Vs Low speed track marks**	
Experiment 1.6	To study and match the track marks.	
Unit-2	**Road and Rail accidents**	**Contact Hours: 25**
Chapter 2.1	Road Accidents: Examination of scene, Victim and the vehicle, Collection of the evidence, Examination of skid mark, assessment of malfunctioning of automobiles. **Self-study: History of Rail accidents**	
Chapter 2.2	Rail Crash investigation: Introduction and examination, derailment, Level crossing accident between passenger train and road vehicle, Jammed breaks. **Self-study: Common causes of accidents**	
Experiment 2.1	To prepare a cast of Shoe prints and their comparison.	
Unit-3	**Food, sports adulteration, and Voice identification**	**Contact Hours: 25**
Chapter 3.1	Food Adulterants: Introduction, types, methods of adulteration, examination techniques to analyze food adulterants. **Self-study: Reason behind adulterations**	
Chapter 3.2	Sports/Recreation forensic investigation: Introduction, sport and recreation in the community, evidence and testing, expert witness, Significance in team and individual sports **Self-study: Drug and Sports**	
Chapter 3.3	Voice Identification: Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography **Self-study: Voice fingerprints**	
Experiment 3.1	To prepare a cast of Shoe prints and their comparison.	
Experiment 3.2	Detection of adulterants in food .	

i) Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

j) Reference Books:

1. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
2. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).

3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
65.	Assignment*	10 marks	1 per Unit	10 marks	
66.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
67.	Quiz	4 marks for each quiz	20per Unit	4 marks	
68.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
69.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
70.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
71.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
72.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	2	2		3	2	2	2	2	3
CO2	3	1	2	1	2	1	2	2		2	2	3	1	2	3
CO3	3	2	2	2	1	1	3	3		3	2	3	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-202	Ethics in Forensic Science	3	0	0	3	AE
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

This course begins with the study forensic science, different forensic labs, and the type of evidences and their importance in forensic investigations. Then the responsibilities, duties and ethics needed to be followed by forensic expert will be discussed.

Course Objectives

1. To familiarize the students with basic functioning of forensic laboratories.
2. To give knowledge to the students about the type of cases received in forensic lab and its importance in courts.
3. To learn the students about the role, responsibilities and ethics for forensic expert.

Course Outcomes

On completion of this course, the students are expected to learn-

CO1	Types of cases received in forensic laboratories.
CO2	The documentation and other important things in lab that needed to be kept within
CO3	Role, responsibilities and ethics for forensic expert.

Syllabus

Unit-1	**Background, history, and review of ethics in forensic science**	**Contact Hours: 15**
Chapter 1.1	Definition, history, importance and purpose of ethics in life.	
Chapter 1.2	Existing Codes of Ethics, Enforcement of Codes of Ethics.	
Unit-2	**Professional Ethics**	**Contact Hours: 15**
Chapter 2.1	Importance of Codes of Professional Ethics, Legal vs. Scientific Practices, Ethics and Morals	
Chapter 2.2	Credibility as a Reason for a Code of Ethics, Obligations of the Expert Witness, Other Rules Are Not Enough	
Chapter 2.3	Competence and General Societal Obligation	
Unit-3	**Development of a Code of Ethics**	**Contact Hours: 15**
Chapter 3.1	Various Models of Codes of Ethics, Making a Complaint, The Ethical Requirements for Work Done on a Case	

Chapter 3.2	Interactions between the Forensic Scientist and the Client, Interactions with Colleagues
Chapter 3.3	Criticism of Work Not Done, Selective Evidence Examinations, Attacking Incorrect or Incompetent Work

Text Books:

1. Principles and Practices of Criminalistics: The Profession of Forensic Science by Keith Inman and Norah Rudin.
2. Ethics in Forensic Science: Professional Standards for the Practice of Criminalistics by Peter D. Barnett.

Reference Books:

1.R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).
3. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014)

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
73.	Assignment*	10 marks	1 per Unit	10 marks	
74.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
75.	Quiz	4 marks for each quiz	20per Unit	4 marks	
76.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
77.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
78.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
79.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
80.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	3	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	2	3	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21SHT-120	Organic Chemistry-I	3	0	0	3	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE		21SHP-219					
ANTI-REQUISITE							

Course Description

The course begins with basic study of hydrocarbons and their chemical reactions. The students are then introduced to the aromaticity and stereochemistry of these compounds.

Course Objectives

1. The course attempts to address the specific topics relevant to Chemistry, wherein the students can apply this learning in their respective areas of expertise.
2. The focus is more on the application of the basic concepts with introduction of some advanced concepts in the area of chemistry.

Course Outcomes

CO1	Define the different electronic effects and identify the various types of reaction intermediates formed during the chemical reactions and their stabilities.
CO2	Understand about identification, classification and nomenclature of alkanes and cycloalkanes from various sources to create cohesive and persuasive concepts.
CO3	Introduction of general methods of preparations of saturated and unsaturated hydrocarbons.
CO4	Analyse the problems related to alkenes, dienes and alkynes and create and purpose different types of organic reactions and reaction mechanisms.
CO5	Infer knowledge about concept of stereochemistry, aromatic hydrocarbons and aromaticity.
CO6	Apply the concept to create new ideas about the directing effects of different groups.

Syllabus

Unit-1	Fundamentals of Organic Chemistry	Contact Hours: 15
Electrophiles, Bond Fission and Reaction Intermediates	Electronic Displacements: Inductive, electrometric, resonance and mesomeric effects, hyper conjugation Dipole moment, Hydrogen bonding, Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Types, shape and relative stability of Carbonations, Carbanions, Free radicals, Carbenes, Nitrenes and Benzenes. **Self study: Examples related to identification of different types of electronic effects.**	
Alkanes	General methods of preparation, physical and chemical properties of alkanes: Wurtz Reaction, Wurtz-Fittig Reactions, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids) Free radical substitutions: Halogenation, Relative reactivity and selectivity.	

	Conformational analysis of alkanes: Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Chair, Boat and Twist boat forms of cyclohexane with energy diagrams, Relative stability of mono substituted cycloalkanes. **Self study: Chlorination/Bromination of alkanes.**	
Unit-2	**Unsaturated Hydrocarbons**	**Contact Hours: 15**
Alkenes	Introduction to types of organic reactions: Addition, Elimination and Substitution reactions, Preparation, Mechanism of E_1, E_2, E_{1cb} reactions. Saytzeff and Hofmann eliminations, cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation),	
Alkynes	Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$, Acidity, electrophilic and nucleophilic additions. Hydration to form carbonyl compounds, alkylation of terminal alkynes. **Self study: Hydration of other examples of alkenes.**	
Unit-3	**Stereochemistry and aromaticity**	**Contact Hours: 15**
Introduction of Stereochemistry	Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for up to 2 chiral carbon atoms) and E / Z Nomenclature (for up to two C=C systems).	
Aromaticity	Aromaticity: aromatic, non aromatic, anti aromatic compounds, Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. **Self study: Identification of stereochemistry of organic Compounds.**	

l) Text Books:

T1: Mukherji, SM.; Singh, SP and Kapoor, RP. 2008. Organic Chemistry. Vol. I,, 1st Edition, Wiley Eastern Ltd. (New Age International).

T2: Bhal, A. and Bhal, BS.2013.A textbook of Organic Chemistry 21st Edition, 2013, S. Chand Publication.

T3: Madan, RL. 2010-13, Chemistry for Degree Students. Vol. I, II & III, S. Chand Publication.

T4 :Kalsi, PS. 2005. Stereochemistry Conformation and Mechanism, New Age International.

m) Reference Books:

R1: Morrison, RN and Boyd, RN. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

R2: McCurry, John. 2011. Introduction to Organic Chemistry, Cengage Learning.

R3: Finer, IL. Organic Chemistry (Volume 1-2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

R4: Eliel, EL. And Wile, SH. 1994. Stereochemistry of Organic Compounds, Wiley: London.

n) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
81.	Assignment*	10 marks	1 per Unit	10 marks	
82.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
83.	Quiz	4 marks for each quiz	20per Unit	4 marks	
84.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
85.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
86.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
87.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
88.	Attendance and Engagement Score on BB	NA	NA	2 marks	

o) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	--	--	--	--	--	--	3	--	--	--	--	3	--
CO2	3	3	--	--	3	--	--	--	--	--	--	3	--	3	--
CO3	3	--	2	--	3	--	--	--	--	1	--	3	--	3	--
CO4	3	3	2	--	--	--	--	--	3	--	1	--	--	3	--
CO5	3	3	--	--	3	--	--	--	3	--	--	3	--	3	--
CO6	3	3	--	--	3	--	--	--	--	--	--	--	--	3	--
Average	3	3	2	--	3	--	--	--	3	1	1	3	--	3	--

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21SHP219	Chemistry Lab –III	0	0	2	2	PC
PRE-REQUISITE							
CO-REQUISITE		21SHT-120					
ANTI-REQUISITE							

a. Course Description:

The course begins with the preparation and separation of mixture of organic compounds experimentally. Major topics include the melting point determination, isolation, enthalpy change and construction of diagrams.

b. Course Objectives

To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory. The practical work has been designed to give hands on experience of various tools and lab techniques used in chemistry.

c. Course Outcomes

Students will be able to:

CO1	Understand the method of formation of organic compounds with mechanisms and isolation techniques
CO2	Demonstrate the physical properties of solutions using physical methods and apply appropriate knowledge for boiling point determination and to examine the enthalpy of neutralization and hydartion
CO3	Analyze the critical solution temperature for different solutions and constructing the phase diagram of binary systems

d. Syllabus

Unit-1	**Preparation and Isolation of organic compounds**	**Contact Hours: 5**
Experiment 1.1	Preparation of acetanilide from aniline and its isolation.	
Experiment 1.2	Preparation of p-bromo acetanilide from acetanilide and its isolation.	
Experiment 1.3	Preparation of aspirin from salicylic acid and its isolation.	
Experiment 1.4	Separation of the Benzoic acid, Phenol and naphthalene from the mixture **Self study: Synthesis and Separation of Organic Compounds**	
Unit-2	**Boiling Point and Enthalpy Determination**	**Contact Hours: 5**
Experiment 2.1	Determination of boiling points of three liquids ethanol, cyclohexane, toluene.	
Experiment 2.2	To find out the water equivalent by the calorimeter and also find the heat of dilution of sulphuric acid.	
Experiment 2.3	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	

Experiment 2.4	Determination of enthalpy of hydration of copper sulphate **Self study: Heat of Neutralisation and Heat of Hydration**	
Unit-3	**Phase Diagram and Resins**	**Contact Hours: 5**
Experiment 3.1	Construction of phase diagram of a binary system (simple eutectic) using cooling curves.	
Experiment 3.2	Determination of the critical solution temperature and composition of the phenol water system.	
Experiment 3.3	Preparation of Urea Formaldehyde resin.	
Experiment 3.4	Free radical polymerization of Styrene using benzoyl peroxide as initiator. **Self study: Phase Diagram and Resin formation**	

e. Textbooks

T1. Ahluwalia, Aggarwal, Renu.2000, Comprehensive Practical Organic Chemistry, University Press.

T2. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G., 1989.Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pubs: ELBS.

T3. Das R C, Behera B, 2011, Experimental Physical Chemistry, 9th, Tata Mc Graw Hill Publishers

T4.Khosla B D, Garg V C and Gulati Adarsh, 2002, Senior Practical Physical chemistry, 4th, R Chand and company.

T5.Bhasin S.K., Rani Sudha, 2009, Laboratory manual on engineering chemistry, 3rd edition, reprint 2009, Dhanpat Rai Publishing Company (New Delhi).

T6.Julius Berend Cohen, 2006, Practical Organic Chemistry for Advanced Students, Macmillan, 1900

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	2	2	2	1	2	3	3	--
CO2	3	3	2	3	2	2	1	2	2	2	1	2	3	2	-
CO3	3	3	3	2	1	1	2	1	2	1	2	2	2	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
5	**Course Code- 21FSH-204**	Diversity and Systematic of Gymnosperms	2	0	2	4	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

i) Course Description

The course begins with introduction to characters of gymnosperms and its comparison with angiosperms.The students are then introduced with detailed study of various groups of gymnosperms.

j) Course Objectives

1. The Course deals with highly advance and evolved group of plants with naked seeds i.e. Gymnosperms.
2. The course work of this paper gives a fair idea about the general features, economic importance and study of fossil as well as living gymnosperms.

k) Course Outcomes

On completion of this course, the students are expected to

CO1	Analyze about general characters of Gymnosperms
CO2	Infer Cycadales and Coniferales
CO3	Compare the general characters of Ephedrales and Gnetales including their structure
CO4	Study the living fossil

l) Syllabus

Unit-1	**Gymnosperms and Progymnosperms**	**Contact Hours: 20**
Chapter 1.1	Gymnosperms: General features and their classification, fossilization and fossil gymnosperms. Economic Importance of Gymnosperms.	
Chapter 1.2	General characters, morphological features of ArachaeopterisandAneurophyton; Seed habit in gymnosperms, Distinguishing features of angiosperms and gymnosperms, Manoxylic and pycnoxylicwood	
Experiment 1.1	External morphology, young and old foliage leaves, scale leaves Study of microsporophyll, mega sporophyll and mature seed.	
Experiment 1.2	Study through permanent slides – normal root (T.S.) and ovule (L.S.)	
Experiment 1.3	Study through hand sections– coralloid root (T.S.). rachis (T.S.), leaflet (V.S.)	
Unit-2	**Cycadales and Coniferales**	**Contact Hours: 20**
Chapter 2.1	General characters of Cycadales and Coniferales, Structure, reproduction (male and female strobilus; structure of ovule; development of male and female gametophytes; pollination, fertilization, development of embryo) and life cycle of *Cycas*	
Experiment 2.1	External morphology: Long and dwarf shoot, male and female cones, winged seeds.	

Experiment 2.2	Study through permanent slides – root (T.S.), Male cone (L.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition.	
Chapter 2.2	Structure, reproduction (male and female strobilus; structure of ovule; development of male and female gametophytes; pollination, fertilization, development of embryo) and life cycle of *Pinus*.	
Experiment 2.3	Study through hand sections and prepration of permanent studies in young stem (T.S.), old stem (T.S., T.L.S. and R.L.S.), needle (T.S.), pollen grains (W.M.)	
Unit-3	**Pteridophyta**	**Contact Hours: 20**
Chapter 3.1	General characters of Ephedrales and Gnetales, Structure, reproduction (male and female strobilus; structure of ovule; development of male and female gametophytes; pollination, fertilization, development of embryo and structure of seed) and life cycle of: *Ephedra* and *Gnetum*	
Experiment 3.1	External morphology, Structure of male and female cones.	
Chapter 3.2	Important features and life history of *Ginkgo biloba.*	
Experiment 3.2	Hand sections – Stem (T.S.), maceration to show vessel structure; pollen grains (W.M.)	
Experiment 3.3	Study of Modifications of stem.	

m) Text Books:

T1 Singh, V; Pande, PC and Jain, DK. 2013. A Text Book of Botany: Diversity a Systematics of Seed Plants, 5th Ed., Rastogi Publications, Meerut.

T2 Bhatnagar, AM. 2004. Gymnosperms, 4th Ed., New Age International (P) Limited, Publishers, New Delhi.

T3 Sharma, OP. 2002, Gymnosperms, 6th Ed., Pragati Prakashan, Meerut.

n) Reference Books:

R1 Bhatnagar, SP and Moitra, A. 1996.Gymnosperms, 1st Ed., New Age International Limited, New Delhi.

R2 Chamberlain, CU. 1966. Gymnosperms, 1st Ed., Dover Publications Inc. New York, USA.

R3 Gifford, EM and Foster, AS. 1988. Morphology and Evolution of Vascular Plants,1st Ed., W.H. Freeman & Company, New York.

R4 Stewart, WM. 1983.Paleobotany and the Evolution of Plants, 1st Ed., Cambridge University Press, Cambridge.

R5 Dhand, N. 2102. Systematics of Spermatophyta, 3rd Ed., Trueman Publications, Jalandhar.

o) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
89.	Assignment*	10 marks	1 per Unit	10 marks	
90.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
91.	Quiz	4 marks for each quiz	20per Unit	4 marks	

92.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
93.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
94.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
95.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
96.	Attendance and Engagement Score on BB	NA	NA	2 marks	

p) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1
CO4	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
6	Course Code- 21FST-205	Biodiversity (Chordates)	2	0	0	2	PC
PRE-REQUISITE		10+2 with sciences					
CO-REQUISITE							
ANTI-REQUISITE							

p) Course Description

The course begins with the general characters of chordates, proceeds with protochordates and cyclostomes. It also provides knowledge about the characters and specimens of pieces, amphibian, reptiles, aves and mammals.

q) Course Objectives

To acquaint students with the general characters and classification of chordates and the affinities between different groups. To impart knowledge regarding the morphological, anatomical and physiological make up of a few representative organisms from each phylum.

r) Course Outcomes

On completion of this course, the students are expected to learn:

CO1	Compare appropriate information about about the chordates, protochordates, cyclostomes from various sources to analyze and create cohesive and persuasive concepts.
CO2	Summarize information and problems related to classes Pisces and Amphibia in order to formulate strategies for mitigation in future scenarios.
CO3	Assess knowledge about Aves and Mammals and apply that knowledge to create new ideas at a local and global levels
CO4	Classify phylum Protochordates to Mammalia
CO5	Get an overview of the morphology and physiology of typical examples.
CO6	Familarise the adaptations and economic importance of specific vertebrates.

s) Syllabus

Unit-1	Chordates and protochordates	Contact Hours: 10
Chapter 1.1	General Characters of Chordates. General characteristics and classification of protochordates upto orders. Urochordata Type study-Herdmania: Body wall, skeletal system, coelom, digestive system, blood vascular system, respiratory system, nervous system, sense organs, excretory system, reproductive system.	
Chapter 1.2	General characteristics and classification of protochordates upto orders. Cephalochordata—Type study-Amphioxus: Body wall, skeletal system, coelom, digestive system, blood vascular system, respiratory system, nervous system, sense organs, excretory system, reproductive system.	
Unit-2	Pisces and Amphibia	Contact Hours: 10

Chapter 2.1	General characteristics and classification of class avesuptoorders.Type study : *Labeo:* Body wall, skeletal system, digestive system, Blood vascular system, respiratory system, nervous system, sense organs, excretory system, urinogenital system.	
Chapter 2.2	General characteristics and classification of class amphibia upto orders. Type study –Frog: Body wall, skeletal system, digestive system, blood vascular system, respiratory system, nervous system, sense organs, excretory system, urinogenital system, endocrine system.	
Unit-3	**Reptiles and Mammals**	**Contact Hours: 10**
Chapter 3.1	General characteristics and classification of reptilian upto orders. Type study—*Uromastix*: Body wall, digestive system, blood vascular system, respiratory system, nervous system, sense organs, excretory system, urinogenital system	
Chapter 3.2	General characteristics and classification of class mammalia upto orders. Type study—Rat: Body wall, skeletal system, Digestive system, Blood vascular system, Respiratory system, Nervous system, Sense organs, Excretory system, urinogenital system	

t) Text Books:

T1 Jorden, EL.2001. Invertebrate Zoology, 4th Ed., S. Chand Publishers.

T2 KotpalRL. 2009. Modern Text Book of Zoology: Invertebrate, 10th Ed., Rastogi Publications.

u) Reference Books:

R1Hyman, LH .1955. Invertebrates,5th Ed, Mcgraw Hill.

R2Verma, PS. 2005. A Manual of Practical Zoology: Invertebrate,3rd Ed., S. Chand Publishers.

R3LalSS.2009. Practical Zoology Invertebrate ,2ndEd., Rastogi Publications.

R4Dhami&Dhami.1983. Text Book of Zoology ,4thEd., Pardeep Publications.

R5Aggarwal, VK .2011. Zoology for Degree Students ,5th Ed., S. Chand Publications.

v) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
97.	Assignment*	10 marks	1 per Unit	10 marks	
98.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
99.	Quiz	4 marks for each quiz	20per Unit	4 marks	
100.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
101.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
102.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	

103.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
104.	Attendance and Engagement Score on BB	NA	NA	2 marks	

w) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
CO5	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
CO6	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
7	Course Code- 21UCT201	Entrepreneurship	0	0	0	1	UC
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

h. Course Description

The course attempts to create understanding about the various aspects of the Entrepreneurial challenges and start-up basic elements. Tasks will help students to build the practical approach towards the entrepreneurial world. This course will make students able to create the business ideas will also help to set up their own startups.

i. Course Objectives

The Course aims to:

1. Introduce the students to the defining characteristics of an entrepreneur.
2. Introduce the students to concepts related to Strategy, Finance and Planning essential for an entrepreneur to take into consideration for conceiving and launching an enterprise.
3. Impart knowledge about Institutional Support available for financing an enterprise.

j. Course Outcomes

1	To understand the basics of operation management and various best operations strategies of industry
2	To apply the knowledge of different strategies for improving the productivity of an organization
3	To Enable students for analyzing the different types of productivities in manufacturing and production management
4	To compare and support the different queuing models on various real life problems.
5	To evaluate the various quality measures for assuring quality in organizations.

Learning Module –

1) Module Overview – This will give you an overview of syllabus contents of this subject based upon student will gain knowledge of entrepreneurship and aware themselves from Job crisis. • Content - Since start-ups are not small versions of big companies, a different approach is required to develop a successful business. As such the main output of the module Entrepreneurship is not a 5-year business plan, but instead a portfolio of start-up activities and an iteratively validated business proposition to launch an innovative, internationally scalable new venture, either as an individual start-up or as a new venture within an existing organization. As this subject introduced as University Subject for all graduate courses, we study, discuss and experiment with a combination of traditional and contemporary business development insights, methods, theories and tools in order to facilitate you to start your own business or develop (incept) a new business concept for an existing company with an unidirectional scope

through the task given in rubric sheet. The minor differentiates itself from other Entrepreneurship programs in its 3 pillar approach to Entrepreneurship; I. Theory & research in entrepreneurship - deepening your understanding of entrepreneurship and its various disciplines from an academic perspective, by actively doing the self-study through pre-recorded videos and given reading material that are concerned in building a successful businesses, either as an individual startup or as part of a corporate entrepreneurial initiative; II. Entrepreneurship in practice - experiencing entrepreneurship from a practical perspective as this subject is having syllabus with all theory concepts. So, delivering knowledge in the era of entrepreneurship when practicing tasks in their own fields/stream. III. Development as an entrepreneur - developing your entrepreneurial skills such as pitching, presenting, customer orientation, customer development, selling, buying, negotiating, planning and dealing with diversity through performing such tasks as this subject is focused to aware students about the business options and start-up options available in their study streams through this subject so that they may establish themselves without any job crisis and this can only be done if they will search and work according to their own choices

k. Syllabus

Unit-I:	**Introduction and Planning Stage**
Introduction:	Entrepreneurship, Role of Entrepreneurship, Scope and Importance of Entrepreneurship, Introduction to new Venture, Opportunities and challenges.
Idea Generation:	SWOT analysis, New and Existing Product and Services, Franchising and its benefits
Unit-2:	**Implementation stage**
Business plan development:	Value Propositions, Customer segments, Channels, Customer relation, Revenue streams, Key resources, Partners, Activities, Costs.
Sources for start-up:	Financial Analysis/Project estimation cost, financial institution, loans etc.
Registration process:	Government policies and prospects.
Unit-3:	**Sustainability and growth**
Cross-Cultural Communication	Selling plan, Vendor Management, Branding and Advertising, Business Growth, Social effect of business and its eco-friendliness

Lecture number	**Topic**
Lecture -1	Role of Entrepreneurship
Lecture -2	Scope and Importance of Entrepreneurship
Lecture -3	Introduction to new Venture
Lecture -4	Opportunities and challenges
Lecture -5	New and Existing Product and Services
Lecture -6	Franchising and its benefits

Lecture -7	Business plan and development
Lecture -8	Financial Analysis/Project estimation
Lecture -9	Financial institution, loans etc
Lecture -10	SWOT analysis
Lecture -11	New and Existing Product and Services
Lecture -12	Government policies and prospects
Lecture -13	Vendor Management
Lecture -14	Branding and Advertising
Lecture -15	Business Growth

Textbooks / Reference Books

TEXT BOOKS

T1 Dr. K.C. Sharma, (2012) Entrepreneurship Development, JAIN PUBLICATIONS.

REFERENCE BOOKS

R1-Entrepreneurial Development and Small Business Management" by Dr. P T Vijayashree & M A lagammai
R2-"Entrepreneurial Development" by Khanka SS
R3-"Dynamics of Entrepreneurial Development and Management "by V Desai
R4-Entrepreneurship Development by G. P. Prasain (2015), McGraw Hill Publications.
R5 - Entrepreneurship Development and Management by Dr. AK Singh (2006), Modern Publishers

MODE OF ASSESSMENT

The assessment will be done in the form of multiple choice based questions (MCQB) at the end of the semester (Internal=0 and External=100)

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Workshop (WS)	Ability Enhancement Category University Core (UC)	Graded	MCQ based

LMS PLATFORM FOR DELIVERY OF COURSE CONTENT

1. The academic delivery of the course will be done in the form of Pre-recorded lectures to sensitize the students on Entrepreneurship. 5-6 lectures, each of 1 hrs will be planned and recorded based on the syllabus.

2. As per the Instruction of E-gov. delivery of the course content will be through blackboard and doubt clearing sessions will be delivered through open platforms like Microsoft teams/ Google meet.

l. CO-PO Mapping

PO / CO	Description of CO	Apply knowledge of management theories and practices to solve business problems **(PO1)**	Foster Analytical and critical thinking abilities for data-based decision making **(PO2)**	Ability to develop Value based Leadership ability **(PO 3)**	Ability to understand, analyze and communicate global, economic, legal, and ethical aspects of business **(PO 4)**	Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment **(PO5)**	Ability to develop innovative and entrepreneurial mindset. **(PO 6)**
CO1	To understand the conceptual framework of entrepreneurship and identifying various factors influencing the entrepreneurial approach.	3				1	3
CO2	To apply the conceptual understanding in setting up a new venture.		3	2	2		
CO3	To analyze the feasibility of different elements of an enterprise like marketing, finance, human resources, operations, and technology.	3				3	1
CO4	To evaluate the sustainability of an enterprise in the long run.	3	2		3		
CO5	To create value prepositions and opportunities associated with entrepreneurship.		3	2			2

CO PO correlation matrix of each subject to be mapped with

High correlation (3)
Medium correlation (2)
Low correlation (1)

Faculty Incharge- Mr. Gaurav Sharma (E-7691), USB, 9882201702

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
8	**Course Code-** 21FSH-207	Quantum Physics	2	0	2	4	PC
PRE-REQUISITE		The candidate must have studied Physics Subject upto +2 level					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with theoretical study of need of quantum mechanics. The students are then introduced to equations and tools used to understand quantum mechanics. The course further emphasizes on the application of quantum mechanics like linear harmonic oscillators.

Course Objectives

The course attempts to address the specific topics relevant to Physics. The focus is on the basic concepts with introduction of some advanced topics and applications in the area of Physics.

Course Outcomes

On completion of this course, the students are expected to;

CO1	Get Knowledge about conservation laws and symmetries of space.
CO2	To understand about inertial and non-inertial frames of reference, fictitious forces and Focault's pendulum
CO3	Learn About elastic collisions in Lab and CM systems, rigid body motion, principle moments of inertia, Euler's equations

Syllabus

Unit-1	**(Origin of Quantum Mechanics)**	Contact Hours: 15
Chapter 1.1	Brief introduction to need and development of quantum mechanics, Photoelectric effect, Classical and Quantum explanation, Compton Effect, Wave-particle duality, de-Broglie hypothesis, Davisson and Germer experiment	
Experiment 1.1	To determine value of Boltzmann constant using V-I characteristic of PN diode	
Chapter 1.2	Wave nature of particles, free particle, Wave function,	
Experiment 1.2	To determine work function of material of filament of directly heated vacuum diode.	
Chapter 1.3	Wave packet, phase velocity, group velocity, relation between p	

Experiment 1.3	To determine value of Planck's constant using LEDs of at least 4 different colors.	
Unit-2	**(Schrodinger Wave equation)**	Contact Hours: 15
Chapter 2.1	Time dependent and independent S.W.E and their general solution, Stationary state, Normalization condition, Properties of wave function, conservation of probability density, probability current for a plane wave, orthogonal wave function, Expectation value of position and momentum.	
Experiment 2.1	To determine the beam intensity of Helium-Neon laser	
Chapter 2.2	Operator, Eigen function and eigen values, Angular momentum operator**,** energy operator, Hermitian operator	
Experiment 2.2	To find the divergence of LASER beam	
Chapter 2.3	commutators for position and momentum, commutation relations, time and energy, Ehrenfest theorem.	
Experiment 2.3	To determine the diffraction using LASER beam and find the grating element of diffraction grating	
Unit-3	**(One Dimensional barrier transmission problems)**	Contact Hours: 15
Chapter 3.1	Time dependent and independent Schrodinger equation. Application to stationary states for one-dimension, Potential step, Rectangular Potential barrier	
Experiment 3.1	To determine the numerical aperture of optical Fiber	
Chapter 3.2	Square potential well, Degeneracy, Reflection and transmission of a wave packet, concept of Tunneling, Tunneling probability	
Experiment 3.2	To determine the temperature co-efficient of resistance by Platinum resistance thermometer.	
Chapter 3.3	Introduction of classical harmonic oscillator, Solution of time independent S.W.E, Zero point energy, Wave Function, Rigid Rotator and equation (Proof)	
Experiment 3.3	To study the refractive index profile of a given optical fiber.	

Textbooks

T1. Beiser, A;Ghatak, A;Garg, S C. 2013. Applied Physics, 1st Ed., Tata Mcgraw Hill, Noida.
T2. Beiser, A. 2003. Concepts of Modern Physics, 6th Ed., Tata Mcgraw Hill, Noida.
T3. Mani, H S; Mehta, G K. 1990. Introduction to Modern Physics, 1st Ed., East-West Press, New Delhi.
T4. Ghatak, A;Lokanathan, S. 2004. Quantum Mechanics, Theory and Applications, 5th Ed., Macmillan India Ltd, New Delhi.
T5. Lab Manuals of Physics, Department of Applied Physics, Physics Group.

Reference Books:

R1 Powell, J, L;Crasemann, B. 1990. Quantum Mechanics, 1st Ed., Narosa Publishing House, New Delhi.
R2 Mathews, P M;Venkatesan, K.2002. A Text Book of Quantum Mechanics, 2nd Ed., Tata McGraw Hill Pub. Co. Delhi.
R3. Arora C L, 1995B.Sc. Practical Physics, S. Chand Publications

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
105.	Assignment*	10 marks	1 per Unit	10 marks	
106.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
107.	Quiz	4 marks for each quiz	20per Unit	4 marks	
108.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
109.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
110.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
111.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
112.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	1	-	-	-	1	1	-	1	1
CO2	-	2	-	-	2	-	-	-	-	-	2	1	2	2	1
CO3	-	2	2	-	-	3	-	-	-	-	1	1	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
9	**Course Code-** 21FST-208	Mechanics (Statics & Dynamics)	2	0	0	2	PC
PRE-REQUISITE		Basic Knowledge of Mathematics up to +2 level.					
CO-REQUISITE							
ANTI-REQUISITE							

k) Course Description

This course covers the fundamentals of Statics & Dynamics: Laws of motion, Forces, Moments, Friction, Simple harmonic motion, Central force, Projectiles and basic concepts of work, power and energy. It shows the utility of concepts and teaches an understanding of concepts in daily routine.

l) **Course Objectives**

The focus is on the basic concepts relating to law of motion, forces and type of forces, knowledge about moments, friction, coplanar concurrent forces. To introduce Newton's law of motion, motion under gravity, acceleration, knowledge about motion of particle connected by string, projectile and circle central force motion.

The focus is on the fundamentals ofwork, power and energy. Understand the essential concepts relative motion.

m) Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Derive the specific topics relevant to Statics & Dynamics
CO2	Analysis the law of motion, forces and type of forces, knowledge about moments, friction, coplanar concurrent forces
CO3	Examine the basic concepts of Newton's law of motion, motion under gravity, acceleration

n) Syllabus

Unit-1	**Statics**	**10 Hours**
Chapter 1.1	Resultant of two concurrent forces, Triangular law of forces, Lami's theorem, λ - μ theorem, Parallel forces, Moment of a force, Couple.	
Chapter 1.2	Varignon's theorem on moments, Friction, Law of friction, Coplanar forces.	
Chapter 1.3	Resultant of three coplanar concurrent forces, Equilibrium of two concurrent forces, Equilibrium condition for any number of coplanar concurrent forces.	
Unit-2	**Motion**	**10 Hours**

Chapter 2.1	Basic Concept. Newton's law of Motion, Motion of a particle with constant acceleration, Acceleration of falling bodies.	
Chapter 2.2	Motion under gravity, Motion of a body projected vertically upward, Motion of a two particles connected by a string, Motion along a smooth inclined plane, constrained motion along a smooth inclined plane.	
Chapter 2.3	Projectile, Simple harmonic motion.	
Unit-3	**Work, Power, Energy and Relative Motion**	**10 Hours**
Chapter 3.1	Conservative fields and potential energy, Work done against gravity, Potential energy of a gravitational field. Relative displacement, velocity and acceleration, Motion relative to a rotating frame of reference.	
Chapter 3.2	Linear momentum, Angular momentum, Conservation of angular momentum, Impulsive forces, Principle of impulse and momentum.	
Chapter 3.3	Motion with respect to centre of mass of a system of particles, Collisions of elastic bodies, Loss of energy during impact, Kepler's laws of motion.	

o) Textbooks

T1 G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
T2 Synge J. L. and Griffth B. A., Principles of Mechanics, Published by Nabu Press.

Reference Books:

R1 Kyn-Jung Kin: Mechanics: Statics and Dynamics, Mechanical Engineering Department, California Polytechnic college, USA.

p) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
113.	Assignment*	10 marks	1 per Unit	10 marks	
114.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	

115.	Quiz	4 marks for each quiz	20per Unit	4 marks	
116.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
117.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
118.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
119.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
120.	Attendance and Engagement Score on BB	NA	NA	2 marks	

q) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
10	Course Code- 21UCT-203	Life Skills and Mentoring-3	0	1	0	1	UC-MNG
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION

In this course, students will learn skills like how to interpret and manage your emotions and balance your optimism and pessimism, using coping methods and relaxation. Develop positive coping strategies and understand why they differ from one individual to another and to learn the joy of helping others.

COURSE OBJECTIVES

1	**Emotional Intelligence** – To help students to communicate in an emotionally intelligent way and understand the benefits of positive thinking how negative thinking. Enabling students to face fear and challenges and allowing student to be more purposefully confront the stress present in our lives
2	**Coping Skills**- To develop the skills and strategies that help the student to build the resilience
3	**Value Inculcation**: To Learn about the joy of giving and the joy of helping others

COURSE OUTCOMES

On completion of this course, the students will able to

21UCT203.1	Interpret the benefits of positive thinking
21UCT203.2	Build Resilience skills to manage conflict, negativity and other challenges
21UCT203.3	Develop active coping skills for emotional intelligence ,stress and Anger Management
21UCT203.4	Appraise the value of giving and start applying it in personal life and society.

TEXT BOOKS

REFERENCE BOOK

R1	The Relaxation and Stress Reduction Workbook by Martha Davis, Matthew McKay and Elizabeth Robbins Eshelman	**2008**
R2	Relax and Unwind: A New Positive Approach by Jenni Adams	**1994**
R3	POWER OF POSITIVE THINKING - by Dr. Norman Vincent Peale	**2018**

COURSE CONTENTS		**Total Contact Hours: 12**
Unit I	**Cognitive Skills**	**4 Hour**

Chapter 1	**Positive Thinking**: Importance of positive thinking, how to develop positive attitude, benefits of positive attitude	**2 Hour**
Chapter 2	**Building Resilience:**Understanding of resilience ,Characteristics of a resilient person, How to become more resilient, Benefits of resiliency	**2 Hour**
Unit 2	**Active coping**	**6 Hour**
Chapter 3	**Coping with Emotions**: Understanding emotions and emotional intelligence, characteristics of emotional intelligence, coping techniques	**2 Hour**
Chapter 4	**Coping with Anger:** Understanding Anger, Why it's a common problem among youth, Techniques to Manage anger	**2 Hour**
Chapter 5	**Coping with Stress:** Coping with stressful situations, Behavioral monitoring, Relaxation and Stress reduction techniques, Developing resilience	**2 Hour**
Unit 3	**Values**	**2 Hour**
Chapter 6	**Giving:** Understanding the concept of giving, importance of giving, giving and gratitude	**2 Hour**

Mode of Evaluation: The performance of students is evaluated as follows:

	Life Skills and Mentoring	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

CO-PO Mapping												
	PO1Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning
21UCT203.1	-	-	-	-	-	-	-	-	1	1	-	3
21UCT203.2	-	-	-	-	-	-	-	-	1	1	-	3
21UCT203.3	-	-	-	-	-	3	-	-	3	3	-	3
21UCT203.4	-	-	-	-	-	3	-	3	1	1	-	3
1=addressed to small extent			2= addressed significantly						3=major part of course			

Syllabus Designed By	**Approved By**
Navneet Kaur (E7283)	**Director, Students Welfare**

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
11	Course Code- 21TDP-201	SOFT SKILLS	0	0	2	2	AE
PRE-REQUISITE		Basic Communication Skills					
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION
This course will act as the base for Personality and Communication Enhancement. It will help the studentstoimprovetheircommunicationskillsandpersonalitybyunderstandingthebasicSoftSkills. Moreover, it will develop the students' creative, analytical and divergent thinking skills which are required to be motivated for setting goals in order to become confident in performing in front of an audience.

COURSE OBJECTIVES	
1	Instilconfidenceinthestudentstoovercomehesitationandbecomeproactivepublic speakers through variousactivities.
2	StrengthentheholdoverEnglishlanguageandutilizethesameinprofessional communication.
3	Augmentcreativeandrationalthinkingskillsofthestudentsandgivetheminsightofthe coreelementsoftheplacementprocess;GroupDiscussionsandPersonalInterviews
COURSE OUTCOMES	
On completion of this course, the students will be able to	
CO1	Enhancecompetenceinthefourskillsoflanguagelearning:writing,speaking,readingand listening
CO2	ApplythecommunicationskillsbyparticipatinginGroupdiscussions,debates,and collaborativeactivitiesinvarioussituationstoenhancetheirpersonality.
CO3	Evaluatetheirperformancewhileworkingonthefeedbackshareduringthecourse activities.
CO4	Solvetherangeofproblemsfacedthroughtheapplicationofcreative,analyticaland divergent thinkingskills.
REFERENCE BOOKS	
R1	High School English Grammar and Composition by Wren & Martin
R2	How to prepare for Verbal Ability and RC - Arun Sharma & Meenakshi Upadhyay
R3	How to Win Friends and Influence People -Dale Carnegie 1995 Levine & Crom
R4	E-book: Soft Skills by Manmohan Joshi
COURSE CONTENTS	
Unit I	**10 Hrs**
1	Soft Skills Prologue
2	Being Effective
3	Forced Connections
4	Game Plan
5	The Power of Time
Unit 2	10 Hrs
6	Speechify
7	Official Formalities
8	Proof of Proficiency
9	Silent Communication Skills
10	Functional Forums
Unit 3	10 Hrs
11	Convincing Conversations
12	Deliberative Discussions
13	First Impressions

14	Crowning Competencies
15	Headliners

Mode of Evaluation: The performance of students is evaluated as follows:

CODE	**SOFT SKILLS**	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	60	40
Total Marks	100	

CO-PO Mapping

	PO1 Forensic knowledge	**PO2 Individual and team work**	**PO3 Ethics**	**PO4 Communication**	**PO5 F Sustainability**	**PO6 Conduct investigations of complex**	**PO7 Modern tool usage**	**PO8 Lifelong Learning**	**PO9 Design/development of solutions**	**PO10 Forensic scientists and society**	**PO11 Adoption of new skill for future**	**PO12 Innovation and Entrepreneurship**	**PSO1**	**PSO2**
21TDP201.1	0	0	0	3	0	0	0	1	0	0	1	0	0	0
21TDP201.2	0	1	0	3	0	1	1	0	2	0	2	0	0	0
21TDP201.3	0	0	0	1	0	0	0	1	0	0	0	1	0	0
21TDP201.4	0	2	1	1	0	2	1	2	2	0	0	2	0	0
21TDP201 Consolidated	0	3	2	8	0	3	2	4	4	0	3	3	0	0

1=addressed to small extent | 2= addressed significantly | 3=major part of course

Syllabus Designed: Jaskiran Kaur | **Approved By**

Pardeep Kr. Bansal

Name with Employee Code: Jaskiran (E3844) | **HoD (DCPD)**

SN	**Program Code- BS214**	**Course Title**	**L**	**T**	**P**	**CH**	**Course Type***
11	**Course Code- 21TDT-202**	**Aptitude**	0	0	2	2	AE
PRE-REQUISITE		Basic Communication Skills					
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION

To generate problem solving skills, counting techniques, ability to analyze the situation, demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions with logical thinking and applying decision making in all national and internationalprojects

COURSE OBJECTIVES			
1	To develop the understanding of basic rules of logic, including critical thinking, Data analyzing techniques, mathematical analysis, and formulate mathematical models of such problems		
2	To apply mathematical methodologies to open-ended real-world problems		
COURSE OUTCOMES			
On completion of this course, the students will able to			
21TDT202.1	To define, understand the basic knowledge of Numbers, percentage, time and work, speed and distance, building base of arithmetic via and explain the concepts of quantitative aptitude and logical reasoning.		
21TDT202.2	To apply the concept of Vedic Mathematics to find squares, cubes ,roots, the types of Simple and Compound annual growth to solve MCQs faster by the application of shortcut methods.		
21TDT202.3	To analyse the data in a bar graph, pie chart and tabular column and line graph and the combination of data given in the graphical format and infer the results.		
21TDT202.4	To develop the ability to apply the concepts of time and work, time seed distance, probability and its applications in real life scenarios.		
21TDT202.5	To effectively solve problems of profit and loss and problems related to average, direction sense and extend the application shortcuts in such topics as simple interest, compound interest and profit and loss		
TEXT BOOKS			
T1	CU-DCPD_Building Blocks of Aptitude	**9th Edition**	**2021**
REFERENCE BOOKS			
R1	Guha Abhijit: Quantitative Aptitude for Competitive Examinations , Tata McGraw Hill Publication	**8thEdition**	**2018**
R2	Aggarwal R.S: A Modern Approach to Verbal and Non Verbal Reasoning 2012	**11th Edition**	**2018**
COURSE CONTENTS			
Unit I			**10 Hrs**
Chapter 1.1	**Vedic Math**: Mental Calculations; How to find squares and square root; Approximations; How to solve tough calculations		**2 Hrs**
Chapter 1.2	**Number System:** Number Chart: Real numbers, Imaginary numbers, Rational numbers, Irrational numbers, Integers, Whole numbers & Natural numbers, Prime and composite numbers; **Simplification:** Simplification techniques using Digital Sum Method **Divisibility Rules** (2 to 17)		**2 Hrs**
Chapter 1.3	**Percentages:** Concept of percentages; Concept of percentage increase and percentage decrease; Concept of successive percentages		**2 Hrs**

Chapter 1.4	**Profit & Loss:** Concepts of cost price, selling price and marked price; Fundamentals of profit, loss and discounts; Fundamental problems based on above concepts; Complex problems based on above concepts	**2 Hrs**
Chapter 1.5	**Simple & Compound Interest:** Concept of simple & compound interest; Fundamental problems on it.	**2 Hrs**
Unit 2		**8 Hrs**
Chapter 2.1	**Syllogism:** Concept of Venn Diagram; How to draw conclusions using the available information; Basic problems on above mentioned concepts.	**2 Hrs**
Chapter 2.2	**Coding- Decoding:** Concept of EJOTY to learn alphabet; Letter Coding; Number Coding; Substitution Coding; Mixed Letter and Number Coding; How to solve abstract problems.	**2 Hrs**
Chapter 2.3	**Direction Sense:** Concept of left & right turn (direction);Clock & anticlockwise movement with East, West, North and South direction; Basic problems based on above concepts; Complex problems based on above concepts; Passage Based problems; Problems based on data sufficiency.	**2 Hrs**
Chapter 2.4	**Data Interpretation:** Analyze data in Tabular Representation; Line Graph; Bar Graph; Miscellaneous	**2 Hrs**
Unit-3		**12 Hrs**
Chapter 3.1	**Average:** Concept of Mean; Different type of mean – Arithmetic, Geometric and Harmonic; Application of means while taking averages in different types of questions.	**2 Hrs**
Chapter 3.2	**Time & Work:** Concept of time and work; Basic problems based on above using LCM method; Basic work problems based on efficiency of manpower.	**2 Hrs**
Chapter 3.3	**Time, Speed & Distance:** Basic concept and relationship between time, speed and distance; Questions based on average speed, relative speed.	**4 Hrs**
Chapter 3.4	**Permutation and Combination:** Fundamental concept of counting: AND and OR; Relation and difference between Permutation and Combination; Different properties of P and C; Applications of the same on different problems; Problems based on data sufficiency.	**2 Hrs**
Chapter 3.5	**Probability: Introduction to different types of events; Concept of sample space and experiment; Application of these concepts on different problems related to coins, dice, cards and balls; Addition theorem; Problems based on data sufficiency.**	**2 Hrs**

Mode of Evaluation: The performance of students is evaluated as follows:

21TDT202	**Aptitude**	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

CO-PO Mapping

	PO1 Forensic knowledge	PO2 Individual and team work	PO3 Ethics	PO4 Communication	PO5 F Sustainability	PO6 Conduct investigations of complex problems	PO7 Modern tool usage	PO8 Lifelong Learning	PO9 Design/development of solutions	PO10 Forensic scientists	PO11 Adoption of new skill for future employment	PO12 Forensic scientists and society	PSO1	PSO2
21TDT202.1			3					3						
21TDT202.2			3					2						
21TDT202.3			2					3						
21TDT202.4			3					2						
21TDT202.5			3					2						
21TDT202 Consolidated			2.8					2.4						

1=addressed to small extent	2= addressed significantly	3=major part of course

Syllabus Designed By	**Approved By**
Name with Employee Code	**Director (DCPD)**

SEMESTER IV

Module-I (+2 Medical)

Semester-IV														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-251	Questioned Document Examination	3	0	4	5	7	Core	20	20	60	40	20	40	200
21FSH-252	Forensic Photography	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-217	Organic Chemistry II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP221	Chemistry Lab-IV	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-254	Development and Reproduction in Flowering Plants	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-255	Animal Physiology	2	0	0	2	2	Core	20	20	60				100
21UCT-202	Ethics and Gender Equality*	1	0	0	0	1	Ability Enhancement	20	20	60				100

21UCT-204	Life Skills and Mentoring-4*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-222	General Proficiency-IV (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-282	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-281	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**22**	**29**								
Cumulative Credit					**83**									

Module-I (+2 Non-Medical)

Semester-IV														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-251	Questioned Document Examination	3	0	4	5	7	Core	20	20	60	40	20	40	200
21FSH-252	Forensic Photography	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-217	Organic Chemistry II	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP221	Chemistry Lab-IV	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FSH-256	Physics of Atoms &Molecules	2	0	2	3	4	Core	20	20	60	40	20	40	200
21FST-257	Probability and Statistics	2	0	0	2	2	Core	20	20	60				100
21UCT-202	Ethics and Gender Equality*	1	0	0	0	1	Ability Enhancement	20	20	60				100
21UCT-204	Life Skills and Mentoring-4*	0	1	0	0	1	Ability Enhancement	100						100
21GPT-222	General Proficiency-IV (NSS, NCC, Club activity, Skill Basket)	1	0	0	1	0	Ability Enhancement							0
21TDT-282	Aptitude	2	0	0	2	2	Ability Enhancement	20	20	60				100
21TDP-281	Soft-skills	0	0	2	1	2	Ability Enhancement				40	20	40	100
Total Credit					**22**	**29**								
Cumulative Credit					**83**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.
Student should select at least one value added subject per semester from the basket.

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSH-251	Questioned Document Examination	3	0	4	7	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

r) **Course Description**

The course begins with the theoretical study of documents nature and scope and handwriting analysis which is widely utilized in all questioned document examinations. The students are then introduced to principles of handwriting, ink analysis, paper analysis and typewriter examination

s) **Course Objectives**

To skill the students to identify and analyse different natures of documents and questioned documents at the crime scene and also to maintain the chain of custody.
To serve as a foundation to evaluate the problems of handwriting examinations, signature forgeries through scientific methods in Science and Engineering applications through Statistical testing method.

Course Outcomes

CO1	The student will able to handling, preservation and basic tools used in question document examination involving ink, paper and printed documents.
CO2	The student will able to implementing the handwriting principles in the questioned document examination.
CO3	The student will able to recognize the method of examination to be applied in forgeries, alterations, intended writings and other manipulations done on the document to prove or disapprove the authenticity of the document.
CO4	The student will able to handling, preservation and basic tools used in question document examination involving ink, paper and printed documents
CO5	The student will able to recognize the method of examination to be applied in forgeries, alterations, intended writings and other manipulations done on the document to prove or disapprove the authenticity of the document.

t) Syllabus

Unit-1	**Introduction to question documents**	**Contact Hours: 25**
Chapter 1.1	Introduction to types of documents in routine or official work, passports, stamp papers, visas, currency notes, Handling and preservation of documents at crime scene, basis of a fake document. Preliminary examination	
Experiment 1.1	Introduction to UV light, stereomicroscope, Thin layer chromatography for preliminary examination of document.	
Chapter 1.2	Important characteristics of Passports, Visa, Indian currency notes, stamp papers, comparison of genuine and fake documents-optical fibres, security features, microprinting etc.	
Experiment 1.2	Important characteristics of Indian currency notes-optical fibers, security features, microprinting etc.	
Chapter 1.3	**Printing techniques**	
Experiment 1.3	Introduction and examination of charred documents, soaked documents, shredded documents, mutilated documents.	
Unit-2	**Handwriting examination**	**Contact Hours: 25**
Chapter 2.1	**Topic:** Law of individuality, law of comparison, law of progressive change, General writing Characteristics, Individual Characteristics, Development of Individuality in Handwriting, copy book form, Comparison of Handwriting: Natural Variations, Fundamental Divergences..	
Experiment 2.1	General writing Characteristics, Individual Characteristics, Comparison of Handwriting: Natural Variations, Fundamental Divergences.	
Chapter 2.2	**Topic:** Anonymous writing identification, disguised writing and its identification, secret writing – Introduction, secret inks, restoration techniques	
Experiment 2.2	secret writing –Introduction, secret inks, restoration techniques.	

Chapter 2.3	**Topic:** Signatures & its categories-Receipt signatures, spurious signatures, death bed signatures, spouse imitation signatures, Traced forgeries and its methods, simulated forgery, digital forgeries	
Experiment 2.3	Signatures & its categories-Receipt signatures, spurious signatures, death bed signatures, spouse imitation signatures, Traced forgeries and its methods, simulated forgery, digital forgeries.	
Unit-3	**Ink Examination**	**Contact Hours: 25**
Chapter 3.1	Ink-Introduction, its categories-aqueous and non aqueous, its examination.	
Experiment 3.1	Examination of Ink by various methods	
Chapter 3.2	Paper-Introduction, manufacturing, its examination based on physical and instrumental analysis-X-ray diffraction, Atomic Absorption spectroscopy, Estimation of relative age of documents on basis of paper.	
Experiment 3.2	Estimation of relative age of documents on basis of paper by various tools	
Chapter 3.3	Erasures-its types and examination methods, Obliterations-its examination based on physical and instrumental analysis	
Experiment 3.3	Examination of Obliterations by various methods	
Chapter 3.4	Typewriters and its working, Laser printers and Inkjet printers and their working, types of conventional printings- Intaglio, offset, screen printing and their printing processes, comparison of different types of printings	
Experiment 3.4	comparison of different types of printings by various methods	

u) Textbooks

T1. O. Hilton, *Scientific Examination of Questioned Documents*, CRC Press, Boca Raton (1982).
T2. R.N. Morris, *Forensic Handwriting Identification: Fundamental Concepts and Principles*, Academic Press, London (2000).
T3. E. David, *The Scientific Examination of Documents – Methods and Techniques*, 2nd Edition, Taylor & Francis, Hants (1997).
T4. Directorate of Forensic Science Manual.

v) Reference Books:

R1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
R2. Osborn A.S. (1929): Questioned Documents, Boyd Print Co., Albany; 499-521.
R3. Brewester F. (1932): Questioned Documents and Forgeries, The Book Company Ltd., Calcutta; 169-176.

w) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
121.	Assignment*	10 marks	1 per Unit	10 marks	
122.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
123.	Quiz	4 marks for each quiz	20per Unit	4 marks	
124.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
125.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
126.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
127.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
128.	Attendance and Engagement Score on BB	NA	NA	2 marks	

x) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	1	3	2	2	3	1	2	2	3
CO2	1	3	1	1	2	1	3	1	1	2	1	3	1	2	2
CO3	1	1	3	2	1	1	1	2	2	1	3	1	2	1	1
CO4	1	1	1	1	1	1	2	2	2	2	1	2	2	2	3
CO5	1	1	1	2	1	1	1	2	2	1	1	3	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	**Course Code-** 21FSH-252	Forensic Photography	3	0	2	5	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

The course begins with the basic Photography concepts of camera that could be used in forensic investigations.

b) **Course Objectives**

The students will able to understand and apply the concepts of photography in forensic investigations and for research work used in forensic photography, forensic ballistics, Dermatoglyphics and all brnaches of forensics to visual examination and documentation.

c) Course Outcomes

CO1	Establish understanding of optics, light and camera functions
CO2	Establish understanding and skills in camera operation, image composition and proper focus and exposure.
CO3	Establish understanding and skills in crime scene, vehicle, subject & evidence photography during investigative situations

d) Syllabus

Unit-1	**Introduction to Photography**	**Contact Hours: 25**
Chapter 1.1	History of photography in criminal investigations, Case law, Forensic working groups on photography, Infamous cases, Basics of light and optics, Light Temperature, Sources of light, Light intensity, Light angles, Optics	
Experiment 1.1	To study process of crime scene photography by controlling the lights	
Chapter 1.2	Camera equipment & functions, Camera body, Lenses & lens care, Hot shoe, Camera/equipment handling, Date/time, Media storage, Image files	
Experiment 1.2	Study about crime scene photography in Close range	
Chapter 1.3	Basics of focus & exposure, Exposure triangle, Focus & focus settings, Diopter adjustment, Light metering, Adjusting shutter speed, f-stop & ISO, Histograms	
Experiment 1.3	Study about crime scene photography in Far range	
Chapter 1.4	Flash Photography. Taking flash on/off, Inverse square rule, Flash mode selection, Flash sync, Flash positioning/flash cord, Flash limitations	
Experiment 1.4	Study about crime scene photography in Wide view	
Unit-2	**Crime Scene Photography**	**Contact Hours: 25**
Chapter 2.1	Principles of crime scene/evidence photography, General rules, Photo card, Over-all photos, Mid-range photos, Close-up photos, Macro photography, Use of scale	
Experiment 2.1	Study about photography at different angles	
Chapter 2.2	Vehicle & Collision Photography, General rules-"8-way" photos, VIN & License plate photos, Using flash in vehicles, Confined/small spaces photos, Marks/debris/roadway photos	
Experiment 2.2	Study about photographic concepts in indoor Crime scene	
Chapter 2.3	Subject & Injury Photography, General rules-"4-way" photos, Flash considerations for subject/injury, Use of scale and color chart, Clothing and footwear photography	
Experiment 2.3	Study about photographic concepts in outdoor Crime scene	
Unit-3	**Concept of Light**	**Contact Hours: 25**
Chapter 3.1	Principles of long exposure photography, Adjusting shutter speed, aperture & ISO, Composing long exposure photographs, Exposure evaluation, Bracketing, Common issues	

Experiment 3.1	Study about Photography using various light sources (UV)
Chapter 3.2	Principles of Painting with Light, Composing photograph, Preventing "ghosting" effect, Adding light with flash, Adding light with flashlight.
Experiment 3.2	Study about Photography using various light sources (IR)
Chapter 3.3	Fundamentals of Photography, Choosing your Camera, Use of natural light and portrait photography, Crime scene photography, Micro and Macro photography, Color Photography, Advanced Digital Photography Techniques, Crime Scene Sketching and Digital Photography, Photography Effects, Post Processing, Introduction to Photoshop
Experiment 3.3	Study about different type of lenses and filters for various type og evidences.

e) Textbooks

T1. Grewal BS, Higher Engineering Mathematics. Khanna Publishers, New Delhi. Latest Edition.
T2. A Textbook of Mathematics for XI-XII students, NCERT Publication, New Delhi. Latest Edition.
T3. Textbook of APHE by S.B Bhise Edition 6th

f) Reference Books:

R1. Textbook of Mathematics by NCERT.
R2. Basic Mathematics by David W. Novak, 1987.
R3. Basic Mathematics by Trevor Wegner, 2004.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
129.	Assignment*	10 marks	1 per Unit	10 marks	
130.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
131.	Quiz	4 marks for each quiz	20per Unit	4 marks	
132.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
133.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

134.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
135.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
136.	Attendance and Engagement Score on BB	NA	NA	2 marks	

g) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	1	3	2	2	3	1	2	2	3
CO2	1	3	1	1	2	1	3	1	1	2	1	3	1	2	2
CO3	1	1	3	2	1	1	1	2	2	1	3	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	**Course Code-** 21SHT-217	Organic Chemistry II	3	0	0	3	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE		21SHP-221					
ANTI-REQUISITE							

a) **Course Description**

The course begins with the general introduction to common organic compounds followed by methods of their preparation and reactions with different reagents. The students are then introduced to different naming reactions and their mechanistic detail.

b) **Course Objectives**

1. The course outcome is to introduce the students to common organic compounds along with their synthesis and reactions.

2. The course also attempts to familiar the students with detailed reaction mechanisms of different chemical reactions.

c) Course Outcomes

CO1	Define alkyl halides to analyze and create different reaction mechanisms and cohesive and persuasive concepts.
CO2	Illustrate appropriate information about of aryl halides to analyze and create different reaction mechanisms and cohesive and persuasive concepts.
CO3	Apply information related to alcohols to clearly present and discuss their conclusions and propose different reaction mechanisms.
CO4	Analyze information related to phenols and ethers to clearly present and discuss their conclusions and propose different reaction mechanisms and differentiate between alcohols and phenols.
CO5	Evaluate knowledge about aldehydes and ketones to create reaction mechanisms and new ideas at local and global levels.
CO6	Creating various reaction mechanisms of the aldehydes and ketones.

d) Syllabus

Unit-1	**Alkyl and Aryl Halides**	**Contact Hours: 15**
Chapter 1 **Alkyl Halides**	Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereo chemical aspects and effect of solvent; nucleophilic substitution vs. elimination. Chemical reactions of alkyl halides	
Aryl Halides	Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution: Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Chemical reactions of aryl halides Organometallic compounds of Mg (Grignard reagent) – structure, preparation and Use in synthesis of organic compounds. **Self Study: Identification of different aspects of organometallic compounds and their applications**	
Unit-2		**Contact Hours: 15**
Alcohols	Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, dehydration of alcohols, Hydrogen bonding and acidic nature of alcohol, Bouvaelt-Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol Pinacolone rearrangement. **Self Study: Identification of chemistry of alcohols and their applications**	
Phenols and ethers	Preparation, acidic character, Comparative acidic strengths of alcohols and phenols, Chemical reactions of phenols, Mechanisms of Fries rearrangement, Claisen rearrangement, Gattermansyntheis, Lederer-Manasse reaction and Reimer-Tiemann reaction Preparation of ethers, physical properties, Chemical reactions, cleavage and auto oxidation, Ziesel's method. **Self Study: Identification of different aspects of phenols chemistry and their applications**	
Unit-3		**Contact Hours: 15**

Aldehydes and Ketones	Preparation and physical properties of aldehydes and ketones; chemical reactions, Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, halo form reaction and Baeyer Villiger oxidation, oxidations and reductions (Clemmensen, Wolff-Kishner,$LiAlH_4$, $NaBH_4$, MPV). Addition reactions of α, β- unsaturated carbonyl compounds: Michael addition.	

e) Textbooks

T1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
T2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
T3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

f) Reference Books:

R1. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly & Sons (1976).
R2. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
R3. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
R4. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
R5. Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Parakashan (2010).

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
137.	Assignment*	10 marks	1 per Unit	10 marks	
138.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
139.	Quiz	4 marks for each quiz	20per Unit	4 marks	
140.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
141.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
142.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
143.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	

144.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-		3	--
CO2	3	3	3	3	-	-	-	-	-	-	-	-		3	--
CO3	3	3	3	3	-	-	-	-	3	-	-	-		3	--
CO4	-	3	-	3	-	2	-	-	3	-	-	-		3	--
CO5	-	-	3	3	-	2	-	-	3	2	-	-		3	--
CO6	-	-	3	3	-	-	-	-	3	2	-	-		3	--
Average	3	3	3	3	-	2	-	-	3	2	-	-		3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21SHP-221	Chemistry Lab-IV	0	0	2	2	PC
PRE-REQUISITE							
CO-REQUISITE		20SHT-217					
ANTI-REQUISITE							

a. Course Description

The course begins with the experimental investigation of temporary, permanent and total hardness of water. The students are then introduced to the separation of mixtures of amino acids using thin layer chromatography.

b. Course Objectives

To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory.

The practical work has been designed to give hands on experience of various analytical techniques used in chemistry.

c. Course Outcomes

Students will be able to:

CO1	Understand the fundamentals of hardness and electrical conductivity of water.
CO2	Apply and learn about chromatography techniques and synthesis of organic compounds in chemistry laboratory.
CO3	Analyze the techniques of separating organic mixture by using solvent extraction method.

d. Syllabus

Unit-1	**Water Analysis**	**Contact Hours: 10**
Experiment 1.1	Determination of the temporary and permanent hardness of given sample of water	
Experiment 1.2	Determination of the total hardness and electrical conductivity of given water sample using electrode method.	
Experiment 1.3	Determination of the sodium and potassium ions in a given sample of water/food/soil.	
Unit-2	**Chromatography**	**Contact Hours: 10**
Experiment 2.1	Separation of the mixture of unknown amino acids (minimum 2) into its various components using Thin layer Chromatographic Technique and find out the R_f value of the amino acids.	
Experiment 2.2	Separate the red and blue ink present in a given mixture by using paper chromatography.	
Experiment 2.3	(i) Preparation of acetyl ferrocene from ferrocene (ii) Separate the contents using column	
Unit-3	**Preparation and isolation**	**Contact Hours: 10**
Experiment 3.1	Preparation of oxime of aldehyde/ketone.	
Experiment 3.2	Preparation of 2,4-dinitrophenyl hydrazone of aldehyde/ketone.	
Experiment 3.3	Diazotization/Coupling: Preparation of Methyl orange/methyl red.	
Experiment 3.4	Isolation of caffeine from tea leaves.	

e. Textbooks / Reference Books

T1 Bassett, J; Denney, RC and Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th ed., Orient Longman.

f. Reference Books

R1 Svehla, G andSivasankar, B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Edition,Pearson

Assessment Pattern - internal and external

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Practical worksheet (in journal category) and class room learning	20 marks for each experiment	8-10 Experiments	40 marks	Depending upon the no. of experiments
2	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments
3	Discussion Forum/ Short digital assignment/ Journal to submit design	4 marks for each task	1 per semester	4 marks	
4	Presentation	-------		Non graded Engagement Task	
5	Attendance and BB Engagement score	-------		4 marks	End semester

CO-PO-PSO Mapping

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	3	3	-	-	-	3	-	3	3	-	3	-
CO2	3	3	3	3	3	-	-	-	3	-	3	3	-	3	-
CO3	3	3	3	3	3	-	-	-	3	-	3	3	-	3	-

Average	3	3	3	3	3	-	-	-	3	-	3	3	-	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
5	**Course Code-** 21FSH-254	Development and reproduction of flowering plants	2	0	2	4	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

The course begins with introduction to vegetative reproduction and its types found the plants. The students are then introduced to developmental processes which help in development of angiosperms.

b) **Course Objectives**

The basic objective of this paper is to make students aware about the development and reproduction in flowering plants.

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c) Course Outcomes

CO1	conclude about vegetative reproduction
CO2	illustrate about male and female gametophyte
CO3	Summarize about endosperm formation
CO4	conclude about structure of seed

d) Syllabus

Unit-1	**Vegetative Reproduction and Apomixis**	**Contact Hours: 15**
Chapter 1.1	Vegetative Reproduction: Meaning, Various methods of vegetative propagation (Natural and artificial) and the affecting factors and applications in floriculture and horticulture.	
Experiment 1.1	Angiosperms: Description of flowers in technical terms.	
Chapter 1.2	Apomixis: A brief account. Apomixis: introduction, classification, causes and applications. Structure of a typical flower. Structure of anther and pistil	
Experiment 1.2	Drawing Floral Diagram, V.S. flower, T.S. ovary and writing Floral Formula with reference to the respective families of the genera mentioned in different families in theory syllabus.	
Chapter 1.3	Flower development: genetic and molecular aspects.	
Experiment 1.3	Examination of flowers for their pollination mechanism (*Salvia, Ficus*, *Calotropis*, *Triticum*).	
Unit-2	**Male and female gametophyte**	**Contact Hours: 15**
Chapter 2.1	Structure and development of Male and female gametophytes.	
Experiment 2.1	Structure of stamens, internal structure of anther and pollen grains of any plants (using whole mounts).	
Chapter 2.2	Types of pollination, advantages and disadvantages of self and cross-pollination; contrivances for self and cross-pollination, various agencies to bring about cross-pollination, characters of flowers pollinated by different agencies; Pollen-pistil interaction, Self-incompatibility	
Experiment 2.2	1. Study of pollinia in Calotropis.	
Chapter 2.3	Double fertilization and its significance; different types of ovules and embryo-sacs.	
Experiment 2.3	1. Study of Pollen viability using glycero-acetocarmine.	
Unit-3	**Post fertilization changes and Seed structure**	**Contact Hours: 15**
Chapter 3.1	Post fertilization changes: Endosperm: formation, Types and structure and embryo development in monocots and dicots	
Experiment 3.1	Study of Nuclear and cellular endosperm. (Permanent slides	
Chapter 3.2	Seed structure, development, Dormancy and seed dispersal; Parthenocarpy.	
Experiment 3.2	Study of monocot and dicot embryos. (Permanent slides).	

Chapter 3.3	Fruit Structure and types.
Experiment 3.3	Testing percentage seed viability through tetrazolium chloride and actual seed germination
Experiment 3.4	Study of fruit types and seed types.

d) Textbooks

T1Bhojwani, SS and Bhatnagar, SP. 2000.The Embryology of Angiosperms, 4th Ed., Vikas Publishing House, Delhi.

T2 Davis, GL. 1966. Systematic Embryology of Angiosperms, 1st Ed., John Wiley & Sons New York, USA.

T3 Fagergi, K and Van der Pijl. 1979.The Principles of Pollination Ecology, 1st Ed., Pergamon Press, Oxford.

T4 Hartmann, HT and Kestler, DE. 1976.Plant Propagation: Principles and Practices, 2nd Ed., Prentice-Hall of India Pvt. Ltd., New Delhi.

Reference Books

R1 Larsten, NR. 2008. Flowering Plant Embryology, 2nd Ed., John Wiley & sons, New York, USA.

R2 Pullaiah, T. 2001. Text Book of Embryology of Angiosperms, 4th Ed., Regency Publications, New Delhi.

R3 Steeves, TA and Sussex, IM. 1989. Patterns in Plant Development, 2nd Ed., Cambridge University Press, Cambridge.

e) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	60	40
Total Marks	100	

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

Internal Evaluation Component

S. No.	**Type of Assessment**	**Weightage of actual conduct**	**Frequency of Task**	**Final Weightage in Internal Assessment**	**Remarks**

1	Assignment	10 marks of each assignment	One per unit	10 marks	
2	Time Bound Surprise/ tutorial test	12 marks for each test	One per unit	4 marks	
3	Quiz	4 marks of each unit	2 per unit	4 marks	
4	Mid-Semester Test	20 marks for one MST	2 per semester	20 marks	
5	Presentation			Non graded Engagement task	
6	Homework	NA	One per lecture topic (of 2 questions)	Non graded Engagement Task	
7	Discussion Forum	NA	One per chapter	Non graded Engagement task	
8	Attendance and Engagement Task on BB	NA	NA	2 marks	

f) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	2	2	2	2	1	2	3	3	3
CO2	2	3	3	3	2	2	2	2	1	2	1	2	3	3	3
CO3	3	3	3	3	2	3	2	2	2	2	1	2	3	3	3
CO4	2	3	3	3	2	2	2	2	1	2	1	2	3	3	3

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
6	**Course Code-** 21FST-255	**Animal Physiology**	2	0	0	2	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

The course provides knowledge about the digestion, excretion, respiration, blood, heart, muscles, neural integration, reproduction and endocrine system.

b) **Course Objectives**

The basic objective of this paper is to make students aware about the animal physiology

c) Course Outcomes

CO1	Assess appropriate information about digestion, respiration and excretion to analyze and create cohesive and persuasive concepts.
CO2	Conclude information and problems related to blood, heart and muscles and apply these strategies for alleviation to analyze, create and propose designed concepts.
CO3	Summarize knowledge about neural integration, physiology of behavior and endocrine glands and apply that knowledge to create new ideas.
CO4	Described the mechanism of circulation and composition of blood
CO5	Relate the integration of the cardiovascular and respiratory systems and their overall control
CO6	Compare the different energy requirements of an animal at rest and during exercise, and how this is reflected in the regulation of the oxygen transporting systems

d) Syllabus

Unit-1	**Digestion, excretion and respiration**	**Contact Hours: 15**
Chapter 1.1	Digestion of dietary constituents, regulation of digestive processes and absorption. types of nutrition, feeding mechanism, Extra and intra cellular digestion, enzymatic digestion and symbiotic digestion. Urine formation and osmoregulation. Chemical nature of nitrogenous wastes, Control of excretion.	
Chapter 1.2	Transport of O2 and CO2, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride (-) shift, Haldane effect and control of breathing.	
Unit-2	**Blood, heart and muscle**	**Contact Hours: 15**
Chapter 2.1	Composition and functions of blood and lymph. molecular structure and function of haemoglobin, blood flow and its regulation, Blood clotting. Blood groups including Rh factor, haemopoiesis and haemostasis. .	
Chapter 2.2	Physiology of heart,origin and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, Blood pressure and micro-circulation. Ultrastructure, chemical and physiological basis of skeletal muscle contraction.	
Unit-3	**Post fertilization changes and Seed structure**	**Contact Hours: 15**
Chapter 3.1	Structure of neuron, resting membrane potential, Action potential, Origin and propagation of impulse along the axon, synapse and myoneural function. Structures of gonads and physiology of reproduction.	
Chapter 3.2	Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus, pituitary, Thymus, pineal, pancreas and gonads, hormones of alimentary canal and kidney.	

e) Textbooks / Reference Books

T1Dhami, PS and Dhami JK.1998. Vertebrates,5th Ed., R. Chand & Co., New Delhi.
T2 Taneja, SK.1997. Biochemistry & Animal Physiology,7thEd.,Trueman Book Co.

R1Guyton, AS.1994. Text Book of Medical Physiology, 7th Ed., W.B. Saunders Company.
R2 Robert, K; Murray; Mayes Daryl; K. Granner; Victor, W and Woodwell.1990. Harper's Biochemistry, 22ndEd., Prentice Hall International Inc..

f) Assessment Pattern - internal and External

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

g) Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Assignment	10 marks of each assignment	One per unit	10 marks	
2	Time Bound Surprise/ tutorial test	12 marks for each test	One per unit	4 marks	
3	Quiz	4 marks of each unit	2 per unit	4 marks	
4	Mid-Semester Test	20 marks for one MST	2 per semester	20 marks	
5	Presentation			Non graded Engagement task	
6	Homework	NA	One per lecture topic (of 2 questions)	Non graded Engagement Task	
7	Discussion Forum	NA	One per chapter	Non graded Engagement task	
8	Attendance and Engagement Task on BB	NA	NA	2 marks	

h) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	0	0	1	1	0	1	2	0	0	0	0	0	0	0	0
CO5	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO6	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
7	**Course Code-** 21FSH-256	**Physics of Atoms & Molecules**	2	0	2	4	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the study of hydrogen atom and quantum numbers. The students are then introduced to Magnetic Moment of electron, Space Quantization and Stern-Gerlach Experiment. The course furtheremphasizes on the concept Pauli's Exclusion principle, Symmetric and Antisymmetric Wave functions and molecular bond

b) Course Objectives

The course attempts to address the specific topics relevant to Physics.

The focus is on the basic concepts with introduction of some advanced topics and applications in Physics.

c) Course Outcomes

CO1	Describe, derive and formulate S.W.E for the hydrogen atom, Separation of variables, Quantum numbers, Principle quantum number, Orbital quantum number.
CO2	Determine Magnetic quantum numbers, nuclear atom, Electron orbits, Atomic spectra, Bohr atom, Energy levels and spectra.
CO3	Learn and apply the knowledge of Electron Magnetic Moment, Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton, Angular Momentum, Space Quantization.
CO4	To understand electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment and Stern-Gerlach Experiment.
CO5	Describe and explain the concept of Electron spin, Pauli's Exclusion principle, Symmetric and Antisymmetric Wave functions.
CO6	To understand Periodic table, Atomic Structures, Spin-orbit coupling Spectral Notations for Atomic States, molecular bond, Electron sharing, The hydrogen molecule and Complex molecules.

d) Syllabus

Unit-1	**Algebra and Matrix**	**Contact Hours: 10**
Chapter 1.1	**Atomic Structure** The nuclear atom, Electron orbits, Atomic spectra, Bohr atom, Energy levels and spectra, Correspondence principle, Nuclear motion, Atomic excitation.	
Chapter 1.2	Schrodinger Wave Equation for the hydrogen atom, Separation of variables	
Chapter 1.3	**Hydrogen Atom,** Quantum numbers, Principle quantum number, Orbital quantum number, Magnetic quantum number, The uncertainty principle and space quantization, Radiative transitions, Selection rules	
Unit-2	**Atom in Electric and Magnetic fields**	**Contact Hours: 15**
Chapter 2.1	Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton	
Chapter 2.2	Electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment	
Chapter 2.3	Angular Momentum, Space Quantization, Stern-GerlachExperiment.Zeeman Effect (normal and anomalous)..	
Unit-3	**Many electron atoms and molecules**	**Contact Hours: 15**
Chapter 3.1	**Many electron atoms** Electron spin, Pauli's Exclusion principle, Symmetric and Antisymmetric Wave functions, Periodic table, Atomic Structure	
Chapter 3.2	**Molecules** Spin-orbit coupling Spectral Notations for Atomic States. Total Angular Momentum, Vector Model. Spin-orbit coupling in atoms-L-S and J-J coupling.	
Chapter 3.3	**Molecules** The molecular bond, Electron sharing, The hydrogen molecule, Complex molecules, Rotational Energy levels, Vibrational Energy levels, Electronic Spectra of molecules	

e) Text Books

T1 Beiser A, Ghatak A, Garg S.C., Applied Physics, Edition 1st, (2013), Tata Mc graw Hill, Noida.

T2Beiser A, Concepts of Modern Physics, Edition 6th, (2003), Tata Mc graw Hill, Noida.

T3 Mani H.S. and Mehta G.K, Introduction to Modern Physics, Edition 1st, (1990), East-West Press, New Delhi.

T4Ghatak A, Lokanathan S, "Quantum Mechanics, Theory and Applications", Edition 5th (2004), Macmillan India Ltd., New Delhi.

f) REFERENCE BOOKS

R1 Powell J.L, Crasemann B, Quantum Mechanics, Edition 1st (1990), Narosa Publishing House, New Delhi.

R2 Mathews P.M, Venkatesan K, "A Text Book of Quantum Mechanics", Edition 2nd (2002), Tata McGraw Hill Pub. Co. Delhi.**Assessment Pattern- internal and External**

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
9.	Assignment*	10 marks	1 per Unit	10 marks	
10.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
11.	Quiz	4 marks for each quiz	20per Unit	4 marks	
12.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
13.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

14.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
15.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
16.	Attendance and Engagement Score on BB	NA	NA	2 marks	

a. CO-PO-SO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	1	1	1	2	2	1			1
CO2	3	3	3	2	3	3	1	1	1	2	2	1			1
CO3	3	3	3	2	3	3	1	1	1	2	2	1			1
CO4	3	3	3	2	3	3	1	1	1	2	2	1			1
CO5	3	3	3	2	3	3	1	1	1	2	2	1			1
CO6	3	3	3	2	3	3	1	1	1	2	2	1			1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
8	**Course Code-** 21FST-257	Probability and Statistics	2	0	0	2	PC
PRE-REQUISITE		+2 Medical/Non Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

This course covers the fundamentals of Probability and Statistics: random variables, discrete and continuous random variable probability distributions, testing of hypothesis, conditional probability bayes theorem and joint distributions. It shows the utility of abstract concepts and teaches an understanding and construction of proofs

b) Course Objectives

This course presents a rigorous treatment of fundamental concepts in probability and statistics. To introduce students to the fundamentals of mathematical theory and writing mathematical formulation, the course objective is to understand the axiomatic foundation of the probability, in particular the notion of statistics and some of its consequences.

c) Course Outcomes

CO1	Remember and understand the concept of probability analyse the Random Variable.
CO2	Applyto solve the problems and create the moment generating function for continuous random variable.
CO3	Identify and illustrate various probability distribution and solving related problems and analyse testing of hypothesis.
CO4	Developthe problem of Baye's theorem to apply in industry problem
CO5	Identify and illustrate the fundamentals of joint distribution.
CO6	Analyse the data for kurtosis andskewness create a problem for chebyshev problem

d) Syllabus

Unit-1	**Notion of probability, Discrete and Continuous random variable**	**Contact Hours: 25**
Chapter 1.1	Random experiment, sample space, axiom of probability, elementary properties of probability, equally likely outcome problems. Concept, cumulative distribution function.	
Chapter 1.2	Discrete and continuous random variables, expectations, mean, variance, moment generating function. Bernoulli random variable, binomial random variable, generic random variable, Poisson random variable	
Chapter 1.3	Uniform random variable, exponential random variable, Gamma random variable, normal random variable.	
Unit-2	**Probability Distribution, Testing of Hypothesis, Baye's theorem**	**Contact Hours: 25**
Chapter 2.1	Binomial, Poisson and Normal Distribution.	
Chapter 2.2	Chi-test and t-test, F-test Conditional probability and conditional expectations, Baye's theorem, independence, computing expectation by conditioning, some applications–a list model, a random graph, Polya's urn model.	
Chapter 2.3	Baye's theorem, independence, computing expectation by conditioning, some applications–a list model, a random graph, Polya's urn model.	
Unit-3	**Bivariate and Functions of random variables, Mathematical Expectation**	**Contact Hours: 25**
Chapter 3.1	Joint distribution joint and conditional distributions, the correlation coefficient Sum of random variables.	
Chapter 3.2	The law of large numbers and central limit theorem, the approximation of distributions.	
Chapter 3.3	Skewness, Kurtosis, Moments	

e) Textbooks / Reference Books
TEXTBOOKS

T1Ross S. M., Introduction to Probability Models, Edition 6th, Academic Press, 1997.

T2 Murray R.S. et al., Probability and Statistics3rd edition, Schaum's Series ISBN 0070151547, 9780070151543, 2010

f) REFERENCE BOOKS

R1Blake I., An Introduction to Applied Probability, John Wiley & Sons.

R2Yagolam A. M. and Yagolam I. M. 1983.Probability and Information, Hindustan Publishing Corporation, Delhi.

g) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h. CO-PO-SO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	1	2	2	1	1	1		3	
CO2	3	3	2	3	2	1	2	2	1	2	2	3		3	
CO3	3	2		1	2	3	2	3	2	1	2	2		3	
CO4	3	3		3	3	2	1		2	2	2	1		3	

CO5	3	3	2	2	1	1	3	2	3	1	3			3	
CO6	3	3	2	1	1	3	2	1		2	1	2		3	

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
8	Course Code- 21UCT202	Ethics and Gender Equality	1	0	0	1	UC-MNG
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a. Course Description

This course is designed to make the students aware about ethics as part of a value system for individual life. They are also expected to abide and observe ethics as morally upright professionals. The course introduces the basic concepts of professional ethics, code of conduct, moral responsibilities and dilemmas confronting graduates in their profession.

The course also sensitizes the graduates to important gender issues and gender equality as a goal in itself as it is a precondition for reducing poverty, promoting sustainable development and building good governance.

b. Course Objectives

1. Sensitize students to ethics, values and moral dilemmas, professional ideals and Virtues.
2. Aims at preparing the students to face gender related diversity including sensitization to gender relationships, equality, gender identities etc.
3. An understanding of the gender issues will enable the students to develop good inter-personal skills in the society as well as at the workplace.

c. Course Outcomes

The students will be able to:

CO1	Understand perceptions on ethics, values, and moral dilemmas as a significant aspect of life.
CO2	Apply the code of ethics and appreciate gender diversity in their social and professional environment.
CO3	Analyse gender as a socio-cultural, ideological construct essential for sustainable development of society.

d. Syllabus

Unit-1	**Ethics**	Contact Hours: 5
Ethics	Concept of Ethics and Values, Code of Ethics, Scope of Ethics, Uses of Ethics, Moral Dilemma and Moral Autonomy.	
Professional Ethics	Concept and types; Environmental Ethics and Cyber Ethics & Whistle Blowing	
Unit-2	**Gender Equality**	Contact Hours: 5
Gender Introduction	Understanding Gender Gender: Definition, Nature, Tradition and Culture, Gender Disparity, Gender based division of labour; Alternate Gender Identities: Third gender Space and LGBTQ identities.	
Gender Equality	Contemporary Perspectives 1. Sexual Harassment and Domestic Violence: Eve Teasing, Child Abuse, Workplace Harassment 2. Gender Equality and Justice, Human Rights. 3. Masculinity- Contribution of men in women empowerment.	
Unit-3	**Cross-Cutting Issues**	Contact Hours: 5
Cross-Cutting Issues	**Seminar on the following:** 1. Gender Emerging Issues in Education, Poverty, Health, Employment, Policy Making 2. Strategies for Bridging the gender gap 3. Women Empowerment Goals (Goal 5 - UNO)	

e. Textbooks / Reference Books

R1 Subramainam, R (2013) Professional Ethics, Oxford University Press, New Delhi.

R2 Kathy Davis, Mary Evans, Judith Lorber (Eds.) (2009) Handbook of Gender and Women's Studies, SAGE Publications Ltd

R3 Grewal, I, Kaplan, C. (2006) An Introduction to Women's Studies: Gender in a Transnational World, McGraw-Hill Education,

R4 Melissa J. Gillis, Jacobs, A. (2016) Introduction to Women's and Gender Studies: An Interdisciplinary Approach, Oxford University Press.

f. Assessment Pattern- Internal and External

The performance of students is evaluated as follows:

	Theory

Components	Internal Assessment	Mid Term Assessment	End Term Examination
Marks	0	0	100
Total Marks	100		

Internal Evaluation Component

S No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	MCQ Exam	100	1	100	End Term Exam

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Theory (TH)	Ability Enhancement Category University Core (UC)	Non-Graded	MCQ based

g. CO-PO Mapping (Engineering)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1								3				
CO2								3				
CO3												

Faculty Incharge- Dr. Ashita Chadha (E-7691), UILAH, 814665156

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
9	Course Code- 21UCT-204	Life Skills and Mentoring-4	0	1	0	1	UC-MNG
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION	
This course will help students to Being able to communicate effectively, can lead them to become more assertive, have better relationships, able to express your views clearly and firmly, but without aggression	
COURSE OBJECTIVES	
1	**Building Relations –** Strengthen communication skills and learn how to build healthy relationships, building relationships by influencing interactions either positively or negatively

2	**Social Competencies -** The use of social media in education provides students with the ability to get more useful information, to connect with learning groups and other educational systems that make education convenient. To acquire the knowledge of nonviolent skills to resolve the conflict and to cultivate interpersonal communication skills
3	**Value Inculcation –** To understand self to create an open mind and recognition of the strengths of the self and others.

COURSE OUTCOMES

On completion of this course, the students will able to

21UCT204.1	Demonstrate appropriate communication behavior to enhance self-representation
21UCT204.2	Make use of effective interpersonal communication in a variety of settings.
21UCT204.3	Interpret the positive and negative consequence of utilizing media
21UCT204.4	Build the key concepts of managing and resolving conflicts.
21UCT204.5	Appraise, accept and appreciate of one's qualities from the inside and will understand self to create an open mind and recognition of the strengths of the self and others.

TEXT BOOKS

REFERENCE BOOK

R1	Interpersonal Communication by Richard West and Lynn H. Turner	**2019**
R2	Managing Conflict: A Practical Guide to Resolution in the Workplace by David Liddle	**2017**

COURSE CONTENTS		**Total Contact Hours:12**
Unit I	**Knowing Others**	**6 Hour**
Chapter 1	**Effective communication**- Importance of effective communication, improving effective communication skills, Communicate effectively by staying calm under pressure.	**2 Hour**
Chapter 2	**Effective Interpersonal Interaction**-Understanding Relationships, What are examples of good interpersonal skills, Good interpersonal skills, How Do You Show Good Interpersonal Skills	**2 Hour**
Chapter 3	**Family communication-** Effective Communication Skills can help prevents misunderstandings, Verbal and non-verbal techniques for effective communication, Effective Communication Skills can help you become more comfortable with family.	**2 Hour**
Unit 2	**Social Competencies**	**4 Hour**
Chapter 4	**Effective use of Media-** advantages and disadvantages of social media, ethics and etiquettes, effective ways of using social media , ethics and etiquettes for online Classes	**2 Hour**
Chapter 5	**Conflict Resolution**-Understanding Conflict Management, Strategies to avoid Conflicts, Tips for Managing Conflict	**2 Hour**
Unit 3	**Values**	**2 Hour**
Chapter 6	**Humility:** Understanding Humility, importance of humility, why does humility matters, developing and cultivating humility	**2 Hour**

Mode of Evaluation: The performance of students is evaluated as follows:

	Life Skills and Mentoring	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**

Marks	40	60
Total Marks	100	

CO-PO Mapping												
	PO1Engineering Knowledge	**PO2 Problem analysis**	**PO3 Design/development of solutions**	**PO4Conduct investigations of complex problems**	**PO5 Modern tool usage**	**PO6 The engineer and society**	**PO7 Environment and sustainability**	**PO8 Ethics**	**PO9 Individual or team work**	**PO10 Communication**	**PO11 Project management and finance**	**PO12 Life-long Learning**
21UCT204.1	-	-	-	-	-	1	-	-	1	1	-	3
21UCT204.2	-	-	-	-	-	1	-	-	1	1	-	3
21UCT204.3	-	-	-	-	-	-	-	-	1	1	-	3
21UCT204.4	-	-	-	-	-	-	-	-	1	1	-	3
21UCT204.5	-	-	-	-	-	3	-	3	1	1	-	3
1=addressed to small extent			2= addressed significantly						3=major part of course			

Syllabus Designed By	**Approved By**
Navneet Kaur (E7283)	**Director, Students Welfare**

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Theory (TH)	Ability Enhancement Category University Core (UC)	Non Graded	MCQ based

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
9	Course Code- 21TDP281	SOFT SKILLS	0	0	2	2	UC-MNG
PRE-REQUISITE		Semester 3 Soft Skills					
CO-REQUISITE							
ANTI-REQUISITE							

COURSE OBJECTIVE	
1	To improve the student's teamwork and collaborative skills when being a part of a group or a team working towards a shared and common goal or purpose.
2	To improve the verbal and non-verbal communication skills of the students when interacting with colleagues and professionals.
3	To understand the job-interview process by engaging in group discussions, interacting with the trainer, and researching the topics and lessons shared by the soft skills trainer.

COURSE OUTCOME	
By the end of the course the students will be able to	
CO1	Effectively interact with colleagues and professionals using their verbal and non-verbal communication skills.
CO2	Adeptly implement their analytical, critical and creative thinking skills for achieving their goals and completing any assigned tasks
CO3	Be an effective team member working towards a shared and common goal or purpose.
CO4	Gain knowledge and the soft skills to meet the requirements of recruiters and hiring managers.

COURSE CONTENTS		
	UNIT I	**5 Hours**
1	Refreshing Revision	
2	Quotable Quotes	
3	Round Table Visitation	
4	Prologue Practice	
5	Trending Tech News	
	UNIT II	**5 Hours**
6	Coveted Communications	
7	Outstanding Orators	
8	Showcasing a Presentation	
9	Job Designation Justification	
10	Lively Discussions	
	UNIT III	**5 Hours**
11	Gutsy Grammar	
12	Competing Competencies	
13	Implicit Inference	
14	Self-Analysis	
15	Concluding Confabulation	

TEXT BOOK	
T1	Chandigarh University Text Book-Comprehending Verbal Ability for Success

REFERENCE BOOKS	
R1	Wren & Martin High School English Grammar and Composition Book (Regular Edition)
R2	How to Win Friends and Influence People by Dale Carnegie
R3	How to Talk to Anyone by Leil Lowndes
R4	Group Discussion (PDF) by javaTpoint

MODE OF EVALUATION		
Code	Soft Skills	
Components	Continuous Internal Assessment (CAE)	Semester End Examination (SEE)
Marks	60	40
Total	100	

CO-POMAPPING

	PO1 Forensic knowledge	PO2 Individual and team work	PO3 Ethics	PO4 Communication	PO5 F Sustainability	PO6 Conduct investigations of complex problems	PO7 Modern tool usage	PO8 Lifelong Learning	PO9 Design/development of solutions	PO10 Forensic scientists and society	PO11 Adoption of new skill for future employment	PO12 Innovation and Entrepreneurship	PSO1	PSO2
21TDP-281.1	0	0	0	3	0	0	0	1	0	0	1	0	0	0
21TDP-281.2	0	1	0	3	0	1	1	0	2	0	2	0	0	0
21TDP-281.3	0	0	0	1	0	0	0	1	0	0	0	1	0	0
21TDP-281.4	0	2	1	1	0	2	1	2	2	0	0	2	0	0
21TDP-281; Consolidated	0	3	2	8	0	3	2	4	4	0	3	3	0	0

0 = does not address	1 = addressed to small extent	2 = addressed significantly	3 = major part of the course

Syllabus Designed by:	**Approved by:**
Jaskiran (E3844)	**Pardeep Kr. Bansal**
Name with Employee Code	**HoD (DCPD)**

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
10	**Course Code- 21TDT-282**	**Aptitude**	0	2	0	2	Ability Enhancement
PRE-REQUISITE		Basic Mathematics and Reasoning					
CO-REQUISITE							
ANTI-REQUISITE							

COURSE DESCRIPTION			
To generate problem solving skills, counting techniques, ability to analyze the situation, demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions with logical thinking and applying decision making in all national and international projects			
COURSE OBJECTIVES			
1	To develop the understanding of basic rules of logic, including critical thinking, Data analyzing techniques, mathematical analysis, and formulate mathematical models of such problems		
2	To apply mathematical methodologies to open-ended real-world problems		
COURSE OUTCOMES			
On completion of this course, the students will able to			
21TDT282.1	To define, understand the basic knowledge of Numbers, percentage, time and work, speed and distance, building base of arithmetic via and explain the concepts of quantitative aptitude and logical reasoning.		
21TDT282.2	To apply the concept of Vedic Mathematics to find squares, cubes ,roots, the types of Simple and Compound annual growth to solve MCQs faster by the application of shortcut methods.		
21TDT282.3	To analyse the data in a bar graph, pie chart and tabular column and line graph and the combination of data given in the graphical format and infer the results.		
21TDT282.4	To develop the ability to apply the concepts of time and work, time seed distance, probability and its applications in real life scenarios.		
21TDT282.5	To effectively solve problems of profit and loss and problems related to average, direction sense and extend the application shortcuts in such topics as simple interest, compound interest and profit and loss		
TEXT BOOKS			
T1	CU-DCPD_Building Blocks of Aptitude	**9th Edition**	**2021**
REFERENCE BOOKS			
R1	Guha Abhijit: Quantitative Aptitude for Competitive Examinations , Tata McGraw Hill Publication	**8th Edition**	**2018**
R2	Aggarwal R.S: A Modern Approach to Verbal and Non Verbal Reasoning 2012	**11th Edition**	**2018**
COURSE CONTENTS			
Unit I			**10 Hrs**
Chapter 1.1	**Ratio, Proportion and Variation:** Concept of ratio; Concept of proportion; Combining ratios; Word problems on ratios; Concept of Direct & Indirect variation between two variable; Equating the constant of variation		**2 Hrs**

Chapter 1.2	**Problem on Ages:** Application of concept of ratio on problems of ages related to past and future; Understanding of linear equations; Application of shortcut tricks	**2 Hrs**
Chapter 1.3	**Partnership:** Dividing profit into ratio of investments; Partial time related problems	**2 Hrs**
Chapter 1.4	**Blood relation:** Concept of symbol representation of blood relations; Family tree based concepts; Basic problems on above mentioned concepts	**2 Hrs**
Chapter 1.5	**Analytical Reasoning:** To analyze the given figure; Find the mirror images and water images; Finding missing term after analyzing the givendata	**1 Hrs**
Chapter 1.6	**Non Verbal Reasoning:** Finding the pattern for next figure; Finding missing figure; Finding the missing images; Problems on cutting and folding paper.	**1 Hrs**
Unit 2		**10 Hrs**
Chapter 2.1	**Mixture and Alligation:** Concept of Alligation; Concept of mixing two or more things; Continuous replacement problem	**2 Hrs**
Chapter 2.2	**Sequence and Series:** Introduction to AP, GP and HP; Relationship between mean of AP, GP and HP; Sum and nth term of each; Applications of above mentioned concepts.	**2 Hrs**
Chapter 2.3	**Seating Arrangements:** Problem on linear arrangements; Problems on Circular arrangements	**1 Hrs**
Chapter 2.4	**Puzzle:** Solving the puzzles; Arrangement problems of matrix.	**1 Hrs**
Chapter 2.5	**Clocks & Calendars:** Concept of angles traversed by hour and minute hand; Fundamental problems on above concept; To find day of week on a given date; Problems based on data sufficiency.	**4 Hrs**
Unit-3		**10 Hrs**
Chapter 3.1	**Logarithm:** Properties of logs; Application of these properties in different problems; Problems based on data sufficiency.	**2 Hrs**
Chapter 3.2	**Cubes & Dice:** Solving problems related to cube cutting painting; Basic problems related to dice faces in different shapes and sizes; Problems based on data sufficiency.	**2 Hrs**
Chapter 3.3	**Eligibility Test:** To decide among the given alternatives after assessing the given data for eligibility of candidate	**2 Hrs**
Chapter 3.4	**Input Output:** Understanding the logic of given steps of input to get required output	**2 Hrs**
Chapter 3.5	**Surface Area and Volume:** Concept of curved and total surface area of different 3-D problems; Concept of volume of 3-D figures; Different properties of 3-D figures; Problems based on above mentioned concepts Problems based on data sufficiency.	**2 Hrs**

Mode of Evaluation: The performance of students is evaluated as follows:

21TDT282	**Aptitude**	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

CO-PO Mapping														
	PO1 Forensic knowledge	**PO2 Individual and team work**	**PO3 Ethics**	**PO4 Communication**	**PO5 F Sustainability**	**PO6 Conduct investigations of complex problems**	**PO7 Modern tool usage**	**PO8 Lifelong Learning**	**PO9 Design/development of solutions**	**PO10 Forensic scientists**	**PO11 Adoption of new skill for future employment**	**PO12 Forensic scientists and society**	**PSO1**	**PSO2**
21TDT282.1			3					3						
21TDT282.2			3					2						
21TDT282.3			2					3						
21TDT282.4			3					2						
21TDT282.5			3					2						
21TDT282 Consolidated			2.8					2.4						

1=addressed to small extent	2= addressed significantly	3=major part of course

Syllabus Designed By	**Approved By**
Name with Employee Code	**Director (DCPD)**

SEMESTER V

For 10+2 Medical/Non-Medical

Semester-V														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-301	Forensic Psychology	3	0	0	3	3	Ability Enhancement	20	20	60				100
21FSH-302	Forensic Ballistics	3	0	2	4	5	Core	20	20	60	40	20	40	200

21SHT-123	Physical Chemistry-I	3	0	0	3	3	Core	20	20	60	40	20	40	200
21SHP-320	Chemistry Lab-V	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FST-###	Program Elective Basket-I/III	3	0	0	3	3	Elective	20	20	60				100
21FST-###	Program Elective Basket-II/IV	3	0	0	3	3	Elective	20	20	60				100
21***-***	Open Elective**	3	0	0	3	3	Elective	20	20	60				100
21FSI-308	Institutional/ Industrial training (Summer)	0	0	0	3	0	Project				45		55	100
21UCT-205	Environmental Science, Waste and Disaster Management	2	0	0	2	2	Ability Enhancement	20	20	60				100
Total Credit					**25**	**24**								
Cumulative Credit					**108**									

Note:**The course code for Open elective will be selected from University Open Elective Basket.
Student should select at least one value added subject per semester from the basket.
Student will select total of 3 Credits from the Ability Enhancement Basket.

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FST-301	Forensic Psychology	3	0	0	3	Ability Enhancement
PRE-REQUISITE							
CO-REQUISITE							

ANTI-REQUISITE		

y) Course Description

The course starts with the introduction to the concepts related to the three states of matter viz. solid, liquid and gas. The course further introduces the concepts of Thermodynamics and Ionization.

z) **Course Objectives**

The Course attempts to address the overview of forensic psychology, its applications and the legal aspects of forensic psychology.

The focus is more on the significance of psychological assessment in gauging criminal behaviour and the tools and techniques required for detection of deception.

aa) Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	the behaviour of criminals, its causes and remedies.
CO2	Role of psychological professionals in the field of forensic and criminal matters.
CO3	Develop appropriate analytical techniques for psychological p3rofessionals.

bb) Syllabus

Unit-1	**INTRODUCTION AND OVERVIEW OF FORENSIC PSYCHOLOGY**	**15 Hours**
Chapter 1.1	Nature, definition, scope, and history of Forensic Psychology. Professional training and education in forensic psychology	
Chapter 1.2	Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology.	
Chapter 1.3	Forensic psychology in India, Ethical & legal issues in forensic practice.	
Unit-2	**The Victim**	**15 Hours**
Chapter 2.1	Victimization, Impact of crimes on victims, Factors affecting for victimization. Ethical & legal issues in forensic practice. Genetics and Crime,Serial murders, Modus Operandi.	
Chapter 2.2	Psychopathology and personality disorder. Psychological assessment and its importance. Serial murderers. Psychology of terrorism. Biological factors and crime – social learning theories, psycho-social factors, abuse. Juvenile delinquency – theories of offending (social cognition, moral reasoning), Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies.	
Chapter 2.3	Civil and criminal case assessment. Forensic psychology in India. The Psychologists as an expert witness.	
Unit-3	**Assessment and Evaluation in Forensic Psychology**	**15 Hours**
Chapter 3.1	Crime scene and investigation, Investigative interviewing: Interviewing vulnerable witnesses, Interviewing suspects, Neurobiological forensic testing and investigation.	

Chapter 3.2	Forensic methods in detection of crime-forensic methods of distortion in eye & ear witnesses, Competence to stand trial and use of psychological tests.
Chapter 3.3	Forensic aspects of memory & recall in children, adolescents and adults, Polygraph, Narco-analysis, BEOSP, Forensic assessment & treatment of sexual offenders & their victims.

cc) Textbooks

T1. Forensic Science in Criminal Investigation & Trials – B.R.Sharma
T2. The Hand Book of Forensic Psychology – Weiner Hass
T3. Hand Book of Forensic Psychology – O' Donohue Levensky

T4. Brain Experience – C.R.Mukundan

Reference Books:

R1. Criminal Profiling – B.Turvey
R2. Investigative Forensic Hypnosis – J. Niehans

R3. Hand Book of Polygraph Testing – M.Kloinen).
R4. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).

dd) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
145.	Assignment*	10 marks	1 per Unit	10 marks	
146.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
147.	Quiz	4 marks for each quiz	20per Unit	4 marks	
148.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
149.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
150.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	

151.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
152.	Attendance and Engagement Score on BB	NA	NA	2 marks	

ee) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FSH-302	Forensic Ballistics	3	0	2	5	PC
PRE-REQUISITE							
CO-REQUISITE							

ANTI-REQUISITE		

Course Description

The course begins with the theoretical study of concept of firearms, history of firearms, their working, firing mechanism, types of firearms, different mechanisms and identification of firearms. The students are then introduced to different type of ammunitions used in firearms, Ballistics parts.

Course Objectives

The Course attempts to give an exposure to the students about various types of firearms, their working and identification. The focused on to familiarize students with firearm injuries, wound characteristics and reconstruction of crime.

Course Outcomes

On completion of this course, the students are expected to learn

CO1	Study About type of firearm used for shooting and criminal activities.
CO2	To Study Comparison of the test bullet & cartridges with the suspected bullets.
CO3	To study the various parts of ballistics and their significance.

Syllabus

Unit-1	**Introduction and History of Forensic Ballistics**	**20 Hours**
Chapter 1.1	History and development of firearms, Parts of Firearms, Classification of firearms.	
Experiment 1.1	Introduction to firearms and it's parts	
Chapter 1.2	Firing mechanisms of different firearms, Principle of firearms identification	
Experiment 1.2	Study about firing mechanisms of different firearms	
Chapter 1.3	Ammunition: Primer types, Propellent types, Primer cap types.	
Experiment 1.3	Study about types of bullets	
Unit-2	**Firearm Identification**	**20 Hours**
Chapter 2.1	Identification of bullets, pellets and wads fired from improvised, country made firearms.	
Experiment 2.1	Study about various types of cartridge cases.	
Chapter 2.2	Ballistics fingerprinting and it's significance.	
Experiment 2.2	Matching of cartridge cases and bullets.	
Chapter 2.3	Gun Shot Residue: Composition, Significance and Chemical Analysis.	
Experiment 2.3	Comparison of marks present on cartridge case for firearm identification	
Unit-3	**Forensic Ballistics and it's types**	**20 Hours**
Chapter 3.1	Introduction to Internal ballistics and it's theories.	
Experiment 3.1	Comparison of marks present on Bullet for firearm identification	
Chapter 3.2	Introduction to External ballistics, Equation of Trajectory.	

Experiment 3.2	Methods of analysis of gunshot residues
Chapter 3.3	Introduction to terminal Ballistics
Experiment 3.3	Reconstruction of crime scene with respect to accident, suicide, murder and self-defense

Textbooks

T1. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).
T2. B.R. Sharma, Firearms in criminal investigation and trials, Central law agency, Allahabad (1990).

Reference Books:

R1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4 th Edition, The Foundation Press, Inc., New York (1995).

R2. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
R3. W.F. Rowe, Firearms identification, *Forensic Science Handbook*, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
153.	Assignment*	10 marks	1 per Unit	10 marks	
154.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
155.	Quiz	4 marks for each quiz	20per Unit	4 marks	
156.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
157.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
158.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
159.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
160.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	1	-	-	-	1	1	-	1	1
CO2	-	2	-	-	2	-	-	-	-	-	2	1	2	2	1
CO3	-	2	2	-	-	3	-	-	-	-	1	1	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21SHT-123	Physical Chemistry I	3	0	0	3	PC
PRE-REQUISITE		The candidate must have studied Sr. Sec. level chemistry.					
CO-REQUISITE							

ANTI-REQUISITE		

a. Course Description

The course begins with the theoretical study of solid, liquid and gaseous state and the basics of thermodynamics. The students are then introduced to the different thermodynamic laws, Carnot cycle, Joule Thomson effect and thermodynamic equilibrium.

b. Course Objectives

The Course attempts to address the specific topics relevant to Chemistry, wherein the students can apply this learning in their respective areas of expertise.

The focus is more on the application of the basic concepts with introduction of some advanced concepts in the area of chemistry.

c. Course Outcomes

CO1	Define Physical properties of each state of matter and laws related to describe the states and fundamentals of thermodynamics
CO2	Illustrtae the behavior of real gases, its deviation from ideal behavior, equation of state, isotherm, and law of corresponding states..
CO3	Understand the concept of Liquid crystals and its physical properties related to temperature and pressure variation
CO4	Analyse the problems related to Solids, lattice parameters – its calculation, application of symmetry, solid characteristics of simple salts.
CO5	apply the laws of thermodynamics and to perform calculations with ideal and real gases
CO6	Design practical engines by using thermodynamic cycles; predict chemical equilibrium and spontaneity of reactions by using thermodynamic principles.

d. Syllabus

Unit-1	**Gaseous State and Liquid State**	**Contact Hours: 15**
Gaseous State	Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation, Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Vander Waal's equation of state for real gases, Boyle temperature, Critical phenomena: PV isotherms of real gases, continuity of gases, isotherms of Vander Waal's equation, Andrews isotherms of CO_2, relationship between critical constants and Vander Waal's constants, law of corresponding states, reduced equation of state.	
Liquid State	Intermolecular forces, structure of liquids (a qualitative description), Structural differences between solids, liquids and gases, Liquid crystals: Difference between liquids crystal, solid and Liquid, Classification, structure of nematic and cholestric phases, applications of liquid crystals. Self-study: properties of state of matter, gas law, properties of liquid state, intermolecular forces.	

Unit-2	Solid State	Contact Hours: 15
Solid State	Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals, elementary ideas of symmetry and symmetry elements, Lattice planes and miller indices in cubic crystals, interplanar distance for cubic system, X-ray diffraction by crystals, Derivation of Bragg's Law in Reciprocal space, Determination of crystal structure of NaCl, KCl by use of Bragg's method, a simple account of Laue method and powder method of X-ray diffraction, Ionic crystals, Characteristic structures of some ionic crystals NaCl, Zinc blende, CsCl. Self-study: Type of solids , unit cell and its types	
Unit-3	**Thermodynamics**	**Contact Hours: 15**
Introduction of Thermodynamics	Thermodynamic terms and basic concepts, Intensive and extensive properties, State function and differentials, thermodynamic processes, reversibility, irreversibility, work done during isothermal and adiabatic processes, zeroth law of thermodynamic, Nature of heat and work, Conservation of energy, various statements of first law, Manipulations of first law, internal energy (U) and enthalpy (H). Reversible isothermal expansion of ideal and real gas, Molar heat capacity at constant pressure C_p and at constant volume C_v, relation between C_p and C_v, Reversible adiabatic expansion of ideal and real gases, Joule Thomson effect,	
Second Law of Thermodynamics and spontaneity of reactions	Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Concept of entropy – entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy as a criteria of spontaneity and equilibrium, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, G as criteria for thermodynamic equilibrium and spontaneity, its advantage over entropy change. Variation of G with P, V and T. **Self study: Basics of thermodynamics,applications of thermodynamics.**	

Textbooks

T1. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press (2011).
T2. Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
T3. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).

Reference Books:

R1. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).
R2. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).
R3. Rogers, D. W. Concise Physical Chemistry Wiley (2010).
R4. Silbey, R. J.; Alberty, R. A. & Bawendi, M. G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc. (2005).

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**

Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
161.	Assignment*	10 marks	1 per Unit	10 marks	
162.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
163.	Quiz	4 marks for each quiz	20per Unit	4 marks	
164.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
165.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
166.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
167.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
168.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	--		--	--	--	--	3	--	--	--	--	3	--
CO2	3	3	--	--	3	--	--	--	--	--	--	3	--	3	--
CO3	3	--	2	--	3	--	--	--	--	1	--	3	--	3	--
CO4	3	3	2	3	--	--	--	--	3	--	1	--	--	3	--
CO5	3	3	--	2	3	--	--	--	3	--	--	2	--	3	--
CO6	3	3	3	3	3	--	--	--	--	--	1	3	--	3	--
Average	3	3	2	--	3	--	--	--	3	1	1	3	--	3	--

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21SHP-320	Chemistry Lab- V	0	0	2	2	PC
PRE-REQUISITE							

CO-REQUISITE	21SHT-123	
ANTI-REQUISITE		

a. **Course Description:** The course begins preparations of precipitates on the basis of gravimetric analysis and various type of titrimetric analysis. The students are then introduced to the standardization of PH meter and preparation of buffer solutions.

b. **Course Objectives:** To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory. The practical work has been designed to give hands on experience of various analytical techniques used in chemistry.

c. Course Outcomes

CO1	Understand the fundamentals of get exposure in the experiments related to pH, lambert beer law
CO2	Understand and apply appropriate knowledge to carry out different experiments related to chemical kinetics.
CO3	Understand and apply appropriate knowledge about gravimetric analysis

d. Syllabus

Unit-1		**Contact Hours: 5**
	1. Preparation of buffer solutions (sodium acetate-acetic acid buffer, ammonium chloride-ammonium hydroxide buffer). 2. Standardization of pH meter and determination of molarity of unknown solution of HCl by titrating against known NaOH solution. 3. Verification of Beer-Lambert's law using UV-visible spectrophotometer and to find out concentration of an unknown solution.	
Unit-2		**Contact Hours: 5**
	1. Determination of the value of rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid. 2. Study of the hydrolysis of ethyl acetate by alkali (NaOH). Show that the reaction is of 2^{nd} order. Also calculate the rate constant. 3. Estimation of amount of Ni present in given solution as bis (dimethylgyoximato) nickel (II) in a given solution gravimetrically.	
Unit-3		**Contact Hours: 5**
	1. Estimation of barium as barium sulphate gravimetrically. 2. Estimation of CO_3^{2-} and HCO_3^- alkalinity using double titration method. 3. Determination of available oxygen and manganese dioxide in pyrolusite ore by KMnO4. 4. Estimation of silica content in a given sample of Portland cement by acid digestion method.	

e. TEXT BOOKS

T1 Bassett, J; Denney, RC; Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th ed., Orient Longman.

REFERENCE BOOKS

R1 Svehla, G andSivasankar, B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Edition, Pearson

f. Internal Evaluation Component: (For continuous lab work)

Sr. No.	Assessment Criterion	Weightage
1	Worksheet completion including writing learning objectives/Outcomes. (To be submitted at the end of the day)	10 Marks
2	Post Lab Quiz Result.	5 Marks
3	Student Engagement in Simulation/ Demonstration/ Performance and Controls/Pre-Lab Questions.	5 Marks
	Total	20 Marks

g. Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Practical worksheet (in journal category) and class room learning	20 marks for each experiment	8-10 Experiments	40 marks	Depending upon the no. of experiments
2	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments
3	Discussion Forum/ Short digital assignment/ Journal to submit design	4 marks for each task	1 per semester	4 marks	
4	Presentation	-------		Non graded Engagement Task	
5	Attendance and BB Engagement score	-------		4 marks	End semester

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	2	2	2	1	2	3	3	--
CO2	3	3	2	3	2	2	1	2	2	2	1	2	3	2	-
CO3	3	3	3	2	1	1	2	1	2	1	2	2	2	3	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
5	Course Code-	Fundamentals of Forensic Science Open Elective	3	0	0	3	OE

PRE-REQUISITE		
CO-REQUISITE		
ANTI-REQUISITE		

a. Course Description

The course starts with the introduction to the concepts related to the three states of matter viz. solid, liquid and gas. The course further introduces the concepts of Thermodynamics and Ionization.

b. Course Objectives

The Course aims to provide students with brief overview of the various sections of the law that are involved during Forensic Investigations. To familiarize students to crime scene management w.r.t. physical evidences, trace evidences, tool marks along with their collection, preservation, examination & importance.

c. Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	the history, branches and principles of forensic science along with the tools used during investigations.
CO2	The management of crime scene in all the ways w.r.t. securing and preserving it and collection, handling & preservation of physical and trace evidences.
CO3	General concepts of Cyber Forensics and Forensic Psychology

d. Syllabus

Unit-1	**General Forensic Science**	**15 Hours**
Chapter 1.1	Introduction to forensic science. Scope, need and principles of forensic science. Organizational set up of CFSL, SFSL, GEQD, BPRD, Fingerprint Bureaus.	
Chapter 1.2	Criminology: Aim & scope, Concept and definition of crime, control and prevention of crime.	
Chapter 1.3	Crime Scene Management: Protection, isolation and analysis.	
Unit-2	**Criminalistics**	**15 Hours**
Chapter 2.1	Physical evidences: their types, handling, preservation forwarding to FSL, trace evidences, chain of custody. Documentation of crime scene by photography, sketching and video, Reconstruction of crime scene.	
Chapter 2.2	Forensic Fingerprints: Fingerprints – classifications, types importance & techniques.	
Chapter 2.3	Forensic Medicine: Development, scope and role of forensic Odontology, Investigation of sexual offences. Injuries. Types and classification of injuries.	
Unit-3	**General of Cyber Forensics and Forensic Psychology**	**15 Hours**

Chapter 3.1	Introduction to Digital forensics, Locard's principle of exchange in digital forensics, Branches of digital forensics, phases of digital/computer forensic investigation, Identification of digital evidences
Chapter 3.2	Cyber Forensics, Classification of cyber-crimes, Different types of attacks in cyber-crime.
Chapter 3.3	Forensic psychology in India, Ethical & legal issues in forensic practice, Criminal Profiling Polygraph and Narco-analysis.

e. Textbooks

T1. Forensic Science in Criminal Investigation & Trials – B.R.Sharma
T2. The Hand Book of Forensic Psychology – Weiner Hass
T3. B.A.J. Fisher, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (1992 & 2000).

T4. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative

Techniques, 2nd Edition, CRC Press, Boca Raton (2005).

f. Reference Books:

R1. Criminal Profiling – B.Turvey
R2. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).

R3. Hand Book of Polygraph Testing – M.Kloinen).
R4. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, *Computer Crimes and Computer Forensics*, Select Publishers, New Delhi (2003)

g. Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
169.	Assignment*	10 marks	1 per Unit	10 marks	
170.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
171.	Quiz	4 marks for each quiz	20per Unit	4 marks	
172.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
173.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
174.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
175.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	

176.	Attendance and Engagement Score on BB	NA	NA	2 marks	

h. CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*

6	**Course Code-** 21UCT205	Environmental Science, Waste and Disaster Management	2	0	0	2	UC
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

*Course Type

University Core, Program Core, Program Specialization, Program Elective, University Open Elective, Domain Aptitude, MOOCs, Project/Research Project, Thesis/Dissertation, Seminar, Mandatory Non-Graded, Self-Study MNG, Summer/Institutional/Industrial Training

Course Description The course begins with the basic scientific knowledge and understanding of world from an environmental perspective. Following that, this introduces to different types of disaster and measures involved in strengthening the capacity to reduce the impact of disaster. The course further provides an overview on the complexities associated with waste material and various techniques for waste management.

Course Objectives To familiarize students with basics of environmental sciences, waste, and disaster management.

Course Outcomes

CO1	Understand different dimensions of environmental studies; problems related to the environmental degradation & the remedial steps taken to address them.
CO2	Understand different type of disaster that occur in nature consequently learning to develop the preparedness and remedial techniques.
CO3	Understand the diverse problems associated with solid waste, as well as waste segregation and effective management techniques.
CO4	Critically analysing the roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO5	Create awareness about environmental issues and to carry out outreach activities.

Syllabus

Unit-1	Introduction to environment and associated problems	Contact Hours: 10
<General>	Environment-Definition, components, segments, Need for Public Awareness. Biodiversity-introduction & its conservation. Introduction to Environmental Impact Assessment.	
<Natural Resources>	Natural Resources and associated problem - Forest resources, Water Resources, Mineral resources, Land resources, Energy resources.	
< Environmental Pollution and their effects>	Water pollution, Land pollution, Noise pollution, Air Pollution- causes, effects, and control measures. Global warming, acid rain- causes, effects, and control measures, Ozone Layer depletion, population growth. Salient Features of Paris agreement 2015	
Unit-2	**Disaster Management**	**Contact Hours: 10**
<Types of disaster >	Introduction to Disaster-definition, classification, Different Types of Disaster: Flood, Cyclone, Earthquakes, landslide, Fire, Industrial disaster, Nuclear Disaster, Structural failures (Building and Bridge), Biological Disasters, Accidents (Air, Sea, Rail & Road), War & Terrorism, Droughts. causes, effects, and practical examples for all disasters.	
< Disaster Management>	Disaster management cycle-Mitigation, preparedness, response, recovery. Disaster management act;Interrelationship between disaster and development; Prediction and Early Warning	
Unit-3	**Waste Management**	**Contact Hours: 10**
< Waste Management>	Introduction to Municipal Solid Waste Management- types and functional elements, Waste generation, Waste Collection, Storage and Transport. Waste Disposal options. Waste Processing Techniques. Source Reduction, Recycling.Introduction to hazardous waste management; Introduction to medical waste management. Integrated Waste Management (IWM);waste management hierarchy; waste to energy;Waste Management Rules 2016 (Amendment)	

Assessment Pattern - internal and External

The performance of students is evaluated as follows:

	Theory	
Components	**Continuous Internal Assessment (CAE)**	**Semester End Examination (SEE)**
Marks	40	60
Total Marks	100	

	Theory	
Continuous Internal Assessment (CAE)	**Extra activities:** • Awareness programmes for general public • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural • Visit to a local area to document environmental assets river/forest/grassland/hill/mountain • Field study of the effects of human interaction on the environment • Field survey of innovative practices adopted for environmental conservation. • Waste management practices adopted in particular area. • Making a compost pile • Conduct an energy audit • Earth Hour observation in particular area • Documentary on environmental issues • Water sampling and analysis • Air quality analysis and comparison	18 Marks
	Recorded video submission	12 Marks
	Plantation Activity	8 Marks
	Attendance	2 Marks

Lecture Plan

Lecture Number	Topics to be covered
1	Environment-Definition, components, segments, need for public awareness.
2	Biodiversity-introduction& its conservation
3	Introduction to Environmental Impact Assessment
4	Natural Resources and associated problem - Forest resources, Water Resources, Mineral resources
5	Natural Resources and associated problem - Land resources, Energy resources
6	Water pollution; Land pollution-causes, effects, control measures
7	Air pollution, Noise Pollution- causes, effects, control measures

8	Global warming, Acid rain- causes, effects, control measures
9	Ozone Layer depletion, population growth
10	Salient Features of Paris agreement 2015
11	Introduction to Disaster-definition; classification
12	Flood, Cyclone
13	Earthquakes, landslide
14	Industrial disaster, Fires
15	Nuclear Disaster, Structural failures (Building and Bridge)
16	Biological Disasters, Accidents (Air, Sea, Rail & Road)
17	War & Terrorism, Droughts
18	Disaster management cycle- Mitigation, preparedness, response, recovery
19	Disaster Management Act
20	Interrelationship between disaster and development; Prediction and Early Warnings
21	Introduction to Municipal Solid Waste Management-types and functional elements
22	Waste generation, Waste Collection,
23	Waste Storage and Waste Transport.
24	Waste disposal options
25	Waste Processing Techniques
26	Source Reduction, Recycling
27	Introduction to hazardous waste management
28	Introduction to medical waste management.
29	Integrated Waste Management (IWM); waste management hierarchy
30	Waste to energy; Waste Management Rules 2016 (Amendment)

MODE OF DELIVERY	COURSE CATEGORY	COURSE TYPE	END TERM MODE OF ASSESSMENT
Theory (TH)	Ability Enhancement Category University Core (UC)	Graded	MCQ based

Faculty Incharge- Mr. Sandeep Naseer, Civil, 7696777029

Program Electives

Botany

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FST-309	Plant Anatomy	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with introduction basic concepts of anatomy. The students are then introduced with detailed anatomical features of stem, root and leaf.

Course Objectives

This paper deals with highly advanced and evolved group of plants i.e. Angiosperms. The study of gradual transition from seedless plants to seed plants would make students familiar with morphology and anatomy of angiosperm plants.

Course Outcomes

On completion of this course, the students are expected to learn:

CO1	about the structure stem, stem modifications in angiosperms.
CO2	about structure of leaf, leaf modifications in angiosperms.
CO3	about structure of root, modifications in angiosperms

Syllabus

Unit-1	Shoot System	Contact Hours: 15
Chapter 1.1	The basic body plan of a flowering plant-modular type of growth. Diversity in plant form: annuals, biennials and perennials, monocots and dicots Shoot system: The shoot apical meristem and its histological organization (various theories); meristematic and permanent tissue, formation of internodes, branching pattern; monopodial and sympodial growth; canopy architecture;	
Chapter 1.2	Anatomical details of Dicot and Monocot stems. Modifications of aerial and underground stem.	
Chapter 1.3	Types of vascular bundles.Cambium and its functions, Secondary growth including anomalous s econdary growth cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings,	

	sapwood and heart wood; ring and diffused porous wood; early and late wood; development and composition of periderm; tyloses, secondary growth in monocots.	
Unit-2	**Leaf Anatomy**	**Contact Hours: 15**
Chapter 2.1	Origin, development of leaf, arrangement; diversity in shape and size of leaf Venation, phyllotaxy, simple and compound leaves, functions and modifications.	
Chapter 2.2	Internal structure of leaf in relation to photosynthesis and water loss; adaptations to water stress.	
Chapter 2.3	Leaf Anatomy in Dicots and Monocots and modification with special reference to their function. Study of stomatal types. Senescence and Abscission. Kranz anatomy, hydathodes.	
Unit-3	**Root Anatomy**	**Contact Hours: 15**
Chapter 3.1	Structure of a typical angio-spermic root (different zones)	
Chapter 3.2	structural and anatomical modifications for storage, respiration and reproduction.	
Chapter 3.3	Anatomical details of Dicot and Monocot roots. Interaction with microbes	

Textbooks

T1Cutter, EG. 1969.Cells and Tissues, 2nd Ed., Edward Arnold, London.
T2Cutter, EG. 1971. Plant Anatomy: Experiment and Interpretation, 2nd Ed., Organs, Edward Arnold, London.
T3Esau, K. 1977. Anatomy of Seed Plants, 2nd Ed., John Wiley & Sons., New York.
T4Fahn, A. 1974.Plant Anatomy, 2nd Ed., Pergamon Press, Oxford.

Reference Books:

R1 Mauseth, JD. 2008.Plant Anatomy, 4th Ed., Blackburn Press, New Jersey, USA.
R2 Quer, PF. 1960. The Anatomy of Plants, 1st Ed., Harper & Brothers, New York, USA.
R3 Rudall, P. 2007. Anatomy of Flowering Plants,- An Introduction to structure and Development, 2nd Ed., Cambridge University Press, Cambridge, U.K.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
177.	Assignment*	10 marks	1 per Unit	10 marks	
178.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
179.	Quiz	4 marks for each quiz	20per Unit	4 marks	
180.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
181.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

182.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
183.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
184.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO2	-	-	--	-	-	--	1	1	-	-	--	-	-	--	--
CO3	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-310	**Plant Growth, Development and Biotechnology**	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with theoretical study of concepts of growth and growth hormones. The students are then introduced to basics concepts of biotechnology and their practical applications.

Course Objectives

The basic objective of this paper is to make students aware about various life processes in plants.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	about various concepts of growth, various plant hormones.
CO2	about tools of biotechnology, various genetic engineering processes.
CO3	about applications of biotechnology, various genetically engineered crops

Syllabus

Unit-1	**Growth and Development**	**15**
Chapter 1.1	Growth and development: Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation.	
Chapter 1.2	Plant movement: the concept of photoperiodism, vernalization, physiology of flowering, florigen concept, biological clocks, physiology of senescence and fruit ripening	
Chapter 1.3	plant hormones - auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of their discovery., physiological role. General account of salicylic acid, jasmonates and brassinosteroids, photomophogensis, phytochromes and cryptochromes, their discovery, physiological role.	
Unit-2	**Genetic engineering**	**15**

Chapter 2.1	Aim of genetic engineering in biotechnology; Vectors and Restriction enzymes; Technique of making Recombinant DNA; Polymerase chain reaction; DNA fingerprinting.	
Chapter 2.2	Applied Genetics**:** recombinant DNA technology**,** Recombination in DNA, Genetic cloning and its applications in medicine and agriculture, DNA finger printing.	
Chapter 2.3	Basic concept of plant tissue culture, cellular totipotency, differentiation and morphogenesis, micropropagation, Anther culture, embryo culture, Protoplast culture.	
Unit-3	**Biotechnology and Its applications**	**15**
Chapter 3.1	Biotechnology and its application in human welfare with particular reference to industry, plant breeding and molecular farming.	
Chapter 3.2	Biology of *Agrobacterium,* vectors for gene delivery and marker genes, salient achievements in crop biotechnology. Brief introduction of genetically modified crops.	

Textbooks / Reference Books

TEXTBOOKS

T1 Gupta, PK. 2004. Biotechnology and Genomics,3rd Ed., Rastogi Publications, Meerut, India.

T2 Singh, DB. 2008. Biotechnology: Expanding Horizons, 5th Ed., Kalyani Publishers, India.

REFERENCE BOOKS

R1 Bhojwani, SS. 1990.Plant Tissue Culture: Applications and Limitations, 1st Ed., Elsevier Science Publishers, New York, USA.

R2 Purohit, SS. 2005.Biotechnology: Fundamental and Applications,4thEd.,Agrobios, India.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	

7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO2	-	-	--	-	-	--	1	1	-	-	--	-	-	--	--
CO3	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21FST-311	Analytical Techniques in Plant Sciences	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with theoretical study of techniques used in botany for cytological studies. The students are then introduced with various applications of these techniques in botanical studies.

Course Objectives

The basic objective of this paper is to impart knowledge to the students about analytical techniques to design and perform experiments pertaining to Botany.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	about contemporary techniques used in botany for cytological and molecular studies and integrate them problems related to these.
CO2	about the concepts about the principle and application of centrifugation and spectrophotometry.
CO3	about the concepts about various techniques used for DNA isolation, characterization and separation of various compounds and pigments and integrate them with problems related to these.

Syllabus

Unit-1	Imaging and related techniques	15
Chapter 1.1	Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy:	
Chapter 1.2	Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	

Unit-2	**Cell Fractionation**	**15**
Chapter 2.1	Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$gradient, analytical centrifugation, ultracentrifugation, marker enzymes	
Chapter 2.2	Radioisotopes: use in biological research, auto-radiography, pulse chase experiment.	
Chapter 2.3	Spectrophotometry, Principle and its application in biological research.	
Unit-3	**Chromatography**	**15**
Chapter 3.1	Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography.	
Chapter 3.2	Molecular sieve chromatography; Affinity chromatography. Characterization of proteins and nucleic acids Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids.	

Textbooks / Reference Books

TEXTBOOKS

T1Plummer, DT.1996. An Introduction to Practical Biochemistry, 3rd Ed., Tata McGraw-Hill Publishing Co. Ltd. New Delhi.

T2Ruzin, SE. 1999. Plant Micro technique and Microscopy, 2nd Ed., Oxford University Press, New York. U.S.A.

REFERENCE BOOKS

R1 Ausubel, F; Brent, R; Kingston, R.E; Moore, DD; Seidman, JG; Smith, JA andStruhl,K. 1995. Short Protocols in Molecular Biology. 1st Ed., John Wiley & Sons. 3rd edition.

R2 Zar, JH. 2012. Biostatistical Analysis, 4th Ed., Pearson Publication. U.S.A.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO2	-	-	--	-	-	--	1	1	-	-	--	-	-	--	--
CO3	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21FST-312	Plant Breeding	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with theoretical study of concepts of plant breeding and its achievements. The students are then introduced with various methodologies of plant breeding.

Course Objectives

The basic objective of this paper is to make students aware about the various methodologies of plant breeding and crop improvement.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	about the concepts of plant breeding, various achievements of plantbreeding and systems of plant breeding.
CO2	about various methodologies used in crop improvement, advantages and limitations of crop improvement.
CO3	about quantitative inheritance, inbreeding depression and heterosis.

Syllabus

Unit-1	**Introduction to plant breeding**	**15**
Chapter 1.1	Concept and role of plant breeding, objectives. Historical account of plant breeding, Future aspects of plant breeding and major achievements.	
Chapter 1.2	Breeding systems, modes of reproduction in crop plants, Undesirable consequences of plant breeding.	
Unit-2	**Crop Improvement**	**15**
Chapter 2.1	Methods of crop improvement. Centers of origin and domestication of crop plants, plant genetic resources.	

Chapter 2.2	Acclimatization, Selection methods: for self-pollinated, cross pollinated and vegetatively propagated plants. .	
Chapter 2.3	Hybridization: for self-cross and vegetatively propagated plants-procedure, advantages and limitations	
Unit-3	**Inbreeding depression and heterosis**	**15**
Chapter 3.1	Quantitative Inheritance: Concepts, mechanism and examples, Monogenic vs Polygenic inheritance.	
Chapter 3.2	Inbreeding depression and Heterosis: History, genetic basis of inbreeding depression and heterosis, applications.	
Chapter 3.2	Role of mutations in plant breeding and crop improvement, distant hybridization and role f biotechnology in crop improvement.	

Textbooks / Reference Books
TEXTBOOKS

T1Pierce, BA. 2011. Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning.
T2 Singh, BD. 2005. Plant Breeding: Principles and Methods, 7th Ed., Kalyani Publishers, New Delhi, India.

REFERENCE BOOKS

R1 Chaudhari, HK. 1984. Elementary Principles of Plant Breeding, 2nd Ed., Oxford – IBH.
R2 Acquaah, G. 2007. Principles of Plant Genetics & Breeding, 5th Ed., Blackwell Publishing, U.S.A.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses

6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO2	-	-	--	-	-	--	1	1	-	-	--	-	-	--	--
CO3	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-

Zoology

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FST-313	Development Biology	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the meaning and historical study of developmental biology and includes the study process of gametogenesis, fertilization, metamorphosis, gastrulation, foetal membranes, regeneration and ageing.

Course Objectives

The basic objective of this course is to make students aware about the developmental biology.

Course Outcomes

On completion of this course, the students are expected to learn:

CO1	assess appropriate information about gametogenesis from various sources to analyze and create cohesive and persuasive concepts.
CO2	evaluate information and problems related animal fertilization in order to formulate strategies for mitigation in future scenarios.
CO3	summarize knowledge about growth, repair, regeneration, ageing and death and apply that knowledge to create new ideas at a local and global levels.
CO4	Came to know the inducer and inductor role in embryogenesis and knowledge about metamorphosis and the process of regeneration.

Syllabus

Unit-1	Introduction and gametogenesis	Contact Hours: 15
Chapter 1.1	Developmental Biology: Introduction. Meaning and History, Modes of reproduction **Self Study** : Meaning pf developmental biology	
Chapter 1.2	Gametogenesis: Spermatogenesis with particular reference to differentiation of spermatozoa, vitellogensis; role of follicle/subtesticular cells in gametogenesis	

	Self Study : Role of Subtesticular cells in gametogenesis	
Chapter 1.3	Oogenesis; Egg maturation; egg membranes; polarity of egg. **Self Study :** Polarity of egg	
Unit-2	**Fertilization, development and metamorphosis**	**Contact Hours: 15**
Chapter 2.1	Fertilization, parthenogenesis, cleavage patterns, blastulation, embryonic polarization **Self Study** : Cleavage patterns	
Chapter 2.2	Gastulation, determination and differentiation,Tissue interactions, basic concepts of organizers and inductors and their role. **Self Study** : Inductors and their role	
Chapter 2.3	Metamorphosis in *Herdamania* and *Rana*(frog). Self Study **: Meaning of metamorphosis**	
Unit-3	**Gastrulation, foetal membranes and ageing**	**Contact Hours: 15**
Chapter 3.1	Development upto three germinal layers and their fate in *Herdmania. Amphioxus,* frog,chick and rabbit. Fate maps of chick and frog embryos. **Self Study** : Fate maps of frog embroys	
Chapter 3.2	Foetal membranes, their formation and role.Mammalian placenta–its formation, types and functions **Self Study :** Functions of placenta	
Chapter 3.3	Growth, repair, regeneration, ageing and death. **Self Study** : Ageing and death	

ff) Textbooks

T1 Gupta, PK.1993. Cytology, Genetics and Molecular Biology,5th Ed., Rastogi Publishers, Meerut.

T2 Chaudhry, S. and Sharma, A.2003.PV's Cytology & Ecology,6th Ed., Vikas & Co., Jallandhar Publishers.

T3 Ballinsky, BI.1981. An Introduction to Embryology, 5th Ed., Saunders Co.

T4 Gilbert, S.F.2000. Developmental Biology,5th Ed., Sinauer Ass. Inc. Publ

gg) Reference Books:

R1 DeRobertis, EDP and DeRobertis, EMF.1995. Cell and Molecular Biology,4th Ed., W.B. Saunders Co., Philadelphia.
R2 Powar, CB.1999.Cell Biology, 7thEd.,Himalaya Publishing House, Bombay.
R3Swanson,CP; Merz,T and Young, WJ.1981.Cytogenetics – The Chromosome in Division, Inheritance and Evolution, Prentice Hall.

hh) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory

Components	Internal Assessment	Mid Term Assessment	End Term Assessment
Marks	20	20	60
Total Marks	100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
185.	Assignment*	10 marks	1 per Unit	10 marks	
186.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
187.	Quiz	4 marks for each quiz	20per Unit	4 marks	
188.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
189.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
190.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
191.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
192.	Attendance and Engagement Score on BB	NA	NA	2 marks	

ii) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-314	Comparative anatomy of vertebrates	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

jj) **Course Description**

The course provides the theoretical knowledge of comparative anatomy of vertebrates and provides the knowledge about the integumentary, skeletal, digestive, respiratory, circulatory, urinogenital and nervous system of vertebrates and also includes the sense organs in vertebrates

kk) **Course Objectives**

The basic objective of this course is to make students aware about concepts of anatomy of Vertebrates..

ll) Course Outcomes

CO1	assess appropriate information about integumentary System, skeletal system and digestive system from various sources to analyze and create cohesive and persuasive concepts..
CO2	evaluate information and problems related to about respiratory system, Circulatory System and Urinogenital System.
CO3	analyze knowledge about nervous System and sense organs and apply that knowledge to create new ideas at a local and global levels.
CO4	gives in depth knowledge of various physiological processes in the animal kingdom

mm)Syllabus

Unit-1	Integumentary system	Contact Hours: 15
Chapter 1.1	Integumentary System: Structure, functions and derivatives of integument **Self Study** : Functions of Integumentary system	
Chapter 1.2	Skeletal System: Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches. **Self Study** : Visceral arches	
Chapter 1.3	Digestive System: Digestive System: Comparative account of alimentary canal and associated glands	

	Self Study : Functions of digestive system	
Unit-2	**Respiratory, circulatory and urinogenital system**	**Contact Hours: 15**
Chapter 2.1	Respiratory System: A general account of respiratory organs of vertebrates i.e Skin, gills, lungs and air sacs; Accessory respiratory organs **Self Study** : Functions of Respiratory system	
Chapter 2.2	Circulatory System: General plan of circulation, evolution of heart and aortic arches. **Self Study** : Functions of Circulatory system	
Chapter 2.3	Urinogenital System: Succession of kidney: Archenephros, Mesonephros, Metanephros, Evolution of urinogenital ducts, Types of mammalian uteri. **Self Study :** Types of mammalian uteri	
Unit-3	**Nervous System and Sense Organs**	**Contact Hours: 15**
Chapter 3.1	Nervous System: Comparative account of brain, Autonomic nervous system, Spinal cord, Cranial nerves in mammals. **Self Study** : Functions of Nervous System	
Chapter 3.2	Organs: Organs of hearing and sight in vertebrates, Functions of sense organs **Self Study** : Functions of Sense organs	
Chapter 3.3	Classification of receptors: Brief account of visual receptors, chemo-receptors and mechanoreceptors. **Self Study** : Chemo-receptors	

nn) Textbooks

T1Kardong, KV.2005. Vertebrates-Comparative Anatomy, Function and Evolution. 4thEd.,McGraw-Hill Higher Education.
T2 Kent, GC and Carr RK.2000. Comparative Anatomy of the Vertebrates, 9th Ed., The McGraw-Hill Companies.
T3Weichert, CK and William,Presch.1970. Elements of Chordate Anatomy,5thEd.,Tata McGraw Hills

oo) Reference Books:

R1Hilderbrand, M and Gaslow,GE.1998. Analysis of Vertebrate Structure,2nd Ed., John Wiley and Sons.
R2Walter, HE. and Sayles,LP.2000.Biology of Vertebrates,4th Ed., Khosla Publishing House. .

pp) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory

Components	Internal Assessment	Mid Term Assessment	End Term Assessment
Marks	20	20	60
Total Marks	100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
193.	Assignment*	10 marks	1 per Unit	10 marks	
194.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
195.	Quiz	4 marks for each quiz	20per Unit	4 marks	
196.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
197.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
198.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
199.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
200.	Attendance and Engagement Score on BB	NA	NA	2 marks	

qq) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21FST-315	Human Genetics	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course aims to understand the basic fundamentals of human genetics about chromosomal structure, various mutations, cell cycles, gene interactions and sex determination.

Course Objectives

1. Aims to provide a brief overview of human genetics.
2. To familiarize students with the chromosomal, gene variations, its importance and about sex determination.

Course Outcomes

On completion of course, students are expected to learn about:

CO1	Concept of Mendelian Genetics
CO2	About chromosome structure, mapping and mutations
CO3	About gene interactions and sex determination

Syllabus

Unit-1	**Introduction and Mendelian Genetics**	**Contact Hours: 15**
Chapter 1.1	Brief history of genetics, cell cycle, cell division: mitosis, meiosis, DNA and RNA as genetic material **Self Study :** DNA as genetic material	
Chapter 1.2	Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information **Self Study :** Lethal alleles	
Chapter 1.3	Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance **Self Study :** Lethal alleles	
Unit-2	**Chromosome: Structure, mapping and Mutations**	**Contact Hours: 15**

Chapter 2.1	Chromosome structure: nucleosome,solenoid,chromatin loops,chromosomal territories, Types of chromosomes, Variation in chromosome structure and number: Deficiency, duplication, translocation, inversions, monosomy, nullisomy, trisomy, tetrasomy, haploidy, polyploidy. Origin and transmission of chromosomal aberrations. **Self Study :** Variations in chromosome structure	
Chapter 2.2	Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence. **Self Study** : Interference and coincidence	
Chapter 2.3	Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations **Self study** : Back versus suppressor mutations	
Unit-3	**Gene Interactions and Sex Determination**	**Contact Hours: 15**
Chapter 3.1	Gene interactions: Epistasis, additive, modifiers, lethal, penetrance, expressivity, phenocopies, pleiotropic genes **Self Study :** Pleiotropic genes	
Chapter 3.2	Genomic imprinting, maternal effects, extranuclear inheritance in mitochondria and chloroplasts, genetic mapping. **Self Study** : Maternal effects	
Chapter 3.3	Sex determination, Dosage compensation with reference to X-inactivation in man, sex-linked, sex limited, sex influenced traits. **Self Study** : Sex influenced traits	

Textbooks

T1. Brooker, R.J. (1999). Genetics, Principles and Analysis. Addison Wesley Longman, California.

T2.Cummings, M.R. (2009). Human Genetics. Cenage Learning, USA.

T3. Gardner, E.J. (2011). Human Genetics. Viva Books Pvt. Ltd., India

Reference Books:

R1. Klug, W.S. and Cummings, M.R. (2003). Concepts of Genetics. Pearson Education, Inc., New Delhi.

R2. Snustad, D.P. and Simmons, M.J. (2010).Principles of Genetics. John Wiley and Sons, Inc., New York.

R3. Strickberger, M.W. (1999). Genetics. Prentice-Hall India Pvt. Ltd., New Delhi.

R4. Tamarin R.H. (2012). Principles of Genetics. Tata McGrawHill, New York.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**

Total Marks	100

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
201.	Assignment*	10 marks	1 per Unit	10 marks	
202.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
203.	Quiz	4 marks for each quiz	20per Unit	4 marks	
204.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
205.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
206.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
207.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
208.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21FST-316	Evolution and Animal Ecology	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the introduction to evolution and includes various theories of evolution. It also provides knowledge about the species, time scale, fossils and population growth regulation.

Course Objectives

The basic objective of this course is to make students aware about origin of life, biological concepts of organic evolution, fossil, bird adaptations and ecosystem

Course Outcomes

On completion of Course, students are expected to learn about :

CO1	conclude information about the origin of life to analyze and create cohesive and persuasive concepts.
CO2	evaluate information and problems related to fossils and evolution in man and apply these strategies for alleviation to analyse, create and propose designed concepts.
CO3	analyze knowledge about bird migration and adaptations and ecology and apply that knowledge to create new ideas.
CO4	To analyze different concepts of molecular cytogenetics'

Syllabus

Unit-1	Introduction and Theories	Contact Hours: 15
Chapter 1.1	Introduction to evolution. Origin of life. Evolution theories of Lamark, Darwin and DeVries. **Self Study :** Meaning of evolution	
Chapter 1.2	Theories of organic evolution, Evidences of organic evolution **Self Study** : Evidences of Organic evolution	
Chapter 1.3	Concept of micro, macro and mega-evolution. **Self Study** : Macro evolution	

Unit-2	**Speciation, fossils and evolution**	**Contact Hours: 15**
Chapter 2.1	Biological Concept of Species ; Speciation, Geological time scale, , Evolutionary rate, Evolution of man (in Brief). **Self Study** : Speciation	
Chapter 2.2	Fossil- its types and significance, fossilization, methods of determination of age of fossils **Self Study** : Fossilization	
Chapter 2.3	Complementation, mutations in cell cultures, studies of differentiated cell functions. Molecular Cytogenetics – Fluorescence in situ hybridization. **Self Study** : Mutations in cell cultures	
Unit-3	**Population Growth Regulation**	**Contact Hours: 15**
Chapter 3.1	Intrinsic mechanism-Density dependant fluctuations and oscillations, Extrinsic mechanism-Density independent, environmental and climatic factors **Self Study** : Climatic factors	
Chapter 3.2	Population interactions-types in a tabular form with examples. **Self Study** : Parasitism	
Chapter 3.3	Niche concept, Gause's principle of competitive exclusion with laboratory and field examples, Lotka Volterra Equation for prey predator interaction, functional and numerical responses of prey and predator **Self Study** : Prey and predator	

Textbooks

T1. Dhami, PS and Dhami, JK.1998. Vertebrates,2nd Ed., R Chand &Co,New Delhi.
T2. Bhamrah, HS and Juneka,K.1993. Cytogenetics & Evolution,4th Ed., Anmol Publication Pvt. Ltd.
T**3**..Parker, TJ and Haswell.1981.Text Book of Zoology, Vol. II (Verterbrates),3rd Ed., Macmillan Press Ltd.

Reference Books:

R1. Dobzhansky, T and Ayala, FJ.1952. Evolution, 2nd Ed., Stebbins and Valentine Publishers.

R2. Colbert, EH.1989. Evolution of Vertebrates, 2nd Ed., Wiley Eastern Ltd..

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**

Total Marks	100	100

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
209.	Assignment*	10 marks	1 per Unit	10 marks	
210.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
211.	Quiz	4 marks for each quiz	20per Unit	4 marks	
212.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
213.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
214.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
215.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
216.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	0	2	0	0	0	0	0	3	0	0
CO2	0	3	3	2	3	0	0	0	0	0	0	0	0	3	0
CO3	0	0	3	0	0	3	2	0	0	3	0	0	0	0	3
CO4	1	0	2	2	0	1	0	0	0	0	0	0	1	1	0

Physics

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	**Course Code- 21FST-317**	Condensed matter physics	3	0	0	3	Elective
PRE-REQUISITE		Physics Subject up to +2 level					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the study of amorphous and crystalline materials. The students are then introduced to Principles of X-ray diffraction. The course further emphasizes on the concept of the essential concepts of Free electron theory of metals and superconductivity.

Course Objectives

The course attempts to address the specific topics relevant to Physics. The focus is on the basic concepts with introduction of some advanced topics and applications in Physics

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	about types of materials-crystalline and amorphous, Concept of basis, lattice points and space lattice, Symmetry operations,
CO2	about Primitive Lattice cell, Inter-planar spacing, Index system for crystal planes Miller indices of crystal direction and crystal planes
CO3	about Principle of X-ray diffraction and Reciprocal Lattice, Bragg's law, Experimental diffraction method, Atomic form factor, Reciprocal lattice vectors, Crystal of inert gases
CO4	about, Van der Walls-London interaction, repulsive interaction, Equilibrium lattice constants, Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons.

Syllabus

Unit-1	**Crystal Structure and Miller Indices**	**15**

Chapter 1.1	Types of materials-crystalline and amorphous, Concept of basis, lattice points and space lattice, Lattice translation vectors, Symmetry operations, Primitive Lattice cell, Two-dimensional lattice types, systems, Number of lattices, three dimensional lattice types, Systems, Number of Lattices, Linear density, Planar density, Packing fraction	
Chapter 1.2	Inter-planar spacing derivation and its expression for different types of lattices, Index system for crystal planes Miller indices of crystal direction and crystal planes, Simple crystal structures, NaCl and Diamond structure.	
Unit-2	**Crystal diffraction and elementary lattice dynamics**	**15**
Chapter 2.1	Principle of X-ray diffraction and Reciprocal Lattice , Bragg's law, Experimental diffraction method, Laue method, Rotating crystal method, Powder method, Atomic form factor, Reciprocal lattice vectors, Diffraction conditions, Ewald's method, Reciprocal lattice to sc, bcc and fcc lattices.	
Chapter 2.2	Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative, Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3law.	
Unit-3	**Band Theory and Superconductivity**	**15**
Chapter 3.1	Free electron theory of metals, Properties of free electron theory, Failure of free electron theory Band Theory: Bolch Theorem Kronig- Penney model, On the basis of Kroing Penney model distinguish between Metals , insulators and semiconductors , Type of semiconductor,band gap in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors.	
Chapter 3.2	Concept of superconductivity, Properties of superconductor, Meissner effect, Types of superconductors-Type-I and Type-II, London equation,BCS Theory of superconductivity	

Textbooks / Reference Books
TEXTBOOKS

T1. Kittel, C. 2004. Introduction to Solid State Physics, 8th Ed., Wiley India Pvt. Ltd.

T2 Srivastava, JP. 2006. Elements of Solid State Physics, 2nd Ed., Prentice Hall of India.

T3Azaroff, LV. 1960. Introduction to Solids, 1st Ed., Tata McGraw Hill, New York

T4Wahab, MA. 2005. Solid State Physics, 2nd Ed.,Narosa Publications, New Delhi

REFERENCE BOOKS

R1 Luth, H; Ibach, H. 2009. Solid State Physics, 4th Ed., Springer

R2 Omar, A. 1999. Elementary Solid State Physics, 1st Ed., Pearson India.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-317	Astrophysics	3	0	0	3	Elective
PRE-REQUISITE		Physics Subject up to +2 level					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the study of astrophysics and ideas related to stellar structure. The students are then introduced to Concept of Novae and Supernovae. The course further emphasizes on the concept of space time physics, Schwarzschild radius

Course Objectives

The objective of the course on Astrophysics is to make student understand about the basic concept of stellar systems and the evolution of the universe.
The student will also get an elementary introduction to the space-time geometry and other basic ideas of the General theory of relativity.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Understand and evaluate basicsconcept of astrophysics, Celestial coordinate systems (Sun-Earth system, Distance measurement, Galactic Coordinate system
CO2	Understand and evaluate the ideas related to stellar structure to find the evolution of galactic systems
CO3	Recognize the basics of various thermonuclear reactions in stars
CO4	Understand and evaluate Stellar objects Concept of Novae and Supernovae.

Syllabus

Unit-1	Cry Fundamentals of Astrophysics:	15
Chapter 1.1	Celestial coordinate systems (Sun-Earth system, Distance measurement, Galactic Coordinate system), Stellar Magnitudes,	

Chapter 1.2	Classification of stars. The basic equations of stellar structure, Hydrostatic equilibrium, Thermal equilibrium, Virial Theorem, Energy sources, Energy transport by radiation and convection, Equation of state. Jeans criteria for star formation.	
Unit-2	**Thermonuclear reactions**	**15**
Chapter 2.1	Thermonuclear reactions in stars, fusion reactions (p-p chain, CNO cycle, triple α reactions), Solar Neutrino problem, nucleo-synthesis beyond iron, r- and s- processes.	
Chapter 2.2	Qualitative discussions on: Galaxies, Nebulae, Quasars, Brown dwarfs, Astrophysical importance of the study of variable stars. Concept of Novae and Supernovae.	
Unit-3	**General theory of relativity**	**15**
Chapter 3.1	Lorentz transformation, Time dilation, Length contraction, Worldline, causality, Equilance principle,	
Chapter 3.2	Relation between spacetime and mass, geodesics, gravitational red shift, Schwarzschild metric, CMB, Black Holes, Schwarzschild radius, event horizon and recent observations.	

Textbooks / Reference Books
TEXTBOOKS

T1 V.BBhatia,Textbook of Astronomy & Astrophysics with Elements of Cosmology, 1st Ed., Narosa Publishing House, 2001.

T2K. D. Srivastava Abhyankar, Astrophysics – Stars and Galaxies, 1stEd.,University Press, Reprint 2009.

T3T. Padmanavan, Theoretical Astrophysics (Vols.I,II,III), Latest Edition, Cambridge University Press, 2010.

T4EW Kolb and MS. Turner, The Early Universe, 1st Ed., Sarat Book House, New Delhi, 2005

REFERENCE BOOKS

R1 J VNarlikar, An Introduction to Cosmology, 3rdEd.,Cambridge University Press, New Delhi.

R2A.K. Raychaudhuri, S. Banerji andA.Banerjee, General Relativity, Astrophysics and Cosmology, 1st Ed., Springer, Reprint 2003.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21FST-319	Optoelectronics	3	0	0	3	Elective
PRE-REQUISITE		Physics Subject up to +2 level					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the study of Band diagram of Semiconductor, semiconductor junctions. The students are the introduced to display devices. The course further emphasizes on the concept of the essential concepts of optical fiber and photodetectors.

Course Objectives

The course attempts to address the specific topics relevant to Physics.

The focus is on the basic concepts with introduction of some advanced topics and applications in optoelectronics, and optical fibre

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	About modulation of light and various effects.
CO2	About the various display devices, working and construction of them
CO3	About photodetectors and optical fiber.

Syllabus

Unit-1	Modulation of light	15
Chapter 1.1	Quantum mechanical concepts, Band diagram of Semiconductor, Fermi-Dirac distribution function, Homo & Hetero junctions, Metal semiconductor junctions.	

Chapter 1.2	Elliptical polarization, Birefringence, Electro-optic effect, Magneto-optic devices– Faraday effect; Acousto-optic effect and Bragg effects.	
Unit-2	**Display Devices**	**15**
Chapter 2.1	Introduction, Luminescence – Photoluminescence, Cathode luminescence, Electroluminescence; Injection luminescence and light emitting diode (working principle and construction) –.	
Chapter 2.2	Radiative recombination processes: Inter band transitions, Impurity center recombination, Exciton recombination; Differences in LED, Plasma displays, Liquid crystal displays, Numeric displays	
Unit-3	**Optical Fiber and Photodetectors**	**15**
Chapter 3.1	Snells law, Critical angle, total internal reflection, Numerical aperture, Acceptance angle,step index fiber, graded index fiber, multimode fiber, V parameter, attenuation loss in fiber.	
Chapter 3.2	Introduction, Detector performance parameters, Photon devices – Photo-emissive devices, Vacuum photodiodes, Si Photomultipliers, APD, Photoconductive detectors.	

Textbooks / Reference Books
TEXTBOOKS

T1Wilson, J; Hawkes, JFB. 1999. Optoelectronics, 2nd Ed., Prentice-Hall of India.

T2 Ghatak, AK; Thyagarajan, K. 1989. Optical Electronics, 1st Ed., Cambridge University Press.

REFERENCE BOOKS

R1Uiga, Endel. 1995. Optoelectronics, 1st Ed., Prentice Hall

R2 Emmanuel, R; Borge, V. 2002. Optoelectronics, 1st Ed., Cambridge.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	

3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21FST-320	Nuclear and Particle Physics	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Physics					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the theoretical study of nucleus and its constituents. The course further provides the knowledge of basic fundamental processes like alpha, beta & gamma decay. The course further emphasize on the applications of nuclear and particle physics like accelerators and detectors.

Course Objectives

The course attempts to address the specific topics relevant to Physics.
The focus is on the basic concepts with introduction of some advanced topics and applications in the area of Physics.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Understand and evaluate basics of constituents of nucleus, their Intrinsic properties and various nuclear models- – Liquid drop model approach.
CO2	Understand and evaluate semi empirical mass formula and significance of various terms, condition of nuclear stability.
CO3	Recognize the basics of alpha decay: basics of α-decay processes, theory of α- emission
CO4	Understand and evaluate correlation between Gamow factor, Geiger Nutal law, Beta and Gamma Decay, and various nuclear reactions.

Syllabus

Unit-1	**Fundamentals of Nuclear Physics:**	**15**

Chapter 1.1	Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve.	
Chapter 1.2	Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, evidence for nuclear shell structure	
Chapter 1.3	nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force	
Unit-2	**Radioactivity**	**15**
Chapter 2.1	Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy, β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis, Gamma decay: Gamma rays emission & kinematics, internal conversion.	
Chapter 2.2	Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).	
Chapter 2.3	**Radioactivity**	
Unit-3	**Applications of Nuclear and particle physics**	**15**
Chapter 3.1	Accelerator facility available in India: Van-de Graff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons and idea of Large Hadron Collider	
Chapter 3.2	Interactions of Energetic particle with matter, Ionization Chamber, GM Counter, Cloud Chamber, Wilson Cloud Chamber, Bubble Chamber, Scintillation Detectors, Semiconductor Detectors.	
Chapter 3.3	Cosmic rays: Nature and Properties	

Textbooks / Reference Books
TEXTBOOKS

T1 K. S. Krane, Introductory nuclear PhysicS, 4th Ed., Wiley India Pvt. Ltd, 2008

T2B. L. Cohen, Concepts of nuclear physics, 1stEd., Tata McGraw Hill, New Delhi, 2008.

T3D. Griffith, Introduction to Elementary Particles, 2ndEd., John Wiley & Sons, 2004.

T4G. F. Knoll, Radiation detection and measurement,4thEd.,John Wiley & Sons, 2010.

T5I. Kaplan, Nuclear Physics, 2ndEd., Addison-Wesley Company, 1962.

REFERENCE BOOKS

R1 R. A. Dunlap, "Introduction to the physics of nuclei & particles", Edition 2nd (2004), Singapore, Thomson Asia,2010

R2K. Heyde, Basic ideas and concepts in Nuclear Physics - An Introductory Approach, 3rdEd., IOP- Institute of Physics Publishing, 2004

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
9.	Assignment*	10 marks	1 per Unit	10 marks	
10.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
11.	Quiz	4 marks for each quiz	20per Unit	4 marks	
12.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
13.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
14.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
15.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
16.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Mathematics

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	**Course Code- 21FST-321**	**Introduction to Partial Differential Equations**	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Mathematics as one of the subjects					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the study of the concept of Partial differential equation of first order, Lagrange's solution. Get knowledge about Partial differential equation of first order but of any degree, Charpit's general method of solution. The student sare then introduced Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces.

Course Objectives

The course attempts to address the specific topics relevant to Mathematics. The focus is on the basic concepts with introduction of some advanced topics and applications in the area of Mathematics.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Understand the concept of basic partial differential equation
CO2	Identify and illustrate the second order partial differential equation
CO3	Identify and illustrate the and higher order partial differential equation
CO4	find the applications of Partial Differentiation.

Syllabus

Unit-1	**Partial differential equations**	**15 Hours**
Chapter 1.1	Partial differential equation of first order, Lagrange's solution.	

Chapter 1.2	Integral surfaces Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces,	
Chapter 1.3	Solution of PDF Partial differential equation of first order but of any degree, Charpit's general method of solution.	
Unit-2	**Partial differential equations of second and higher order**	**15 Hours**
Chapter 2.1	Partial differential equations of the second order and their classification into hyperbolic, elliptic and parabolic types, canonical forms. Boundary value problems	
Chapter 2.2	Initial Value Theorem and Characteristic and Boundary Value Problem.	
Unit-3	**Application of P.D.E.**	**15 Hours**
Chapter 3.1	Homogeneous and non-homogeneous partial differential equations with constant coefficients.	
Chapter 3.2	Solution of Wave, Heat and laplace equation by the method of separation of variable (Cartesian and Cylinderical co-ordinate only.)	

Textbooks/ References Books

TEXTBOOKS

T1 Piaggio H.T.H., An Elementary Treatise on Differential equations, Barman Press.
T2 Sneddon I. N., Elements of Partial Differential Equations, Mc Graw Hill Book Co.
T3 Jain R.K.and Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publishing House.

REFERENCE BOOKS

R1 Ahsan Zafar , Differential Equations and Their Applications, Edition 2nd ,Prentice-Hall of India Pvt. Ltd. New Delhi.
R2 Singhania Rai, Ordinary and Partial Differential Equations ,S. Chand & Company, New Delhi.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
217.	Assignment*	10 marks	1 per Unit	10 marks	

218.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
219.	Quiz	4 marks for each quiz	20per Unit	4 marks	
220.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
221.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
222.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
223.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
224.	Attendance and Engagement Score on BB	NA	NA	2 marks	

rr) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FST-322	Probability and Statistics	3	0	0	3	Elective
PRE-REQUISITE		10+2 with Mathematics as one of the subjects					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

This course covers the fundamentals of Probability and Statistics: random variables, discrete and continuous random variable probability distributions, testing of hypothesis, conditional probability bayes theorem and joint distributions. It shows the utility of abstract concepts and teaches an understanding and construction of proofs.

Course Objectives

This course presents a rigorous treatment of fundamental concepts in probability and statistics. To introduce students to the fundamentals of mathematical theory and writing mathematical formulation, the course objective is to understand the axiomatic foundation of the probability, in particular the notion of statistics and some of its consequences.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Remember and understand the concept of probability analyse the Random Variable.
CO2	Applyto solve the problems and create the moment generating function for continuous random variable.
CO3	Identify and illustrate various probability distribution and solving related problems and analyse testing of hypothesis.
CO4	Developthe problem of Baye's theorem to apply in industry problem

Syllabus

Unit-1	Notion of probability, Discrete and Continuous random variable	15
Chapter 1.1	Random experiment, sample space, axiom of probability, elementary properties of probability, equally likely outcome problems. Concept, cumulative distribution function.	

Chapter 1.2	Discrete and continuous random variables, expectations, mean, variance, moment generating function. Bernoulli random variable, binomial random variable, generic random variable, Poisson random variable. Uniform random variable, exponential random variable, Gamma random variable, normal random variable.	
Unit-2	**Probability Distribution, Testing of Hypothesis, Baye's theorem**	**15**
Chapter 2.1	Binomial, Poisson and Normal Distribution.	
Chapter 2.2	Chi-test and t-test, F-test Conditional probability and conditional expectations, Baye's theorem, independence, computing expectation by conditioning, some applications–a list model, a random graph, Polya's urn model.	
Unit-3	**Bivariate and Functions of random variables, Mathematical Expectation**	**15**
Chapter 3.1	Joint distribution joint and conditional distributions, the correlation coefficient Sum of random variables. The law of large numbers and central limit theorem, the approximation of distributions.	
Chapter 3.2	Skewness, Kurtosis, Moments	

Textbooks / Reference Books
TEXTBOOKS

T1Ross S. M., Introduction to Probability Models, Edition 6th, Academic Press, 1997.

T2 Murray R.S. et al., Probability and Statistics3rd edition, Schaum's Series ISBN 0070151547, 9780070151543, 2010

REFERENCE BOOKS

R1Blake I., An Introduction to Applied Probability, John Wiley & Sons.

R2Yagolam A. M. and Yagolam I. M. 1983.Probability and Information, Hindustan Publishing Corporation, Delhi.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
225.	Assignment*	10 marks	1 per Unit	10 marks	
226.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
227.	Quiz	4 marks for each quiz	20per Unit	4 marks	

228.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
229.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
230.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
231.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
232.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21FST-323	Modern Algebra	3	0	0	3	Elective
PRE-REQUISITE		Basic Knowledge of algebra					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

This course covers the fundamentals of Modern Algebra: group, subgroup and cyclic group Lagrange theorem, group homomorphism, Cayley theorem, center of group, ring, field and integral domain.It shows the utility of modern concepts and teaches an understanding and construction of proofs.

Course Objectives

This course presents a rigorous treatment of fundamental concepts in Modern algebra. To introduce students to the fundamentals of group theory and reading and writing mathematical proofs of theorem, the course objective is to understand the axiomatic foundation of group, homomorphism and ring, in particular the notion of integral domain, field and some of its consequences

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Remember and understand the concept of group and solve the quotient group and cyclic group related problems.
CO2	Analyze the statements of Lagrange theorem and create normal subgroup to use in various domains.
CO3	Analyse and understand the homomorphism and remember the permutations for solving their problems and develop the Cayley theorem and analyse their applications.
CO4	Remember and understand the basic concepts of ring to solve the integral domain.

Syllabus

Unit-1	Group	15
Chapter 1.1	Definition of a group with example and simple properties of groups.	

Chapter 1.2	Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups, Quotient groups.	
Unit-2	**Group Homomorphism**	**15**
Chapter 2.1	Homomorphism, Isomorphism, automorphism and inner automorphism of a group. Automorphism of cyclic groups.	
Chapter 2.2	Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.	
Unit-3	**Ring and Integral Domain**	**15**
Chapter 3.1	Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphism, ideals (principle, prime and Maximal) and Quotient rings.	
Chapter 3.2	Field of quotients of an integral domain.	

Textbooks / Reference Books
TEXTBOOKS

T1Ross Herstein, I. N., Topics of algebra, Edition 2nd, John Wiley & Sons, 1975.

T2 Narayan, S., A Text book of Modern Algebra. S. Chand & Company, Delhi, India, 1965.

T3 Michacl, A., Modern Algebra, 2nd Edition Pearson, ISBN 978-0132413770, 2010.

REFERENCE BOOKS

R1Bhattacharya P.B, Jain S. K and Nagpaul S. R., First course in linear algebra, New Age International Pvt. Limited, 2008.

R2Herstein, I. N. 1975. Topics in Algebra, Wiley Eastern Ltd., New Delhi.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	
4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	

7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code- 21FST-324	Basic Numerical Methods	3	0	0	3	Elective
PRE-REQUISITE		Mathematics Subject up to +2 level					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

This course covers the fundamentals of numerical analysis: error, order of convergence, root finding, solution of simultaneous equations, and interpolation. It shows the utility of numerical methods in real life problems and teaches an understanding and applicability of course.

Course Objectives

The objective of the course is to expose the students with different aspects of basic numerical techniques and methods to solve polynomial equation, simultaneous equations, algebraic and transcendental equations. The students will be able to obtain the approximate solutions to the problem of mathematics.

Course Outcomes

On completion of this course, the students are expected to study and learn

CO1	Define Error Analysis and apply it in various Problems.
CO2	Evaluate the roots of equations using Regula-Falsi, Newton- Raphson method.
CO3	To describe and evaluate of solutions of linear equations using Gauss elimination method, Gauss-Jordan Elimination method.
CO4	Explain Finite difference and solve the various problems using Interpolation.

Syllabus

Unit-1	Errors, Solution of Transcendental and polynomial equations	15
Chapter 1.1	Floating point representation of numbers, Arithmetic operations with normalized floating point numbers and its consequences, Errors in numbers, Binary representation of numbers.	
Chapter 1.2	Bisection method, Regula-Falsi method, Newton-Raphson method and Secant method.	

Unit-2	**Solution to simultaneous linear and algebraic equations**	**15**
Chapter 2.1	Gauss elimination method, Gauss-Jordan Elimination method.	
Chapter 2.2	Pivoting, ill-conditioned equations, Gauss-Seidal iterative method.	
Unit-3	**Finite difference and Interpolation**	**15**
Chapter 3.1	Difference operators, divided differences (definition and properties), relations among operators.	
Chapter 3.2	Newton-Gregory formulae for forward and backward interpolation, Newton's interpolation formula for divided differences, Lagrange's interpolation formula, truncation error in various interpolation formulae.	

Textbooks / Reference Books
TEXTBOOKS

T1 Rao S. B., and Shantha. C.K., Numerical Methods with Programs in BASIC, FORTRAN & PASCAL, University Press (INDIA) Ltd.ISBN 0863113702, 9780863113703, 1992.

T2 Jain. M. K., Iyengar. S. R. K., and Jain. R. K., Numerical Methods for Scientific and Engineering Computation, New age International Publisher, India, 5th edition. ISBN 8122414613, 9788122414615, 2003.

T3 Gupta and Malik, Calculus of Finite Differences and Numerical Analysis, Krishna Prakashan Media,ISBN8182833310, 9788182833319, 2003.

REFERENCE BOOKS

R1 Gerald C.F., and Wheatley P.O., Applied Numerical Analysis, Pearson Education, India,7th edition ISBN 10: 8131717402, ISBN-13: 978-8131717400, 2008.

R2 Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall India Learning Private Limited; 5th edition, ISBN-10: 9788120345928, ISBN-13: 978-8120345928, 2012.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**
Total Marks	**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1.	Assignment*	10 marks	1 per Unit	10 marks	
2.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
3.	Quiz	4 marks for each quiz	20per Unit	4 marks	

4.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
5.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
6.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
7.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
8.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SEMESTER VI

For 10+2 Medical/Non- Medical

Semester-VI														
Course Code	Course name	L	T	P	C	CH	Course Category	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FSH-351	Computer Forensics	3	0	2	4	5	Core	20	20	60	40	20	40	200
21FSH-352	Forensic Microscopy	3	0	2	4	5	Skill Enhancement	20	20	60	40	20	40	200
21SHT-218	Physical Chemistry-II	3	0	0	3	0	Core	20	20	60	40	20	40	200
21SHP-321	Chemistry Lab- VI	0	0	2	1	2	PC	-	-	-	40	20	40	100
21FST-###	Program Elective Basket- V	3	0	0	3	3	Elective	20	20	60				100
21FST-###	Program Elective Basket- VI	3	0	0	3	3	Elective	20	20	60				100
21FSR-362	Project	0	0	4	6	4	Project				45		55	100
Total Credit					**24**	**25**								
Cumulative Credit					**132**									

Note: The above mentioned * is Mandatory Non-Graded Subjects.

List of Program Elective Basket-V for 6TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-354	Elements of Forensic Biology	3	0	0	3	3	Elective	20	20	60				100
21FST-355	Elements of Forensic Toxicology	3	0	0	3	3	Elective	20	20	60				100
21FST-356	Elements of Forensic Chemistry	3	0	0	3	3	Elective	20	20	60				100
21FST-357	Elements of Forensic Serology	3	0	0	3	3	Elective	20	20	60				100

List of Program Elective Basket-VI for 6TH Semester

Course Code	Course Name	L	T	P	C	C H	Course Type	Theory Assessment			Practical Assessment			Total
								IA	MTA	ETA	CA	MTA	ETA	
21FST-358	Elements of Forensic Anthropology	3	0	0	3	3	Elective	20	20	60				100

21FST-359	Elements of Forensic Medicine	3	0	0	3	3	Elective	20	20	60				100
21FST-360	Elements of Forensic DNA typing	3	0	0	3	3	Elective	20	20	60				100
21FST-361	Elements of Wildlife Forensic	3	0	0	3	3	Elective	20	20	60				100

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	**Course Code- 21FSH-351**	Computer Forensics	3	0	2	5	PC
PRE-REQUISITE		+2 Medical/Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

ss) **Course Description**

The course begins with the theoretical study of concepts of computer Forensics. The students are then introduced with the computer and network security, computer crime and Cryptography.

tt) **Course Objectives**

The objective of this course are to :

1. Understand and utilize the fundamental concept of computers and digital forensics.
2. Students shall be prepared for various technologies/tools to combat and investigate computer and cyber-crimes.

uu) Course Outcomes

On completion of this course, the students are expected to learn

CO1	The basics of digital forensic and Networking.
CO2	The computer- network security and computer virus.
CO3	The Digital crime it's classification and investigation.

vv) Syllabus

Unit-1	Computer Forensics	Contact Hours: 20

Chapter 1.1	**Introduction :** Computer forensics, Understanding the binary number system & conversions, Encoding- Decoding, **Self -Study :** Binary to decimal conversions	
Experiment 1.1	**Computer Forensic** Study of Computer Forensics and different tools used for forensic investigation	
Chapter 1.2	**Storage Media:** Methods of Storing data, Retrieval of deleted files, Memory, Development and physical construction of Hard disk. **Self –study :** Types of memory	
Experiment 1.2	**Retrieval of Deleted files** How to Recover Deleted Files using Forensics Tools	
Chapter 1.3	**Networking and Internet:** Network and types of Network, Networking devices, Internet **Self-study :** Internet	
Experiment 1.3	**Network** How to Collect Email Evidence in Victim PC	
Unit-2	**Computer and Network Security**	**Contact Hours: 20**
Chapter 2.1	**Imaging Techniques:** Introduction to imaging techniques and their significance. Image enhancement and restoration. Investigation of erased tapes and analysis of signals. Digitalization techniques. Authenticity of images and videos **Self-study :** Authenticity of images and videos	
Experiment 2.1	**Image files** Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.	
Chapter 2.2	**Computer and Network security :** Basics and Network Security, Encryption and Decryption, Unauthorized access and interception, Program manipulations **Self –Study :** Unauthorized access	
Experiment 2.2	**Network Security and Unauthorized access** Find Last Connected USB on your system (USB Forensics)	
Chapter 2.3	**Computer Virus:** Computer Viruses, Computer worms, Trojan Horse, Malware and other types of viruses. **Self-study :** Trojan Horse	
Experiment 2.3	**Computer Virus** Methods and software to detect virus in computer	
Unit-3	**Cyber-crime and it's types, IT ACT**	**Contact Hours: 20**

Chapter 3.1	**Introduction :** Cyber Crime and it's classification **Self-study :** Meaning of cyber crime
Experiment 3.1	**Cyber Crime** How to View Last Activity of Your PC
Chapter 3.2	**Recovery and Cryptography:** Data recovery, Cryptography and its types. Error detection and correction techniques **Self-study :** Error detection
Experiment 3.2	**Data recovery** How to recover data from PC using various techniques
Chapter 3.3	**Counterfeit currency**: Detection of counterfeit currency and other documents. **Self –study :** Meaning of counterfeit currency
Experiment 3.3	**Counterfeit currency** Self – study **:** Detection of Counterfeit Currency
Chapter 3.4	**Biometrics:** Relevance of biometric in forensics fingerprints, Iris, Retina and voice. **Self – study :** Importance of biometrics
Experiment 3.4	**Biometric** Biometric in Personal Identification

ww) Textbooks

T1. Bayuk, J. (2010). Cyber Forensics: Understanding information security investigations. Springer Science & Business Media
T2. Casey, E. (2009). Handbook of digital forensics and investigation. Academic Press.
T3. Casey, E. (2011). Digital evidence and computer crime: Forensic science, computers and the internet. Academic Press.
T4. EC-Council. (2016). Computer forensics: Investigating network intrusions and cybercrime (CHFI). Cengage Learning.
T5. Holt, T. J., Bossler, A. M., & Seigfried-Spellar, K. C. (2015). Cybercrime and digital forensics: An introduction. Routledge.

xx) Reference Books:

R1. Nelson, B., Phillips, A., & Steuart, C. (2014). Guide to computer forensics and investigations. Cengage Learning.
R2. Rajaraman, V. (2008). Computer basics and C programming. PHI Learning Pvt.
R3. Robertazzi, T. (2011). Basics of computer networking. Springer Science & Business Media.
R4. Sammons, J. (2012). The basics of digital forensics: The primer for getting started in digital forensics. Elsevier
R5. Sammons, J. (2012). The basics of digital forensics: The primer for getting started in digital forensics. Elsevier
R6. Wempen, F. (2014). Computing fundamentals: Introduction to computers. John Wiley & Sons.

yy) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory	**Practical**

Components	Internal Assessment	Mid Term Assessment	End Term Assessment	Continuous Assessment (CAE)	Mid Term Assessment	End Term Assessment
Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
233.	Assignment*	10 marks	1 per Unit	10 marks	
234.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
235.	Quiz	4 marks for each quiz	20per Unit	4 marks	
236.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
237.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
238.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
239.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
240.	Attendance and Engagement Score on BB	NA	NA	2 marks	

zz) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	2	2	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
2	Course Code- 21FSH-352	Forensic Microscopy	3	0	2	5	Skill Enhancement
PRE-REQUISITE		+2 Medical/Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**

The course aims to understand the basic fundamental of microscopy.

b) **Course Objectives**

The course aims to understanding of the basic fundamental of different types of microscopy used in forensic sample analysis.

c) **Course Outcomes**

CO1	Students are able to learn about principle of microscopy
CO2	Students are able to learn about different types of microscopic techniques
CO3	Students are explored about application of microscopic techniques in forensic sample analysis

d) Syllabus

Unit-1	Introduction to Microscopy	Contact Hours: 20
Chapter 1.1	**Introduction :** Microscopy, basic principle, Concept of Resolution and Magnification , Different types of microscopic techniques **Self-study** : Resolution and Magnification	
Experiment 1.1	**Microscopy** To study the process of microscopy and different types of microscopes.	
Chapter 1.2	**Basic parts and components of Microscope**: Head , arm , base.	

	Self –Study : Function of Aperture	
Experiment 1.2	**Components of Microscope** **To study different parts of a microscope and their functions.**	
Chapter 1.3	Lens aberrations, Distortion of image and curvature of field, Image Formation **Self – study :** Curvature of field	
Experiment 1.3	**Lens aberrations** To study different types of lens aberrations.	
Unit-2	**Optical Microscopy**	**Contact Hours: 20**
Chapter 2.1	**Compound Microscope:** Introduction, theory, basic principle, setup, applications and limitations. **Self-study** : Applications of compound microscope	
Experiment 2.1	**Compound microscope** To study human hair under microscope.	
Chapter 2.2	**Stereomicroscope:** Introduction, theory, basic principle, working, setup, applications and limitations. **Self-Study** : Limitations	
Experiment 2.2	**Stereomicroscopy** To analyze samples under Stereomicroscope	
Chapter 2.3	**Comparison Microscope:** Introduction, theory, basic principle, setup, applications and limitations. **Fluorescence Microscope** Introduction, theory, basic principle, setup, applications and limitations. **Self Study** : Applications of comparison microscope	
Experiment 2.3	**Comparison Microscope** To examine samples under comparison microscope.	
Chapter 2.4	**Fluorescence Microscope** Introduction, theory, basic principle, setup,Working, applications and limitations **Self –Study** : Limitations	
Experiment 2.4	**Fluorescence Microscopy** Study about fluorescence microscope	

Unit-3	Electron Microscopy	Contact Hours: 20
Chapter 3.1	**Introduction :**Electron Microscopy- Theory and basic principles of Electron Microscopy, Structure and Forensic applications **Self-Study** : Forensic applications	
Experiment 3.1	**Electron Microscopy** To study about process of electron microscopy	
Chapter 3.2	**Scanning Electron Microscopy (SEM) :** Introduction, parts, working , applications and limitations **, SEM/EDX** **Self-Study :** Parts of SEM	
Experiment 3.2	**SEM** To study and examine samples under SEM (Scanning Electron Microscope)	
Chapter 3.3	**Transmission Electron Microscopy (TEM):** Introduction, parts, working , applications and limitations	
Experiment 3.3	To study about use of TEM in forensic sample analysis	

e) Textbooks

T1. Willdard, H. H (1974) Instrumental Methods of Analysis.

T2. Moonesens A.A. (1979) Scientific Evidence in Criminal Cases.

T3. Settle,F.A.(1997) Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.

Reference Books:

R1. Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology

R2. Lundquist & Curry (1963) Methods of Forensic Science.

f) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal	Remarks

				Assessment	
241.	Assignment*	10 marks	1 per Unit	10 marks	
242.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
243.	Quiz	4 marks for each quiz	20per Unit	4 marks	
244.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
245.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
246.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
247.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
248.	Attendance and Engagement Score on BB	NA	NA	2 marks	

g) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21SHT-218	Physical Chemistry- II	3	0	0	3	PC
PRE-REQUISITE		+2 Medical/Non-Medical					
CO-REQUISITE		21SHP-321					
ANTI-REQUISITE							

a. Course description:

The course begins with the theoretical study and introduction of thermodynamics, science of the relationship between heat, work, temperature, and energy so that thermodynamics can be used to describe how systems respond to changes in their environment. The students are then introduced to bond energy, bond dissociation energy, entropy, free energy functions, Gibbs-Helmholtz equation and Maxwell relations. The course further emphasizes on the polymer chemistry followed by the induction of the concept of chemical equilibrium and phase equilibrium.

b. Course Objectives

The course aims to become familiar the basic concepts relevant to thermodynamics and law of thermodynamics along with calculation of bond energy, bond dissociation energy and resonance energy. Be able to apply concepts associated with variouspolymer chemistry, degree of polymerization and chemical and phase equilibrium**.** Throughout the course, the relationship between physical phenomena and the molecular structure and reactions underpinning advanced materials will be highlighted.

Course Outcomes

On completion of this course, the students are expected to-

CO1	Define the terminologies related to thermodynamics and all laws of thermodynamics.
CO2	Illustrate the thermo chemistry to determine enthalpy of formation of molecules and ions and enthalpy of combustion, bond energy and their applications.
CO3	Apply the concepts of polymerization, chain growth and coordination polymerization and copolymerization.
CO4	Analyze the photonic, fire retardant polymers, thermally stable polymers and its applications.
CO5	Evaluate the problems related to chemical equilibrium in ideal gases and thermodynamic derivation of the law of chemical equilibrium.

CO6	Design the derivation for phase equilibrium in different components system.

Syllabus

Unit-1	**Chemical Energetics**	**Contact Hours: 15**
Chapter-1 **Thermodynamics**	Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermo chemistry. Concept of standard state and standard enthalpies of formations, Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances. **Self study: Evaluate the problems with relation to bond energy, bond dissociation energy**.	
Unit-2	**Polymer Chemistry**	**Contact Hours: 15**
Chapter-1	Introduction, Classification, Functionality, criteria for synthetic polymer formation, bifunctional and polyfunctional systems. Mechanism and kinetics of step growth, radical chain growth, ionic chain growth and coordination polymerization, Mechanism and kinetics of copolymerization, Relationship between functionality, extent of reaction and degree of polymerization	
Chapter-2	Determination of degree of crystallinity. Glass transition temperature and its determination, Specialty polymers, Photo conducting polymers, photonic polymers, fire retardant polymers, thermally stable polymers, and polyelectrolyte. Conducting Polymers, conduction mechanism of polyacetylene, polypyrrole, polyaniline, Applications of conducting polymers **Self study: To relate the concept of polymerization and copolymerization.**	
Unit-3	**Equilibrium**	**Contact Hours: 15**
Chapter-1 **Chemical Equilibrium**	Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^o, Le Chatelier's principle. Relationships between Kp, K_c and K_x for reactions involving ideal gases. **Self study: To analyze the concept of free energy and relate it with spontaneity of reaction.**	
Chapter-2 **Phase Equilibrium**	Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibrium of one component system-water, CO2 and S systems. Phase equilibrium of two component systems-solid-liquid equilibrium, simple eutectic-Bi-Cd, Pb-Ag systems and desilverisation of lead, Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H2O), and CuSO4-H2O) system, Freezing mixtures, acetone-dry ice.	

e. Text Books:

T1. Kapoor K L, A text book of Chemistry, 2004, 1st , McGraw Hill Publication Vol. 1 to 6.

T2. Kiran S, Modern Approach to Physical Chemistry, 2015, 7th, Modern Publishers.

T3. Puri B R, Sharma L R, Pathania M S, 2013, Principles of Physical Chemistry, 46th Ed. Vishal Publishing Company.
T4. Dogra S.K. and Dogra S.,1984, Physical Chemistry through Problems, , John Willey & Sons and Ltd.

f. Reference Books:

R1. Engel Thomas, Reid Philips, 2012, Physical Chemistry, 4th Reprint, Pearson.

R2. Silbey, Alberty R A, 2012, Physical Chemistry, 4th Reprint, Wiley Publishers.

R3. Barrow G.M. Physical Chemistry, 1973, International Student Edition, 2 Revised Ed edition McGraw Hill.

R4. Atkins P.W., 2014,The Elements of Physical Chemistry, , 10th ed., Oxford University Press.

R5. Rao, C.N.R, 2000, University General Chemistry McMillan India Ltd.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
249.	Assignment*	10 marks	1 per Unit	10 marks	
250.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
251.	Quiz	4 marks for each quiz	20per Unit	4 marks	
252.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
253.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
254.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
255.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
256.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	3	-	-	-	-	2	2	-	3	-	-	3
CO3	3	3	-	-	-	-	-	-	2	2	-	-	-	-	3
CO4	3	-	3	3	-	-	-	-	2	2	-	3	-	-	3
CO5	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
CO6	3	3	3	3	-	-	-	-	-	2	-	3	-	-	3
Average	3	3	3	3	-	-	-	-	2	2	-	3	-	-	3

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
4	Course Code-21SHP321	Chemistry Lab-VI	0	0	2	2	PC
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

Pre-requisite: The course(s), which is/are to be mandatorily passed out before opting for a course *(Only Course Code is to be written in the respective column of the concerned row).*

Co-requisite: The course(s), which is/ are to be offered together in same semester *(Only Course Code is to be written in the respective column of the concerned row).*

Anti-requisite: The course(s), which is/ are not to be offered together.

a. **Course Description:** The course begins with the study of estimation of sugars and solvent extraction. It also includes study of experiments related to green chemistry and conductometric titrations. This course also provides knowledge about saponification of oil and fats.

b. **Course Objectives:** To understand intricacies of the subject and to develop the experimental skills by providing sophisticated chemistry laboratory. The practical work has been designed to give hands on experience of various analytical techniques used in chemistry.

c. **Course Outcomes**

CO1	Learn various methods of estimation of sugar, saponificationand Iodine value of the given Oil/Fat
CO2	Perform various green chemistry experiments and extraction of caffeine
CO3	Calculate the solubility and solubility product of a sparingly soluble electrolyte conductometrically and osazone

d. **Syllabus**

Unit-1		**Contact Hours: 10**

	1. Estimation of Sugar by Fehling solution method. 2. Determination of saponification value of the given Oil/Fat 3. Determination of Iodine value of the given Oil/Fat	
Unit-2		**Contact Hours: 10**
	4. Extraction of caffeine from tea leaves and show extraction technique from aqueous solution using ethyl acetate as well as dichloromethane. 5. Green chemistry experiment: A. Diels Alder reaction of maleic acid and furan using water instead of benzene. B. Benzoin condensation using thymine hydrochloride as a catalyst instead of cyanide. 6. Conductometric titration strong acid vs. strong base): to find the normality of hydrochloric acid solution by titrating against sodium hydroxide solution	
Unit-3		**Contact Hours: 10**
	1. Preparations: Bromination of Phenol/Aniline. Recrystallisation, determination of melting point and calculation of quantitative yields for Bromination of Phenol/Aniline 2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically. 3. Preparations:Osazone from glucose/fructose. Mechanism of various reactions involved. Recrystallisation, determination of melting point and calculation of quantitative yields to be done. 4. Project based on the understanding of the Chemistry subject.	

e. TEXT BOOKS

T1 Svehla, G and Sivasankar B. 2013. Vogel's Qualitative Inorganic Analysis, 7th Ed., Pearson.
T2 Bassett, J; Denney, RC; Jeffery, GH and Mendham, J. 1978. Vogel's Textbook of Quantitative

Inorganic Analysis (revised), 4thEd., Orient Longman.

REFERENCE BOOKS

R1 Khosla BD; Garg VC and Gulati A. 2002. Senior Practical Physical chemistry, 4th Ed., R Chand and company
R2 Sambrook, J and Russell, D. 2001. Molecular Cloning: A laboratory manual by, 3rd Ed., CSHL press.

f. Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	Internal Assessment	Mid Term Assessment	End Term Assessment	Continuous Assessment	Mid Term Assessment	End Term Assessment
Marks	-	-	-	40	20	40
Total Marks	-			100		

Internal Evaluation Component: (For continuous lab work)

Sr. No.	Assessment Criterion	Weightage
1	Worksheet completion including writing learning objectives/Outcomes. (To be submitted at the end of the day)	10 Marks
2	Post Lab Quiz Result.	5 Marks
3	Student Engagement in Simulation/ Demonstration/ Performance and Controls/Pre-Lab Questions.	5 Marks
	Total	20 Marks

Internal Evaluation Component

S. No.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
1	Practical worksheet (in journal category) and class room learning	20 marks for each experiment	8-10 Experiments	40 marks	Depending upon the no. of experiments
2	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments
3	Discussion Forum/ Short digital assignment/ Journal to submit design	4 marks for each task	1 per semester	4 marks	
4	Presentation	-------		Non graded Engagement Task	
5	Attendance and BB Engagement score	-------		4 marks	End semester

h. CO-PO-PSO Mapping

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	3	-	-	-	-	-	-	3	-	3	-	
CO2	3	3	1	-	3	3	-	-	-	-	-	-	3	-	
CO3	3	3	-	3	3	3	-	-	1	1	3	1	3	-	
Average	3	3	1	3	3	3	-	-	1	1	3	1	3	-	

PROGRAM ELECTIVES

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FST-354	Elements of Forensic Biology	3	0	0	3	PE
PRE-REQUISITE		+2 Medical/Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the theoretical study of biological fluids and its importance in Forensic field for crime detection as a valuable physical evidence which is widely utilized in all engineering applications. The students are then introduced to maternity, paternity dispute cases and DNA processes and their Forensic application. The course further emphasizes on the concept of techniques that are highly used for identification and confirmation of evidences.

Course Objectives

To familiarize students to identify & examine the biological evidences recovered at the crime scene and make them presentable in court of law.

Course Outcomes

CO1	Student will be skilled forensic biologists so as to gain the knowledge of forensic analysis of biological evidences to help investigating agencies.
CO2	Student will be expert investigator in solving paternity and maternity disputes, analyzing physical and sexual assault evidences.
CO3	Students will be capable of performing DNA profiling of any biological samples aiming at investigations.

Syllabus

Unit-1	Body Fluids	Contact Hours: 15
Chapter 1.1	Blood and its composition (Haemoglobin), Body fluids: their location, Importance, nature, collection and identification by tests. **Self-study** : Composition of blood	

Chapter 1.2	Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques **Self-study** : Absorption-elution technique	
Chapter 1.3	Determination of secretor/non-secretor status **Self-study** : Meaning of secretors and non-secretors	
Unit-2	**Other Biological and Botanical Evidences**	**Contact Hours: 15**
Chapter 2.1	Hair and Fibers: Importance, nature, location, collection, evaluation and tests for their identification **Self-study** : Significance of hair and fiber evidence	
Chapter 2.2	Forensic Varieties of timber, seeds and leaves –•Botanical evidences: location and collection. Various types of woods •their identification and matching. **Self-study** : Various types of wood	
Chapter 2.3	Morphological and anatomical•Study and identification of pollen grains characteristics of plants yielding drugs of abuse like opium, Cannabis, Coca plant, Psilocybe mushrooms, Tobacco **Self-study :** Drugs of Abuse	
Unit-3	**DNA and RNA**	**Contact Hours: 15**
Chapter 3.1	Chemical structures of DNA and RNA. Procedure for collection and preservation of biological sample for Techniques of DNA isolation and its Quantitation. **Self-study** : Collection and Preservation of Biological samples	
Chapter 3.2	Paternity disputes: Causes, calculation of paternity index and probability for paternity and maternity. **Self-study** : Calculation of paternity index	
Chapter 3.3	Immunodiffusion and its types, Electrophoresis and its types, ELISA, RIA, Immunoflorescence **Self-study** : Significance of RIA	

aaa) Textbooks

T1. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (1971).

T2 J.H. Byrd and J.L. Castner, Forensic Entomology, CRC Press, Boca Raton (2001).

T3 R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993).

Reference Books:

R1.Papoulis, A and Pillai, SU. 2014. Probability, Random Variables and Stochastic Processes, 3rd Ed., Tata McGraw-Hill, New Delhi.

R2. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, CRC Press, Boca Raton (1997).

R3.J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005).

R4. K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton (1997)

bbb)Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
257.	Assignment*	10 marks	1 per Unit	10 marks	
258.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
259.	Quiz	4 marks for each quiz	20per Unit	4 marks	
260.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
261.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
262.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
263.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
264.	Attendance and Engagement Score on BB	NA	NA	2 marks	

ccc) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
2	**Course Code- 21FST-355**	Elements of Forensic Toxicology	3	0	0	3	PE
PRE-REQUISITE		+2 Medical/ Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

ddd) **Course Description**

The course begins with the theoretical study of concept of Toxicology, principles of toxicology, action mechanism of poisons, types of poison, collection and preservation of poisons and evidences. The students are then introduced to identification and analysis of poison , NDPS, designer drugs.

eee) **Course Objectives**

1. To give an exposure to the students about various types of poison, analytical procedures and sign and symptom and identification of poisons.
2. To familiarize students with action mechanism of poisons, various law and acts related to drugs and poisons

fff) Course Outcomes

CO1	The significance of toxicological studies in forensic science.
CO2	The classification of poisons and their modes of actions.
CO3	The classification and characteristics of the narcotics, drugs and psychotropic substances.

ggg) Syllabus

Unit-1	**Basics of Toxicology**	**Contact Hours: 15**
Chapter 1.1	**Introduction :** Toxicology: Definition and Scope, Significance of toxicological findings, , Postmortem Toxicology. **Self-study :** Scope of forensic toxicology	

Chapter 1.2	**Chemical Analysis :** Techniques used in toxicology, Toxicological analysis and chemical intoxication tests **Self-study :** Toxicological analysis	
Chapter 1.3	**Clinical toxicology :** Clinical toxicology, Dose-response relationship, Lethal dose 50, Lethal concentration 50 and Effective dose 50 **Self-study :** Lethal dose 50	
Unit-2	**Poison : Introduction , Classification and Analysis**	**Contact Hours: 15**
Chapter 2.1	**Introduction :** Definition, Classification, Physico-chemical characteristics and mode of action of poisons **Self –study :** Mode of action of poisons	
Chapter 2.2	**Classification :** Accidental, suicidal and homicidal poisonings and relevant Sections, Signs and symptoms of common poisoning and their antidotes **Self-study :** Antidotes	
Chapter 2.3	**Analysis :** Collection and preservation of viscera, blood and urine for various poison cases, Extraction and isolation poison from viscera . **Self-study :** Collection of Viscera	
Unit-3	**Identification and Analysis of Drugs**	**Contact Hours: 15**
Chapter 3.1	**Introduction to** Drug: Definition, Classification and Identification of NDPS, Narcotics, stimulants, depressants and hallucinogens. **Self-study** : Depressants	
Chapter 3.2	**Classification** : General characteristics and common example of natural, synthetic and semisynthetic narcotics **Self-study :** Synthetic narcotics	
Chapter 3.3	I**dentification :** drugs and psychotropic substances, Designer drugs, Drugs and driving. Dope tests. **Self-study :** Designer drugs	

hhh)Textbooks

T1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).

T2. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).

T3.S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (1996).

T4. A.W. Jones, Enforcement of drink-driving laws by use of per se legal alcohol limits: Blood and/or breath concentration as evidence of impairment, Alcohol, Drug and Driving, 4, 99 (1988).

T5. Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer

Reference Books:

R1. Saferestein, Criminalistics: An Introduction to Forensic Science. Prentice Hall
R2. ohn D. DeHaan ; Kirk's Fire Investigation, Prentice Hall Eaglewood Cliffs, N.J
R3. Yinon J; Modern Methods & Application in Analysis of Explosives, John Wiley.
R4. Goutam, M. P. and Goutam S Analysis of Plant Poison, Selective & Scientific Books, New Delhi.

iii) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
265.	Assignment*	10 marks	1 per Unit	10 marks	
266.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
267.	Quiz	4 marks for each quiz	20per Unit	4 marks	
268.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
269.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
270.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
271.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
272.	Attendance and Engagement Score on BB	NA	NA	2 marks	

jjj) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	1	1	2	2	1	1	2	2	1	1
CO2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3
CO3	1	1	2	1	2	1	2	2	1	2	1	3	1	2	2

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
3	Course Code- 21FST-356	Elements of Forensic Chemistry	3	0	0	3	PE
PRE-REQUISITE		+2 Medical/Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

kkk) **Course Description**

The course begins with the theoretical study of arson crime scene, chemistry of fire and searching the fire crime scene for forensic investigation. The students are then introduced to Drug of abuse and classification of Drugs, Explosives and its classification and analysis of blast injuries and hidden explosives. The students are then provided the knowledge of detection and analysis of alcoholic beverages, illicit liquors, trap cases and drug of abuse in sports.

lll) **Course Objectives**

1. To give the knowledge to students about fire crime scene, chemistry of fire and its investigation.
2. To make the students able to handle & examine evidences of forensic chemistry such as drugs, explosives, petroleum products, contact traces, alcohol related cases, bribe trap cases and help in criminal investigations

mmm) Course Outcomes

CO1	To perform analysis of adulterated petroleum and construction material samples to help the society.
CO2	The forensic investigation of Arson crime scene, collection, preservation and analysis of evidence collected arson crime scene.
CO3	To analyze and interpret the evidences related to drugs, arson, paint and contact traces qualitatively as well as quantitatively

nnn) Syllabus

Unit-1	Chemistry of fire	Contact Hours: 15
Chapter 1.1	**Arson:** Chemistry of fire, Searching the fire scene, Collection and preservation of arson evidence, Scientific investigation and evaluation of clue materials **Self-study :** Searching the fire scene	

Chapter 1.2	**Petroleum:** Distillation and fractionation of petroleum, Commercial uses of different petroleum fractions, Analysis of petroleum products **Self-study :** Commercial uses of different petroleum fractions	
Chapter 1.3	**Analysis of Petroleum products:** Analysis of traces of petroleum products in forensic exhibits, Comparison of petroleum products, examination of Adulterated petroleum products **Self-study :** Comparison of petroleum products	
Unit-2	**Drug of Abuse and Explosives**	**Contact Hours: 15**
Chapter 2.1	**Drugs of abuse** – natural and synthetic, Drug dependence .Classification of drugs of abuse-Narcotics, hallucinogens, depressants, stimulants and anabolic steroids. Field and laboratory tests of drugs of abuse, Clandestine laboratory investigation and Designer drugs. **Self-study** : Designer drugs	
Chapter 2.2	**Explosives**: Classification of explosives, Synthesis and characteristics of TNT, PETN and RDX, Explosion process, Blast waves, Searching the scene of explosion, Post blast residue collection and analysis, Blast injuries, Detection of hidden explosives. **Self-study :** Blast Injuries	
Chapter 2.3	**Drug abuse in sports:** Introduction, common prohibited substance and Forensic analytical approaches. **Self-study :** Forensic analytical approaches	
Unit-3	**Beverages and Contact Traces**	**Contact Hours: 15**
Chapter 3.1	B**everages**-Alcoholic and non-alcoholic beverages, Analysis of alcoholic beverages, Detection and determination of ethanol, methanol ethylene glycol and chloral hydrate by conventional and instrumental analysis, Licit and illicit liquors **Self-study :** Licit and illicit liquors	
Chapter 3.2	**Trap Cases**, Restoration of numbers. **Self- study** : Significance of restoration of numbers	
Chapter 3.3	**Examination of Contact traces**: Introduction to cosmetics and detective dyes, collection, sampling and forensic analysis **Self-study** : Cosmetics	

ooo)Textbooks

T1. . D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey (1991).

T2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).

T3.R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).

T4. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2ndEdition,Oxford University Press, New York (1983).

Reference Books:

R1. J.C. DeLadurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York (1980).

ppp) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
273.	Assignment*	10 marks	1 per Unit	10 marks	
274.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
275.	Quiz	4 marks for each quiz	20per Unit	4 marks	
276.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
277.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
278.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
279.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
280.	Attendance and Engagement Score on BB	NA	NA	2 marks	

qqq) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
4	**Course Code- 21FST-357**	Elements of Forensic Serology	3	0	0	3	Program Elective
PRE-REQUISITE		+2 Medical/ Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

rrr) **Course Description**

The Course aims to provide students with brief overview of the various sections of importance of biological fluids including blood as an evidence for criminal investigation. It detail about the difference between secretions and excretions of body fluids and importance of genetic markers for practical skill development.

sss) **Course Objectives**

1. Course aims to provide a detailed overview of the working procedures used in the Biology Division of a Forensic Science Lab.
2. To build exceptional Practical skills by making them perform the various tests performed in the Biology Division of an forensic science lab .

ttt) Course Outcomes

CO1	The student will understand the importance of biological fluids in criminal investigation
CO2	To understand the importance of genetic markers .
CO3	The importance of Blood pattern in crime detection

uuu) Syllabus

Unit-1	**Blood and Blood grouping**	**Contact Hours: 15**
Chapter 1.1	**Blood as evidence:** Composition and functions of blood. properties of human blood Collection and preservation of blood evidence	

	Self-study: Functions of blood.	
Chapter 1.2	**Blood grouping:** Distinction between human and non-human blood. Determination of blood groups. Forensic characterization of bloodstains. Typing of dried stains. **Self-study :** Difference between human and non-human blood.	
Chapter 1.3	**Antigens and Antibodies:** Cellular antigens, ABO blood group Antigens, Extracellular proteins and intracellular enzymes and their importance. Antibodies definition, role and types in brief **Self-Study :** Types of Antibodies	
Unit-2	**Body fluids**	**Contact Hours: 15**
Chapter 2.1	**Body fluids:** Composition, functions and forensic significance of body fluids. Collection and preservation. **Self-study :** Significance of body fluids	
Chapter 2.2	**Identification of Body fluids as secretions : se**men and vaginal secretions as evidence. Preliminary and confirmatory Tests for their identifications. **Self-study :** Significance of semen as evidence	
Chapter 2.3	**Identification of Body fluids:** Saliva, sweat, milk and urine. Preliminary and confirmatory Tests for their identifications. **Self-study:** Saliva, sweat, milk and urine. Preliminary and confirmatory Tests for their identifications.	
Unit-3	**Bloodstain Pattern interpretation**	**Contact Hours: 15**
Chapter 3.1	**Recognition of Bloodstain Patterns**: History of Bloodstain Pattern interpretation, target surface considerations, interpretation of Bloodstain on clothing and footwear. **Self-study :** History of Bloodstain pattern interpretation	
Chapter 3.2	**Blood stain characteristics:** Impact bloodstain patterns. Size, Shape and Directionality of bloodstains, Spattered blood, other Bloodstain Patterns, Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails **Self-study :** Contact bloodstain patterns	
Chapter 3.3	**Bloodstain Pattern Analysis:** Documentation and Photography for blood stain pattern analysis, Crime scene reconstruction with the aid of blood stain pattern **Self-study :** Photography of blood stain pattern	

vvv) Textbooks

T1. W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).

T2. G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

Reference Books:

R1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).

R2. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008

www) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
281.	Assignment*	10 marks	1 per Unit	10 marks	
282.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
283.	Quiz	4 marks for each quiz	20per Unit	4 marks	
284.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
285.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
286.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
287.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
288.	Attendance and Engagement Score on BB	NA	NA	2 marks	

xxx) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	2	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	2	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

CO4	1	1	2	1	2	1	2	2	1	2	1	2	1	2	2

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
5	**Course Code-** 21FST-358	**Elements of Forensic Anthropology**	3	0	0	3	PE
PRE-REQUISITE		+2 Medical/ Non-Medical					
CO-REQUISITE							
ANTI-REQUISITE							

Course Description

The course begins with the theoretical study of concept anthropology, scope and problems, Human skeleton, concept of race, age, sex and stature. Identification of bones, somatoscopic and somatometric differences, facial reconstruction and genetic anomalies.

Course Objectives

1. Aims to provide a brief overview of the working procedures employed in the Forensic Anthropological Investigations.
2. To familiarize students with human and non- human bones, wound characteristics and reconstruction of age, sex, race and stature.

Course Outcomes

CO1	To provide a brief overview of the working procedures employed in the Forensic Anthropological Investigations.
CO2	To apply the anthropological solutions to the remained located anywhere at the crime scene.
CO3	To recognize and implement various tools and techniques required at the crime scene.

Syllabus

Unit-1	Introduction to Anthropology	**Contact Hours: 15**
Chapter 1.1	**Topic:** Definition, scope and problems, anthropology and classification. **Self-study: topic___Study problems related to human skeleton and bones**	
Chapter 1.2	**Topic:** Introduction to Human skeleton	

	Self-study: topic___Study about human skeleton	
Chapter 1.3	**Topic:** Introduction to bones **Self-study: topic___Study different bones**	
Chapter 1.4	**Topic:** Concept of race and individualization **Self-study: topic___ Study about different races**	
Unit-2	Anthropological Problems	**Contact Hours: 15**
Chapter 2.1	**Topic:** Identification of long and short bones. **Self-study: topic___ Study about bones**	
Chapter 2.2	**Topic:** Comparison of skeletal remain: Determination of age, sex, stature and race from skeletal material. **Self-study: topic___Study about human skeleton**	
Chapter 2.3	**Topic:** Use of somatometry and somatoscopy observations in personal identification, individual variations with respect somatometry and somatoscopy. **Self-study: topic___ Somatometry and Somatoscopy**	
Unit-3	Anthropological Approximation	**Contact Hours: 15**
Chapter 3.1	**Topic:** Facial reconstruction, Portrait Parle/ Bertillon system, Photofit/identity kit. **Self-study: topic___ Study about facial reconstruction**	
Chapter 3.2	**Topic:** Facial superimposition techniques, Importance of tissue depth in facial reconstruction. **Self-study: topic___ Study about different techniques of facial superimposition**	
Chapter 3.3	**Topic:** Genetic and congenital anomalies, Causes, types, identification and their forensic significance **Self-study: topic___ Study about different genetic and congenital anomalies**	

Textbooks

T1. M.K. Bhasin and S. Nath, Advances in Forensic Science, University of Delhi, Delhi (2001).

T2. M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

T3. D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000)

T4. S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).

Reference Books:

R1.Linda L. Klepinger, Fundamental of Forensic Anthropology, A JOHN WILEY & SONS, INC., PUBLICATION.s

R2. Blau, Soren, and Douglas Ubelaker, eds. 2009. Handbook of forensic anthropology and archaeology. Walnut Creek, CA: Left Coast

R3. Christensen, Angi M., Nicholas V. Passalacqua, and Eric J. Bartelink. 2014. Forensic anthropology: Current methods and practice. San Diego, CA: Academic.

R4. Dirkmaat, Dennis, ed. 2012. A companion to forensic anthropology. Malden, MA: Wiley-Blackwell Forensic science Knowledge Individual and team work Ethics Communication sustainability Conduct investigations of complex problems Modern tool usage Life-long Learning Design/development of solutions (Forensic scientists and society CU-Forensic science University Institute of Sciences M.Sc.-Scheme &Curriculum 2020-22 Page 88

R5. Byers, Steven N. 2010. Introduction to forensic anthropology. 4th ed. Boston: Pearson.

R6. Warren, Michael W., Heather A. Walsh-Haney, and Laurel E. Freas, eds. 2008. The forensic anthropology laboratory. Boca Raton, FL: CRC

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
289.	Assignment*	10 marks	1 per Unit	10 marks	
290.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
291.	Quiz	4 marks for each quiz	20per Unit	4 marks	
292.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
293.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
294.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
295.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
296.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
6	**Course Code-** 21FST-359	**Elements of Forensic Medicine**	3	0	0	3	PE
PRE-REQUISITE		10+2 Med/Non-med					
CO-REQUISITE							
ANTI-REQUISITE							

yyy) **Course Description**

The course begins with the study of forensic medicine to nquiries in criminal matter and medico legal problems on the basis of type of death of deceased person. The students are then supposed to study about estimation the pre-mortem or postmortem injuries or various sexual offences happened to the deceased person.

zzz) **Course Objectives**

1. To skill the students to approximate the time since death of a deceased depending on the basis of changes happened post mortem.
2. To make student approximate the type of death occurred and whether the injuries inflicted or other physical or sexual offences occurred to the body are before or after death of a person.

aaaa) Course Outcomes

CO1	To make inference in order to initiate enquiries in criminal matter and medico legal problems on the basis of type of death of deceased person.
CO2	Estimate the pre-mortem or postmortem injuries or various sexual offences happened to the deceased person.
CO3	To apply the death sciences in legal/court procedures for investigation of criminal cases.

bbbb) Syllabus

Unit-1	Medico-legal aspects of death	**Contact Hours: 15**
Chapter 1.1	**Topic:** Forensic medicine and related terminologies, inquest and its types. **Self-study: topic- Terminologies related to forensic medicine.**	

Chapter 1.2	**Topic:** Forensic pathology, Somatic Death, Brain death, Medico legal aspect of Death, Causes of death **Self-study: topic- Study about forensic pathology and its effect on dead body.**	
Chapter 1.3	**Topic:** Medico-legal Autopsy, exhumation, obscure autopsy, anaphylactic deaths and artifacts **Self-study: topic- Autopsy**	
Unit-2	Physical and sexual offences and Time since death	**Contact Hours: 15**
Chapter 2.1	**Topic:** Signs of death, Determination of time since death **Self-study: topic-Study about Death, its causes and signs**	
Chapter 2.2	**Topic:** Investigation of sexual offences **Self-study: topic-Study about Types of sexual offences and advancements in investigation of sexual offences.**	
Chapter 2.3	**Topic:** Asphyxia and its types- smothering, mugging, bansdola, burking, choking, garroting, strangulation and its types, Drowning deaths **Self-study: topic- Asphyxia and its types**	
Unit-3	Ante mortem and postmortem injuries, disaster management	**Contact Hours: 15**
Chapter 3.1	**Topic:** Injuries-Types and classification, Anti mortem and post mortem injuries, Aging of injuries, Artificial injuries, starvation, electrocution **Self-study: topic-Study about types of injuries**	
Chapter 3.2	**Topic:** Accidents, Custody related torture and deaths , **Self-study: topic-Study about types accidents and causes**	
Chapter 3.3	**Topic:** Disaster management, Principle and scope of disaster management. **Self-study: topic-Study about principle of disaster management**	

cccc)Textbooks

T1. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).

T2 S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).

T3 D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).

T4 Introduction to spectroscopy, Donald L Pavia, Gary M. Lampman, and George S. Kriz, Cengage Learning-2015

T5 W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).

T6 J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).

Reference Books:

R1.Saferstein R. (1982): Forensic Science Handbook, Prentice Hall, Inc., Englewood Cliffs, N.J., 20FST715 Forensic Medicine L T P S C CH Version 1.00 3 0 0 0 3 45 Hrs Pre-requisites/ Exposure 20FST652, 20FSP657 Co-requisites Nil CU-Forensic science University Institute of Sciences M.Sc.-Scheme &Curriculum 2020-22 Page 92 427-503.

R2. Modi's: Medical Jurisprudence & Toxicology, M. M. Tripathi Press Ltd. Allahabad, 1988.

R3. Sex Trafficking A Clinical Guide for Nurses , Mary De Chesnay, Editor, Springer Publishing.

R4. Forensic Nursing: A Handbook for Practice, second edition, by Rita M. Hammer, PhD, RN, BC, Barbara Moynihan,PhD, APRN, BC, AFN and Elaine M. Pagliaro, JD, MS.

R5. Forensic Nursing,Kelly M. Pyrek, CRC press 2006.

R6. Forensic nursing –A Handbook of Practice , R.M. Hammer, B. Moyniham, E.M. Pagliaro, Jones and Bartlek publishers, 2006.

R7. Instrumental Methods Of Chemical Analysis, G.R. Chatwal, S.K. Anand, Himalya Instrumentation Methods of Analysis – Willard Merritt & Dean Settle

R8. Chapmen JR; Practical Organic Mass Spectrometry- A Guide for Chemical and Biochemical Analysis, Wiley & sons, NY(1993)

dddd) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
297.	Assignment*	10 marks	1 per Unit	10 marks	
298.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
299.	Quiz	4 marks for each quiz	20per Unit	4 marks	
300.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
301.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
302.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
303.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	

304.	Attendance and Engagement Score on BB	NA	NA	2 marks	

eeee) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
7	**Course Code-** 21FST-360	**Elements of Forensic DNA Typing**	3	0	0	3	PE
PRE-REQUISITE		10+2 Med/Non-med					
CO-REQUISITE							
ANTI-REQUISITE							

ffff) **Course Description**

The Course aims to provide students with brief overview of the various sections of importance of DNA as an evidence and its application in linking criminal to crime scene, in paternity dispute cases and in unrecognizable bodies.

gggg) **Course Objectives**

1. Course aims to provide a detailed knowledge of Genetic material and it's analysis.

2. To build exceptional skills with respect to DNA profiling and their forensic significance.

hhhh) **Course Outcomes**

CO1	This course will provide a brief overview of the basic principle of DNA analysis.
CO2	Student will able to produce the basic concepts of DNA in Paternity dispute cases
CO3	Student will able to understand the importance of short tandem repeats and restriction fragment length polymorphism in DNA technique.
CO4	Student will understand DNA as the most infallible means of identification.

iiii) Syllabus

Unit-1	**Introduction to DNA**	**Contact Hours: 20**

Chapter 1.1	**Topic:** Basis of DNA, Structural & definitive properties of Chromosomes, Human Genome, Deoxyribose Nucleic Acid – Structural properties **Self-study: topic- Basics about DNA**	
Chapter 1.2	**Topic:**Sources of DNA evidence, Collection of specimens **Self-study: topic- Study about DNA evidences**	
Chapter 1.3	**Topic:**VNTR, Short tandem repeats (STR-role of fluorescent dyes, nature of STR loci). **Self-study: topic- VNTR**	
Unit-2	**Extraction and Quantification**	**Contact Hours: 20**
Chapter 2.1	**Topic:**DNA Extraction, Basic Principles, Method of DNA extraction **Self-study: topic-Study about basic principles of DNA extraction**	
Chapter 2.2	**Topic:** DNA Electrophoresis and its types **Self-study: topic- Electrophoresis process**	
Chapter 2.3	**Topic:**DNA Quantification, Slot Blot Assay, Southern /Northern Blotting **Self-study: topic- Study about Northern and Southern blotting**	
Unit-3	**DNA typing Techniques and its application**	**Contact Hours: 20**
Chapter 3.1	**Topic:**Polymerase chain reaction – historical perspective **Self-study: topic-Study about PCR**	
Chapter 3.2	**Topic:**Restriction fragment length polymorphism (RFLP) – genetic markers used in RFLP, typing procedure and interpretation of results **Self-study: topic-Study about genetic markers used in forensic science**	
Chapter 3.3	**Topic:**DNA testing in disputed paternity. Mandelian laws of parentage testing. Mathematical basis of parentage identification. Role of DNA typing in identifying unrecognizable bodies. **Self-study: topic-Study about paternity disputes**	

jjjj) Textbooks

T1. J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005).
T2. K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton (1997).
T3. H. Coleman and E. Swenson, DNA in the Courtroom: A Trial Watcher's Guide, GeneLex Corporation, Washington (1994).
T4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene, Investigation, CRC Press, Boca Raton (2013).

kkkk) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
305.	Assignment*	10 marks	1 per Unit	10 marks	
306.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
307.	Quiz	4 marks for each quiz	20per Unit	4 marks	
308.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
309.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
310.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
311.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
312.	Attendance and Engagement Score on BB	NA	NA	2 marks	

IIII) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	2	2	1	1

SN	Program Code-BS214	Course Title	L	T	P	CH	Course Type*
8	**Course Code-** 21FST-361	**Elements of Forensic Wildlife**	3	0	0	3	PE
PRE-REQUISITE		10+2 Med/Non-med					
CO-REQUISITE							
ANTI-REQUISITE							

mmmm) **Course Description**

The course begins with the theoretical study of wildlife forensics which is widely utilized in all forensic applications in wildlife crimes. The students are then introduced to various practical related to wildlife forensics and their brief introduction.

nnnn) **Course Objectives**

To familiarize students to different wildlife samples of a forensic science laboratory, causes & preventions of wildlife crime and services provided by a forensic scientist as well as laboratory.

oooo) Course Outcomes

CO1	Student will have thorough knowledge about wildlife animal and their importance in biodiversity and rule and regulation/Act of wildlife conservation.
CO2	Student will be aware about conservation of wild life animals Student will be aware about the forensic wildlife: species identification, origin of species, population and pug marks etc.
CO3	Student will be able to deliver the expert opinion in cases where wildlife evidences are encountered in smuggling and trafficking cases.

pppp) Syllabus

Unit-1	**Concept of Wildlife Crime**	**Contact Hours: 15**
Chapter 1.1	**Topic:** Concept of Wildlife crime, Wildlife crime investigation, Sample Types, Sample collection and preservation, Sample analysis **Self-study: topic- Wildlife crime**	
Chapter 1.2	**Topic:** Wildlife conservation and Management Practices, Prevention and detection of offences **Self-study: topic- Study about different wildlife management practices**	
Chapter 1.3	**Topic:** National wildlife law enforcement, (The wildlife Protection Act, 1972, The Forest Act 1927), International wildlife law enforcement (Traffic, CITES, CBD, WHO). **Self-study: topic- Forest and Wildlife Protection Acts**	
Unit-2	Introduction to Kingdom Animalia	**Contact Hours: 15**
Chapter 2.1	**Topic:** Introduction to Kingdom Animalia **Self-study: topic-Study about different phyllums and subphyllums**	
Chapter 2.2	**Topic:** Trade or Commerce in Wild Animals, Animal Article and Trophies, Concept of endangered, vulnerable species **Self-study: topic- Recent study of endangered and vulnerable species**	
Chapter 2.3	**Topic:** Biological and Toxicological examinations of fauna with respect to blood, tissue, hair, bones, nails, claws, teeth other body parts and their derivatives. Wildlife genetics. **Self-study: topic- Study about collection and preservation of different biological samples**	
Unit-3	Introduction to Kingdom Plantae	**Contact Hours: 15**
Chapter 3.1	**Topic:** Introduction to Kingdom Plantae, Plant as trace evidence, Collection and preservation of Botanical evidence **Self-study: topic-Study about types of botanical evidences**	
Chapter 3.2	**Topic:** Trade or Commerce in Wild plants, medicinal and aromatic plants, Reserved and protected Forest area, Timber and other Forrest Produce **Self-study: topic-Study about trade of different types of medicinal plants**	
Chapter 3.3	**Topic:** Morphological and anatomical study of Confiscated plant samples, Genetic Identification of plant and wood samples **Self-study: topic-Study about confiscated plants**	

qqqq) Textbooks

T1. Linacre A, editor. Forensic science in wildlife investigations. CRC press; 2009 Mar 12.

T2 Hunter Jr ML. Wildlife, forests, and forestry. Principles of managing forests for biological diversity. Prentice Hall; 1990.

Reference Books:

R1.Bhullar L. The Indian forest rights act 2006: a critical appraisal. Law Env't& Dev. J..2008;4:20.

rrrr) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
313.	Assignment*	10 marks	1 per Unit	10 marks	
314.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
315.	Quiz	4 marks for each quiz	20per Unit	4 marks	
316.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
317.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
318.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
319.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
320.	Attendance and Engagement Score on BB	NA	NA	2 marks	

ssss) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	1	1	1	2	3
CO3	1	2	2	2	1	2	3	3	3	3	1	1	2	3	1

Value Added Courses

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-101	Forensic science and Society	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the study of relation of forensic science and its techniques to society. It includes the application of Forensic science as in Forensic Engineering, Forensic archeology and forensic Intelligence.

Course Objectives

The objectives of the course are to:

1. Study role of forensic science to society and engineering.
2. Study of Archeology, forensic and society
3. Study of Forensic Intelligence in relation to society.

b) Course Outcomes

On completion of this course, the students are expected to learn about role of forensic science in

CO1	Describe: Role of forensic Engineering for welfare of society
CO2	**Describe**: Role of forensic Archeology for welfare of society

CO3	**Differentiate:** Role of police and forensic Intelligence and it's analysis methods of crime for the welfare of society.

c) Syllabus

Unit-1	**Forensic Engineering**	**10 Hours**
Chapter 1.1	Role of mechanical, electronics and computer engineers in forensic science. Accident investigations. Failure of signaling and control systems. Ergonomics.	
Chapter 1.2	Applications of animations, simulations and digital imaging in solving crime cases. Episodes involving fire engineering..	
Unit-2	**Forensic Archeology**	**10 Hours**
Chapter 2.1	Role of forensic archeology. Searching the archeological site. Methods of digging the burial site. Recovery of remains. Documenting the recovered material. Preservation of remains.	
Unit-3	**Forensic Intelligence**	**10 Hours**
Chapter 3.1	Role of forensic intelligence in crime analysis. Methods of crime analysis. Databases in forensic intelligence. Management of serial crimes by application of forensic intelligence.	

d) Textbooks

T1 S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
T2 Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.

Reference Book

R1 Criminal Profilling – B.Turvey
R2 Ghosh S.K. and Rustomji K.F. Encyclopedia of police in India.

e) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
321.	Assignment*	10 marks	1 per Unit	10 marks	
322.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
323.	Quiz	4 marks for each quiz	20per Unit	4 marks	
324.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
325.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
326.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
327.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
328.	Attendance and Engagement Score on BB	NA	NA	2 marks	

f) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-102	Forensic science as tool for law enforcement agencies	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the theoretical study of tools and techniques, which is widely utilized in investigation of crime scene. The students are then introduced to working method of police, different types of investigation agency national and international and their method of examination and analysis.

b) **Course Objectives**

The objectives of the course are to:The importance of criminology and forensic science.
The significance of criminal profiling to mitigate crime.
The consequences of crime in society.

c) Course Outcomes

On completion of this course, the students are expected to learn about role of forensic science and role of police in judicial system.

CO1	**Identity:** Relationship between police and forensic scientist.
CO2	**Describe**: Role of forensic science
CO3	**Differentiate:** Role of police and forensic expert.

d) Syllabus

Unit-1	**Police and Forensic Science**	**10 Hours**
Chapter 1.1	Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police	
Chapter 1.2	Admissibility of Expert Testimony and Evidence in Court, Frye and Daubert standards.	
Unit-2	**Police administration**	**10 Hours**
Chapter 2.1	Evolution of Police Administration, Indian Police Service, Nature, Rank of Police, Officers–Badges, Role & Functions of Police. National Investigative Agencies: National Investigative Agency, Research and Analysis Wing, Intelligence Bureau, Narcotic Control Bureau.	
Chapter 2.2	State level Police Organization: Criminal Investigation Department (CID), Modus Operandi Bureau (MOB), District level police, Structure of an Indian Police Station.	
Unit-3	**International Investigative Agencies & Forensic reports**	**10 Hours**
Chapter 3.1	Federal Bureau of Investigation (FBI), Central Investigation Agency (CIA), MI-6, Inter-Services Intelligence (ISI) Mossad, Minister of State Security (MSS) , Federal Security Services of Russian Federation (FSB), Directorate General for External Security (DGSE), Australian Secret Intelligence Service (ASIS) and BND Germany	
Chapter 3.2	Forensic Expert, Forensic Report, Formats of Forensic Report, Court Testimony, PreCourt Preparations & Court appearance, Examination in chief, Cross Examination and Re-examination, Ethics in Forensic Science.	

e) Textbooks

T1 S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).

T2 Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.

Reference Book

R1 Criminal Profilling – B.Turvey

R2 Ghosh S.K. and Rustomji K.F. Encyclopedia of police in India.

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
329.	Assignment*	10 marks	1 per Unit	10 marks	
330.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
331.	Quiz	4 marks for each quiz	20per Unit	4 marks	
332.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
333.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
334.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
335.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
336.	Attendance and Engagement Score on BB	NA	NA	2 marks	

f) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-103	Forensic investigation of Accident cases	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the theoretical study of accidents and its type, nature of accidents which is widely utilized in investigation of accident. The students are then introduced to different types of accident and their method of examination and analysis.

b) **Course Objectives**

The objectives of the course are to:

a. The significance of photographs in accident cases.

b. The importance of trace evidences

c. The consequences of Accident analysis

c) Course Outcomes

On completion of this course, the students are expected to learn

CO1	Background of vehicle accidents, Analyze motor accidents.
CO2	Assess the post-crash movement and Systematic analysis if injuries in accidents.

CO3	Tachographic data analysis

d) Syllabus

Unit-1	**Motor Vehicle Accidents**	**10 Hours**
Chapter 1.1	Accident scene, Sources of forensic information, Eyewitness accounts, Extent of vehicle damage, Visibility conditions, Photographs of accident site.	
Chapter 1.2	Estimation of speed. Tire marks, skid marks, scuff marks. Maintenance of vehicles. Abandoned vehicles. Importance of air bags.	
Chapter 1.3	Railway accidents.	
Unit-2	**Analysis of Injuries**	**10 Hours**
Chapter 2.1	Types of injuries resulting from accident.	
Chapter 2.2	*Biomechanics of injuries. Hit and run investigations.*	
Chapter 2.3	*Trace evidence at accident sites.*	
Unit-3	**Accident Analysis**	**10 Hours**
Chapter 3.1	Pre-crash movement, Post-crash movement, Collision model, gauging driver's reaction, Occupant's kinematics, Types of injuries resulting from accident, Biomechanics of injuries, Hit and run investigations, Trace evidence at accident sites.	
Chapter 3.2	Forensic significance of Tachograph data, Tachographic charts, Principles of chart analysis, Accuracy of speed record.	
Chapter 3.3	Tire slip effects, Falsification and diagnostic signals, Route tracing.	

e) Textbooks

T1. T.S. Ferry, Modern Accident Investigation and Analysis, Wiley, New York (1988).

T2. D. Lowe, The Tachograph, 2nd Edition, Kogan Page, London (1989).

Reference Books:

R1. T.L. Bohan and A.C. Damask, Forensic Accident Investigation: Motor Vehicles, Michie Butterworth, Charlottesville (1995).

R2. S.C. Batterman and S.D. Batterman in Encyclopedia of Forensic Sciences, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000)

f) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory	**Practical**

Components	Internal Assessment	Mid Term Assessment	End Term Assessment	Continuous Assessment (CAE)	Mid Term Assessment	End Term Assessment
Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
337.	Assignment*	10 marks	1 per Unit	10 marks	
338.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
339.	Quiz	4 marks for each quiz	20per Unit	4 marks	
340.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
341.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
342.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
343.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
344.	Attendance and Engagement Score on BB	NA	NA	2 marks	

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-104	Economic offences	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course begins with the theoretical study of economic and financial crime, nature of crime which is widely utilized in investigation of case. The students are then introduced to different types of trafficking and their method of prevention.

b) **Course Objectives: The objectives of the course are to**

•Provide the scientific knowledge and understanding needed in economic offences.

•Provide illustrations of different financial crimes through a wide range of case studies

c) Course Outcomes

On completion of this course, the students are expected to learn

CO1	Basic economic and financial terminology
CO2	Economic crimes in India are linked to several other crimes.

CO3	Types of common economic offences and their consequences.

Syllabus

Unit-1	**Introduction to the Socio-Economic Offences**	**10 Hours**
Chapter 1.1	Concept and Evolution of 'Socio-Economic Offences, Nature and Extent of Socio-Economic Offences. Concept of White Collar Crimes - Sutherland's theory of 'Differential Association.' Distinction among Socio-Economic Offences, White Collar Crimes and Traditional Crimes.	
Chapter 1.2	Black money. Corruption and bribery of public servants. Money laundering and hawala transactions.	
Chapter 1.3	Insurance frauds. Corporate frauds. Bank frauds. Ponzi scheme. Pyramid scheme.	
Unit-2	**Illicit Trafficking**	**10 Hours**
Chapter 2.1	Illicit trafficking in contraband goods. Cultural objects trafficking. Illicit trafficking in arms.	
Chapter 2.2	*Illicit trafficking in explosives. Illicit drug trafficking. Trafficking in human organs. Racketeering in employment. Racketeering in false travel documents.*	
Chapter 2.3	*Racketeering in employment. Racketeering in false travel documents.*	
Unit-3	**Laws Related to Economic Offences**	**10 Hours**
Chapter 3.1	Legislations to deal with different forms of economic offences. RBI Act. SEBI Act. Competition Commission of India Act. Credit card frauds.	
Chapter 3.2	Enforcement agencies to deal with different forms of economic offences.	
Chapter 3.3	International perspectives – measures adopted by FBI and INTERPOL. Case histories of economic offences.	

Textbooks

T1. . S.P. Green, Lying, Cheating and Stealing: A Moral Theory of White Collar Crime, Oxford University Press, Oxford (2006).

T2. Indian Audit and Accounts department, Audit of Fraud, Fraud Detection and Forensic Audit, 2007.

Reference Books:

R1. R.V. Clarke, Situational Crime Prevention: Successful Case Studies, 2nd Edition, Criminal Justice Press, New York (1997).

R2. G. Geis, R. Meier, L. Salinger (Eds.), White-Collar Crime: Classic & Contemporary Views, Free Press, New York (1995).

Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			**Practical**		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
345.	Assignment*	10 marks	1 per Unit	10 marks	
346.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
347.	Quiz	4 marks for each quiz	20per Unit	4 marks	
348.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
349.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
350.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
351.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
352.	Attendance and Engagement Score on BB	NA	NA	2 marks	

d) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-105	Digital Forensics	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description**: The course begins with the theoretical study of cybercrime and its type, nature of cybercrime which is widely utilized in investigation. The students are then introduced to different types of cyber-crime and their method of examination and analysis.

b) **Course Objectives**

The objectives of the course are to:

- To become familiar with various definitions and typologies of cyber crime
- To become familiar with Cyber laws and regulations
- Equip students with the right skills thus enabling them to adapt real working environment, while contributing positively to the society at large.

c) Course Outcomes

On completion of this course, the students are expected to learn

CO1	**Describe**their theoretical and practical knowledge in forensic computing, into the future and emerging technology
CO2	**Identify** and **Explain** at least current issues in the practice of digital forensic investigations.

CO3	**Understand** the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing

d) Syllabus

Unit-1	**Computer Fundamentals**	**10 Hours**
Chapter 1.1	Computer Generations, characteristics and classifications, Concept of Computer Hardware, Concept of Computer Software, Internet	
Chapter 1.2	**Cyber Crimes I** - Hacking, virus, obscenity, pornography, programme manipulation, Cyber terrorism	
Unit-2	**Cyber-crimes and IT Act 2000**	**10 Hours**
Chapter 2.1	**Cyber Crimes II -** Software piracy, intellectual property and computer security, Encryption and Decryption methods	
Chapter 2.2	**IT Act** -Introduction to IT act 2000 with special mention of sections 65, 66, 67, 70, 72, 78	
Unit-3	**Investigation of cyber crimes**	**10 Hours**
Chapter 3.1	Collection, Preservation, Examination and Analysis of information (evidence) in an electronic form.	
Chapter 3.2	Data Protection, Data Acquisition, Imaging, Extraction, Interrogation, Ingestion/Normalization, Analysis,Reporting	

e) Textbooks

T1 James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
T2 Leshin, C.B., Internet Investigation in Criminalistics, Prentice Hall, New Jersey, 1997.
Reference books
R1 Tessarolo, A.A. and Marignani, A., Forensic Science and the Internet. The Canadian Society of Forensic Science Journal, Vol. 29, 1996.
Bernad Jahne: Digital Image processing, Springer Verlag (1993)

f) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**
Marks	**20**	**20**	**60**	**40**	**20**	**40**
Total Marks	**100**			**100**		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
353.	Assignment*	10 marks	1 per Unit	10 marks	
354.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
355.	Quiz	4 marks for each quiz	20per Unit	4 marks	
356.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
357.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
358.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
359.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
360.	Attendance and Engagement Score on BB	NA	NA	2 marks	

g) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-106	Introduction to Biometry	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) **Course Description:** The course begins with the theoretical study of fundamental aspects of biometrics and measures of biometrics and their method of examination and analysis.

b) **Course Objectives**
The objectives of the course are to:

- The basis of biometry.
- The classification of biometric processes.
- The importance of behavioral biometry.

c) Course Outcomes
On completion of this course, the students are expected to learn

CO1	**Identity:** the classification of biometric system and its fundamental
CO2	**Describe**: utilization of biometric system for positive identification.

CO3	**Differentiate:** Various physical biometric characteristics and use in identification

d) Syllabus

Unit-1	**Introduction & Fundamental Aspects of Biometrics**	**10 Hours**
Chapter 1.1	Definition, characteristics and operation of biometric system. Classification of biometric systems – physiological and behavioral. Strength and weakness of physiological and behavioral biometrics.	
Chapter 1.2	Multimodal biometrics. Key biometric processes – enrollment, identification and verification. Positive and negative identification.	
Unit-2	**Measures of Biometrics**	**10 Hours**
Chapter 2.1	Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV. Biometric versus traditional technologies.	
Chapter 2.2	**Physiological Biometrics-** Fingerprints, palm prints, iris, retina, geometry of hand and face.	
Unit-3	**Behavioral Biometrics**	**10 Hours**
Chapter 3.1	Handwriting, signatures, types of forgery, keystrokes, gait and voice and speaker recognition.	

e)Text References;-

T1 J.R. Vacca, *Biometric Technologies and Verification Systems*, Butterworth-Heinemann, Oxford (2007).
T2 Daniloff, R., Schuckers, G. and Feth, L. (1980) *The Physiology of Speech and Hearing: An Introduction*, Englewood Cliffs: Prentice-Hall.

Reference:

R1 Daubert (1993) *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993) 113 S Ct 2786.
R2 Davies, S. B. and Mermelstein, P. (1980) 'Comparison of parametric representations for monosyllabic word recognition in continuously spoken sentences', *IEEE Transactions on Acoustics, Speech, and Signal Processing* 28: 357–66.

f) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory			Practical		
Components	**Internal Assessment**	**Mid Term Assessment**	**End Term Assessment**	**Continuous Assessment (CAE)**	**Mid Term Assessment**	**End Term Assessment**

Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
361.	Assignment*	10 marks	1 per Unit	10 marks	
362.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
363.	Quiz	4 marks for each quiz	20per Unit	4 marks	
364.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
365.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
366.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
367.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
368.	Attendance and Engagement Score on BB	NA	NA	2 marks	

g) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1

SN	Program Code- BS214	Course Title	L	T	P	CH	Course Type*
1	Course Code- 21FSV-107	Handwriting Examination	2	0	0	2	Value added
PRE-REQUISITE							
CO-REQUISITE							
ANTI-REQUISITE							

a) Course Description

The course will start with introduction to Handwriting examination its important, and important aspect of forensic document examination.Due to the prevalent and integral role played by handwriting in everyday communication, the Handwriting examination typically involves the comparison of known specimens to handwriting evidence found on questioned or disputed documents.

b) **Course Objectives**

The objectives of the course are to:

- Developing an understanding and appreciation for the scope of Handwriting Identification and Examination.
- Develop an understanding on handwriting and their characteristics, principles of identification.
- Give brief description on various methods of their detection and examination.

c) Course Outcomes

On completion of this course, the students are expected to learn

CO1	The student will able to **recognize** and **categorize** the Handwriting and its characteristics.
CO2	The students will able to **assess** and **distinguish** theForged and Disguised Documents and their characte features.
CO3	They will be able to **identify** and **memorize** the General equipments used for examination of documents.

d) Syllabus

Unit-1	**Introduction to Questioned Documents**	**10 Hours**
Chapter 1.1	Definition: Documents, questioned documents and the type of cases encountered; Importance, nature and problems of documents.	
Chapter 1.2	Collection, handling and presentation of documents, adequacy of exemplars and standards.	
Unit-2	**Handwriting and forged documents**	**10 Hours**
Chapter 2.1	Handwriting, Class and Individual characteristics, Natural variations, Principles of handwriting identification, External and internal factors which influence handwriting.	
Chapter 2.2	Forged documents, disguised documents, characteristics features and variations found in handwriting characteristics due to forgery/ disguise, types of forgeries and their identification	
Unit-3	**Tampered Documents & General Equipments for Examination**	**10 Hours**
Chapter 3.1	Physical and Chemical erasures, Obliterations, addition, alterations and charred documents. Examination of tampered documents.	
Chapter 3.2	Hand lens, Camera, Compound Microscope, Stereo microscope, Transmitted light source, UV-IR radiation chamber and Oblique Light source.	

e) Text Books:

T1Albert, S. Osborn, Questioned Documents, Second Ed., Universal Law Publishing, Delhi, 1998.

T2 Charles, C. Thomas, I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates, Springfield, Illinois, USA, 1971.

T3 Kelly, J. S. Lindblom, B. S. (2006).*Science, Handwriting Examination and the Courts. Scientific Examinations of Questioned Documents*, 2nd edition, CRC Press, Taylor & Francis group.

References:

R1 Huber, A. R. Headrick, A. M. (1999). *The Discrimination and Identification of writing. Handwriting Identification Facts and Fundamentals*, CRC Press, Boca Raton London.

R2 James, S. H. And Nordby, J. J. (Eds), Forensic Science; An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.

R3 Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.

R4 Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rd Ed) Universal Law Publishing Co. Ltd. New Delhi, 2001.

f) Assessment Pattern- internal and External

The performance of students is evaluated as follows:

	Theory	Practical

Components	Internal Assessment	Mid Term Assessment	End Term Assessment	Continuous Assessment (CAE)	Mid Term Assessment	End Term Assessment
Marks	20	20	60	40	20	40
Total Marks	100			100		

Internal Evaluation Component

S.no.	Type of Assessment	Weightage of actual conduct	Frequency of Task	Final Weightage in Internal Assessment	Remarks
369.	Assignment*	10 marks	1 per Unit	10 marks	
370.	Time Bound Surprise Test	12 marks for each test	1 per Unit	4 marks	
371.	Quiz	4 marks for each quiz	20per Unit	4 marks	
372.	Mid Semester Test*	20 marks for MST	2 per semester	20 marks	
373.	Presentation**			Non-Graded: Engagement Task	Only for self-study MNG courses
374.	Homework	NA	1 per lecture topic (of 2 questions)	Non-Graded: Engagement Task	
375.	Discussion forum	NA	1 per Chapter	Non-Graded: Engagement Task	
376.	Attendance and Engagement Score on BB	NA	NA	2 marks	

g) CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	3
CO2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	1	1	2	2	1	1	1	2	1	1