Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SCHEME & SYLLABUS
(Choice Based Credit System)
for
B.Sc. Forensic Science
1st TO 6th SEMESTER

(w.e.f. Session 2019 onwards)

Program Code: FORS301

DEPARTMENT OF FORENSIC SCIENCE

SCHOOL OF PARAMEDICAL SCIENCE
RIMT UNIVERSITY, MANDI GOBINDGARH, PUNJAB

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

TABLE OF CONTENTS

S. No.	Content	Page No.
1.	**Section 1**: Vision and Mission of the University	3
2.	**Section 2**: Vision and Mission of the Department	4
3.	**Section 3**: About the Program	5
4.	**Section 4**: Program Educational Objectives (PEOs) , Program Outcomes (POs) and Program Specific Outcomes(PSOs)	6-8
5.	**Section 5**: Curriculum / Scheme with Examination Scheme	9-17
6.	**Section 6**: Detailed Syllabus with Course Outcomes	18-97

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society

MISSION

- To impart teaching and learning through cutting edge technologies supported by the world class infrastructure

- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SECTION 2

Vision and Mission of the Department

VISION

The department of forensic science stands out as an Institute that envisions a bright future by imparting Quality Professional Education of very high Standards with special emphasis of Research and Development (R & D) and continuous updating the curricula in consonance with local and Global needs. We see higher aspirations and better results with professional Excellence combined with Perfection and absolutely relentless collective efforts.

MISSION

- To prepare learners for world class Professionals empowered with competitive knowledge, skill ethical values and confidence to lead in the fields of forensic science.

- To provide students a stimulating and intellectual environment conducive to personality development and confident decision making.

- To sharpen India's young talent and helping them discover the true meaning of global education for true success.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SECTION 3

About the Program

Forensic science is the application of all sciences to law. The field of forensic science is undoubtedly expanding as global crime and fraud rates continue to rise. In order to define and uphold these regulations, forensic science utilizes scientific knowledge and technology. The three-year B. Sc. Forensic Science curriculum equips students with the knowledge and abilities needed to complete autonomous projects in the fields of Biology, Chemistry, Law, and Forensic Investigation.

The curriculum provides theoretical and practical expertise in all facets of Criminalistics, demonstrating proficiency in areas including forensic chemistry, questioned documents and toxicology. This curriculum focuses on forensic science, where students learn about crimes, crime scenes, and the related methods and equipment needed to solve crimes, in addition to all laboratory methods and methods for gathering evidence. They research how to investigate different types of crime scenes and how to use lab analysis to find the primary offender.

Eligibility criteria for BSc. : 10+2 Medical/Non-Medical

Bachelor of Forensic Science includes 6 semesters with the practical exposure.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

The PEOs are general statements that outline the career and professional achievements that the programme is preparing its alumni to attain in the few years after the receipt of their degree. The PEOs for the programme in forensic science are as follows:

PEO1	PEO-1: Graduates of RIMT forensic programme will be well-prepared for successful jobs in the field of forensic science, as well as in research and innovation at businesses, in the public sector, and/or in related subfields.
PEO2	PEO-2: RIMT forensic graduates will be proficient in using cutting-edge and established software and technology for the discovery, analysis, and assessment of forensic evidence.
PEO3	Graduates from RIMT forensic programme will be effective in managing interdisciplinary teams with professional capabilities to expand their knowledge, skills, and dexterity in conducting scientific research and providing objective, dependable scientific conclusions in court.
PEO4	By educating the public about the various tactics used by criminals to commit crimes, RIMT forensic graduates will serve society in a way that goes beyond their expertise as forensic experts.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

PROGRAMME OUTCOMES (POs)

PO 1	Problem Solving Attitude: Be proficient in integrating knowledge and applying their understanding in identifying problems and producing powerful solutions.
PO 2	Professional Competence: Attain professional competence, intellectual maturity and personal growth along with a commitment for ethical development of the industry.
PO 3	Critical Analysis & Decision Making: ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
PO 4	Environment and Sustainability: To develop understanding of environment impact of businesses and be able to apply forensic knowledge to develop sustainable crime solving methods.
PO 5	Ethics & Values: To learn and apply Forensic ethics principles and be committed to professional ethics and responsibilities and norms of the crime scene management.
PO 6	Individual & Team Work: To develop team skills and be able to lead various cross functional team with members from different background. An ability to function effectively on teams to accomplish a common goal.
PO 7	Life Long Learning: Aptitude to acquire newer knowledge and skills, assimilate and adapt them to be ready to confront uncharted environment scientifically and confidently.
PO 8	Global Orientation and Cross-Cultural Appreciation: Ability to face any issues related to forensic science especially related to DNA, Fingerprints and Handwriting examination from a global perspective with confidence, positivity and exhibit an understanding of Cross Cultural perspective of science and technology.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Students will understand the basic concepts, fundamental principles, scientific theories related to forensic science and their respective applications in day-to-day life.
PSO 2	Students will be able to design & demonstrate the use of tools and techniques required to provide solutions based on the available data. They will develop scientific outlook not only with respect to the science subjects but also in all aspects related to life.
PSO 3	Students will become familiar with the various disciplines of forensic science like forensic toxicology, forensic ballistics, fingerprint examination, questioned documents, etc. They will also learn to apply appropriate tests and techniques for the qualitative as well as quantitative analysis of various evidences in laboratories as well as industries.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SECTION 5

Curriculum / Scheme with Examination Grading Scheme

SEMESTER WISE SUMMARY OF THE PROGRAMME:
BSc.
(Forensic Science)

S. No.	Semester	Credit
1	I	27
2	II	27
3	III	26
4	IV	26
5	V	26
6	VI	26

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A+	9	Excellent
60-69	A	8	Very Good
55-59	B	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Pass
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA *10

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

Syllabi Applicable For Admissions 2019 Onwards

SYLLABUS & STUDY SCHEME (2019 Batch Onwards)

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

B.Sc. Forensic Science (for Medical)

First Semester

COURSE		Contact Hours/Week			Credit	% of Total Marks					Exam Duration (Hours)
Code	Course Title	L	T	P		CWA	LWA	MTE	ETE	Total	
BFBT-1101	**Biodiversity(Microbes, Algae, Fungi & Archegoniate)**	4	0	0	4	16	-	24	60	100	3
BFBT-1102	**Botany Lab. I**	0	0	4	2	-	-	-	100	100	3
BFZO-1101	**Diversity of Animals-I**	4	0	0	4	16	-	24	60	100	3
BFZO-1102	**Zoology Lab. I**	0	0	4	2	-	-	-	100	100	3
BFCH-1105	**Organic Chemistry-I**	2	0	0	2	16	-	24	60	100	3
BFCH-1106	**Physical Chemistry-I**	4	0	0	4	16	-	24	60	100	3
BFCH-1107	**Chemistry Laboratory-I**	0	0	6	3	-	-	-	100	100	3
BHUM-1101	**Communication Skills**	2	0	0	2	16	-	24	60	100	3
BHUM-1102	**Communication Skills Lab**	0	0	2	1	-	-	-	100	100	3
BFFF-1108	**General Forensic science**	3	0	0	3	16	-	24	60	100	3
Total		**19**	**0**	**16**	**27**	**96**	**-**	**144**	**760**	**1000**	**30**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

Second Semester

COURSE		Contact Hours/Week			Credit	% of Total Marks					Exam Duration (Hours)
Code	Course Title	L	T	P		CWA	LWA	MTE	ETE	Total	
BFBT-1201	Plant Ecology & Taxonomy	4	0	0	4	16	-	24	60	100	3
BFBT-1202	Botany Lab. II	0	0	4	2	-	-	-	100	100	3
BFZO-1201	Diversity of Animals-II	4	0	0	4	16	-	24	60	100	3
BFZO-1202	Zoology Lab. II	0	0	4	2	-	-	-	100	100	3
BFCH-1205	Organic Chemistry-II	2	0	0	2	16	-	24	60	100	3
BFCH-1206	Inorganic-Chemistry-I	4	0	0	4	16	-	24	60	100	3
BFCH-1207	Chemistry Laboratory-II	0	0	6	3	-	-	-	100	100	3
BEVS-1201	Environmental Science	2	0	0	2	16	-	24	60	100	3
BFFS-1208	Criminal Law	4	0	0	4	16		24	60	100	3
Total		**20**	**0**	**14**	**27**	**96**	**-**	**144**	**660**	**900**	**27**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Third Semester

COURSE		Contact Hours/Week			Credit	% of Total Marks					Exam Duration (Hours)
Code	Course Title	L	T	P		CWA	LWA	MTE	ETE	Total	
BFBT-2301	Plant Anatomy & Embryology	4	0	0	4	16	-	24	60	100	3
BFBT-2302	Botany Lab. III	0	0	4	2	-	-	-	100	100	3
BFZO-2301	Physiology & Biochemistry	4	0	0	4	16	-	24	60	100	3
BFZO-2302	Zoology Lab. III	0	0	4	2	-	-	-	100	100	3

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

BFCH-2305	**Organic Chemistry-III**	2	0	0	2	16	-	24	60	100	3
BFCH-2306	**Physical Chemistry-II**	4	0	0	4	16	-	24	60	100	3
BFCH-2307	**Chemistry Laboratory-III**	0	0	6	3	-	-	-	100	100	3
BFFS-2308	**Criminalistics**	4	0	0	4	16	-	24	60	100	3
BFSL-2309	**Criminalistics Laboratory**	0	0	2	1	-	40	-	60	100	3
Total		**18**	**0**	**16**	**26**	**80**	**40**	**120**	**660**	**900**	**27**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

Fourth Semester

COURSE		Contact Hours/Week			Credit	% of Total Marks					Exam Duration (Hours)
Code	Course Title	L	T	P		CWA	LWA	MTE	ETE	Total	
BFBT-2401	Plant Physiology & Metabolism	4	0	0	4	16	-	24	60	100	3
BFBT-2402	Botany Lab. IV	0	0	4	2	-	-	-	100	100	3
BFZO-2401	Genetics & Evolutionary Biology	4	0	0	4	16	-	24	60	100	3
BFZO-2402	Zoology Lab. IV	0	0	4	2	-	-	-	100	100	3
BFCH-2405	Organic Chemistry-IV	2	0	0	2	16	-	24	60	100	3
BFCH-2406	Inorganic-Chemistry-II	4	0	0	4	16	-	24	60	100	3
BFCH-2407	Chemistry Laboratory-IV	0	0	6	3	-	-	-	100	100	3
BFFS-2408	Questioned Document Examination	4	0	0	4	16	-	24	60	100	3

BFSL-2409	**Questioned Document Laboratory**	0	0	2	1	-	40	-	60	100	3
Total		**18**	**0**	**16**	**26**	**80**	**40**	**120**	**660**	**900**	**27**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Fifth Semester

COURSE		**Contact Hours/Week**			**Credit**	**% of Total Marks**					**Exam Duration (Hours)**
Code	**Course Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
BFBT-3501	**Discipline Specific Elective Botany-I Cell and Molecular Biology**	4	0	0	4	16	-	24	60	100	3
BFBT-3502	**Botany Lab. V**	0	0	4	2	-	-	-	100	100	3
BFZO-3501	**Discipline Specific Elective Zoology-I Applied Zoology**	4	0	0	4	16	-	24	60	100	3
BFZO-3502	**Zoology Lab. V**	0	0	4	2	-	-	-	100	100	3
BFCH-3505	**Organic Chemistry-V**	2	0	0	2	16	-	24	60	100	3
BFCH-3506	**Physical Chemistry-III**	4	0	0	4	16	-	24	60	100	3
BFCH-3507	**Chemistry Laboratory-V**	0	0	6	3	-	-	-	100	100	3
BFFS-3508	**Fingerprints Examination**	4	0	0	4	16	-	24	60	100	
BFSL-3509	**Fingerprints Laboratory**	0	0	2	1	-	40	-	60	100	3
Total		**18**		**16**	**26**	**80**	**40**	**120**	**660**	**900**	**27**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Sixth Semester

COURSE		Contact Hours/Week			Credit	% of Total Marks					Exam Duration (Hours)
Code	Course Title	L	T	P		CWA	LWA	MTE	ETE	Total	
BFBT-3601	**Discipline Specific Botany-II Economic Botany and Biotechnology**	4	0	0	4	16	-	24	60	100	3
BFZO-3601	**Discipline Specific Elective Zoology-II Immunology**	4	0	0	4	16	-	24	60	100	3
BFBT-3602	**Botany Lab. VI**	0	0	4	2	-	-	-	100	100	3
BFZO-3602	**Zoology Lab. VI**	0	0	4	2	-	-	-	100	100	3
BFCH-3605	**Organic Chemistry-VI**	2	0	0	2	16	-	24	60	100	3
BFCH-3606	**Inorganic Chemistry-III**	4	0	0	4	16	-	24	60	100	3
BFCH-3607	**Chemistry Laboratory-VI**	0	0	6	3	-	-	-	100	100	3
BFFS-3608	**Cyber Forensics**	4	0	0	4	16	-	24	60	100	
BFSL-3609	**Cyber Forensics Lab.**	0	0	2	1	-	40	-	60	100	3
Total		**18**		**16**	**26**	**80**	**40**	**120**	**660**	**900**	**27**

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Biodiversity (Microbes, Algae, Fungi & Archegoniate)
SUBJECT CODE: BFBT-1101
SEMESTER: I
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instructions of question paper setter:

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

O OUTCOME OF COURSE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of biodiversity of microbes, algae, fungi and archegoniate.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Section-A

- **Microbes: Viruses** – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.
- **Algae :** General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas, Oedogonium*, *Vaucheria*, Economic importance of algae
- **Fungi :**Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic Associations-Lichens:

General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance, Fungi like organisms Albugo, Phytophthora and slime molds

Section-B

- **Introduction to Archegoniate :** Unifying features of archegoniates, Transition to land habit, Alternation of generations
- **Bryophytes:** General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance ofbryophytes with special mention of *Sphagnum*.

Section-C

- **Pteridophytes:** General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.
- **Gymnosperms:** General characteristics, classification. Classification (up to family), morphology, anatomy andreproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Ecological andeconomical importance.

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, PearsonBenjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillanPublishers Pvt. Ltd., Delhi.
4. B.R. Vashishta , (2016) Botany For Degree Students Fungi. S Chand & Company.
5. Geeta Sumbali, (2011) The Fungi. Alpha science Intl Ltd Second Edition.
6. K R Aneja & R S Mehrotra (2015) An Introduction to Mycology. New Age International Publishers Second Edition.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Botany Lab. I
SUBJECT CODE: BFBT-1102
SEMESTER: I
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

Practical

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc, Chlamydomonas* (electron Micrographs), *Oedogonium, Vaucheria, Fucus* and Polysiphonia* through permanent slides.
5. *Rhizopus and Penicillium*: Asexual stage from temporary mounts and sexual structuresthrough permanent slides.
6. *Alternaria:* Specimens/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves
8. *Agaricus*: Specimens of button stage and full grown mushroom
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. ***Marchantia***- morphology of thallus, w.m. rhizoids and scales, v.s. thallus throughgemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore,l.s. sporophyte (all permanent slides).
12. ***Funaria***- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s.capsule and protonema.
13. ***Selaginella***- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m.microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. ***Equisetum***- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore,w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
15. ***Pteris***- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte(permanent slide).
16. ***Cycas***- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet,v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanentslide).
17. ***Pinus***- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m.dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m.microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: DIVERSITY OF ANIMALS-I
SUBJECT CODE: BFZO-1101
SEMESTER: I
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consist three questions of eight marks each from the respective sections of the syllabus.

Section-A

Unit 1: Kingdom Protista

General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa-Ameoba,Paramecium,Euglena

Unit 2: Phylum Porifera

General characters and classification up to classes; Canal System in *Sycon*

Unit 3: Phylum Cnidaria

General characters and classification up to classes; Polymorphism in Hydrozoa,coral &coral reefs

Section-B

Unit 4: Phylum Platyhelminthes

General characters and classification up to classes; Life history of *Taenia solium and Fasciola Hepatica*

Unit 5: Phylum Ashelminthes

General characters and classification up to class**,** Life Cycle of Ascaris,Parasitic adaptation in Helminthes

Unit 6: Phylum Annelida

General characters and classification up to classes; Metamerism in Annelida

Section-C

Unit 7: Phylum Arthropoda

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects, Importance of Arthropoda in Forensic Sciences

Unit 8: Phylum Mollusca
General characters and classification up to classes; Torsion in gastropods

SUBJECT TITLE: Zoology Lab. I
SUBJECT CODE: BFZO-1102
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

1. Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium
2. Examination of pond water collected from different places for diversity in protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
5. One specimen/slide of any ctenophore
6. Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/microphotographs)
7. Study of adult Ascaris lumbricoides and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

Recommended Books:

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
3. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
4. Pough H. *Vertebrate life*, VIII Edition, Pearson International.
5. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: ORGANIC CHEMISTRY-I
SUBJECT CODE: BFCH-1105
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of organic chemistry & Stereochemistry of organic compounds.

Section A (10 hrs)

Basics of organic chemistry

Hybridization, shapes of molecules, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding(applications of all these effects);organic acids & bases, and their relative strengths; dipole moment, Curved arrow notation, drawing electron movements with arrows, half-headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles.Nucleophilicity& basicity; Types of organic reactions & their mechanisms, Energy considerations. Reactive intermediates-carbocations, carbanions, free radicals, carbenes, and nitrenes (their types, shapes & relative stability). Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Section B (10 hrs)

Stereochemistry-I

Concept of isomerism.Types of isomerism. Optical isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, specific rotation, properties of enantiomers, Chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enatiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Section C (10 hrs)

Stereochemistry-II

Geometric isomerism - determination of configuration of geometric isomers.Syn-anti & E & Z notations with C.I.P. rules, geometric isomerism in oximes and alicyclic compounds. Optical isomerism, Conformational isomerism - conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives.Difference between conformation and configuration, Fischer and flying wedge formulae Newman projection and Sawhorse formulae & their interconversion.

Recommended Books:

1. Robert Thornton Morrison and Robert Neilson Boyd, Organic Chemsitry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. I.L. Organic Chemistry (Volume I), Darling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. I.L. Finar, Organic Chemistry (Volume II): Stereochemistry & the chemistry of natural products, Darling Kindersley (India) Pvt. Ltd. (Pearson Education).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: PHYSICAL CHEMISTRY-I
SUBJECT CODE: BFCH-1106
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Outcome: To impart knowledge of basics of physical chemistry

Section – A (15 hrs)

Mathematical Concepts

Logarithmic relations, differentiation of functions like Kx, e^x, x^n, sin x, log x, maxima and minima, partial differentiation and reciprocity relations.Integration of some useful relevant functions.

Liquid State

Intermolecular forces, differences between solids, liquids and gases states, Physical properties of liquid-vapour pressure, surface tension, surface active agents, viscosity, effects of temperature on viscosity, Liquid crystals: Difference between liquid crystal, LCDs & the seven segment cell, Classification of thermotropic, liquid crystal, semetic liquid crystal, nematic liquid crystals, cholestric liquid crystal, disc shaped liquid crystals, polymer liquid crystals.

Section- B (15 hrs)

Gaseous State

The kinetic molecular theory of gases, deviation from ideal behaviour, van der Waals equation of states, kinetic energy & temperature, Maxwell distribution of molecular velocities & energies, types of molecular velocities, collision parameters (diameter, cross section, number frequency), mean free path , the critical phenomena P-V isotherm of CO2, the vander Waal's equation of critical state, principal of corresponding states, reduced equation of state, molar masses & density of real gases, liquefaction of gases, viscosity, diffusion.

Chemical Equilibrium

Irreversible & reversible reactions, chemical equilibrium, law of mass action, thermodynamic treatment of law of mass action, Van't Hoff reaction isotherm, relation between Kp, Kc&Kx, homogenous &heterogenouseuilibria, Le Chatelier's principle, applications of Le Chatelier's principle, Clausius-Claperyron equation.

Section- C (15 hrs)

Chemical Kinetics-I

Rate of a reaction, rate law & rate constant, factors influencing the rate of a reaction,

Units of rate constant, integration of rate exoressions, order &molecularity of reactions, zero order, first order, second order & third order reactions, pseudo order reactions, half life time of a reaction, methods of determining order of a reaction,Radioactive decay as a first order phenomenon, kinetics of complex reactions: opposing, consecutive & chain reactions.

Chemical Kinetics-II

Erying equation, Lindnann theory unimolecular gaseous reactions, effect of temperature & pressure on reaction rate, theories of reaction rates. Catalysis Introduction, Homogeneous &heterogenous catalysis, enzyme catalysis, kinetics of enzyme catalyzed reaction-MichaelisMenten equation.

Recommended Books:

1. Physical Chemistry by Gurdeep Raj; Krishna Prakashan Media (P) Ltd.
2. Physical Chemistry by Puri Sharma Pathania; Vishal Publishing Co.
3. Physical Chemistry by Atkins; W.H. Freeman & Company, New York.
4. Advanced Physical Chemistry by Gurthu; PraghatiPrakashan.
5. Physical Chemistry by K L kapoor; Rajiv Beri for Macmillan india Ltd.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: CHEMISTRY LABORTARY-I
SUBJECT CODE: BFCH-1107
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Outcome: To impart knowledge of basics principles of chemistry phenomenons

INORGANIC

Semi-micro analysis: Cation analysis, separation and identification of Groups I, II, III, IV, V and VI. Anion analysis (2 cation and 2 anion with no interference).

ORGANIC

1. (a) Determination of melting point of following solids: naphthalene, benzoic acid, acetanilide & urea.

(b) Determination of boiling point of following liquids: ethanol, cyclohexane, propanol, toluene.

2. Purification of organic compounds by crystallization:

(a) Phthalic acid from hot water.

(b) Acetanilide from boiling water.

(c) Benzoic acid from water.

Recommended Books:

1. Vogel's book on Inorganic Qualitative Analysis

2. Vogel's book on Organic Qualitative Analysis

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: COMMUNICATION SKILLS
SUBJECT CODE: BHUM-1101
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Outcome:

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this subject is to enable the graduate students to acquire proficiency, both in spoken (oral) and written language. At the end of the subject, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English.

Contents of Syllabus:

UNIT-I Comprehension exercises on the following selective readings :

- The Voice of God
- The Portrait of a Lady
- Kabuliwala
- A Service of Love
- Green Parrots in A Cage

UNIT-II **Communication**: Introduction, Meaning, Definition, Process of communication, Objectives, Features/Characteristics of communication, Types of communication, Principles/Essentials of Effective communication.

UNIT-III **Listening Skills-** Introduction, Difference between Listening and Hearing, Essential skills for listening, Barriers to listening, Tips for improving Listening skills

Personality Development: Introduction, Meaning, Definitions of Personality, Determinants of Human Personality, Traits of an effective Personality, Steps for Personality Development, Self Esteem.

UNIT-IV **Vocabulary and Grammar:** Parts of Speech,Tenses**,** One word substitution, Antonyms, Prefixes and Suffixes, Letter Writing(Personal), Essay Writing, Comprehension(Unseen Passage)

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: COMMUNICATION SKILLS (Pr.)
SUBJECT CODE: BHUM-1102
SEMESTER: I
CONTACT HOURS/WEEK:

Internal Assessment: 60
End Term Exam: 40
Duration of Exam: 1 Hr

Contents of Syllabus:

***The following activities to be conducted in Comm. Skills Lab.**

1	Personality development , Mannerism & Etiquette
2	Essentials of a Good Speech
3	JAM Sessions
4	Telephone Etiquette
5	Debate
6	Group Discussions
7	Interviews Technique
8	SWOT Analysis
9	C's in Life
10	Ten Commandments

Recommended Books:

- *Fluency in English*- Part II, Oxford University, 2006
- *Prose Parables by Orient Blackswan (for Unit - I)*
- *Business English*, Pearson, 2008
- *Language, Literature and Creativity*, Orient Blackswan, 2013
- *Language through Literature*(forthcoming) ed. Dr. Gauri Mishra, DrRanjanaKaul, DrBrati Biswas
- *The Students' Companion,* Wilfred D. Best

- *English for Effective Communication* by Navjot S.Deol
- *An Approach to Communication Skills* by Indrajit Bhattacharya
- *Business Communication* by Varinder Kumar and Bodh Raj
- *Personality Development and soft Skills by Achhru Singh and Dharminder Singh Ubha*
- *Business Communication by M.K. Sehgal and Vandana Khetarpal*

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: General Forensic Science
SUBJECT CODE: BFFF-1108
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Course Outcome: To impart knowledge of Forensic Science and Crime Scene Investigation.

Section-A

Forensic Science: History of Forensic Sciences, Definitions of Forensic science given by different authors, Nature, Scope, Need and Functions.

Principles of forensic science: Law of individuality, principle of exchange, law of progressive exchange, principle of comparison, Principle of analysis, law of probability. Tools and techniques in forensic science, Set up of Forensic Science Laboratory, Hierarchy of experts in Forensic Science Laboratories.

Section-B

Ethics in Forensic Science, Duties of Forensic Scientist.

Various Police Organizations, Organization of Police Station, Role & Functions of Police in crime scene investigation, Modus Operandi, Crime Record.

Types of Forensic Science Laboratories: CFSLs, State Forensic Science Laboratory, Regional Forensic Science Laboratory, Mobile Forensic Science Laboratory.

Definitions, concepts of crime, causes of crime, prevention of crime.

Section-C

Crime Scene Investigation: Types of crime scene, Understanding and purposes of crime scene examination, First responding officers, Protection of the crime Scene, documentation of Crime scene, methods of search for physical clue materials, Reconstruction of Crime scene.

Physical Evidences: Definition, its collection, packing and transportation, chain of custody.

Role of Forensic Scientist in Collection of Physical evidence, role of investigating officers in collection of Physical evidence**.**

Books Recommended:

1. Siegel J. A. and Mirakovits K: **Forensic Science: The Basics,** CRC Press, 3rd Edition, 2016.
2. Siegel J. A. and Saukko P. J.: **Encyclopedia of Forensic Sciences,** Academic Press, 2nd Edition, 2013.
3. Saferstein R: **Forensic Science Hand Book**, Vol I, CRC Press, 3rd Edition. 2020.
4. Saferstein R: **Forensic Science Hand Book**, Vol II, Pearson, 2nd Edition. 2005.
5. Saferstein R: **Forensic Science Hand Book**, Vol III, Pearson, 2nd Edition. 2010.
6. Saferstein, R: **Criminalistics: An Introduction to Forensic Science**, Pearson, 12th Edition, 2018.
7. Sharma B. R.: **Forensic Science in Criminal Investigation & Trials**, Universal Law Publishing, 6th Edition, 2020.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Plant Ecology & Taxonomy
SUBJECT CODE: BFBT-1201
SEMESTER: II
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instructions of question paper setter:

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

Course Outcome:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of plant ecology and taxonomy.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Section-A

- **Introduction**
  Ecological factors: Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.
- **Plant communities:** Characters; Ecotone and edge effect; Succession; Processes and types.
- **Ecosystem:** Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramidsproduction and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous
  Pollution: Types, control and prevention
  Ecological Footprints: Carbon footprint, Carbon dating

Section-B

- **Introduction to plant taxonomy:** Identification, Classification, Nomenclature.
- **Identification :** Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access
- **Botanical nomenclature:** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.
- **Classification:** Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (up to series).

Section-C

- **Complete description of families :** Brassicaceae (Brassica, Iberis), Asteraceae (Sonchus, Ageratum), Solanaceae (Solanum, Withania), Lamiaceae (Salvia, Ocimum), Liliaceae, (Asphodelus), Ranunculus (Ranunculus), Gramineae (Triticum, Oryza)

Suggested Readings:

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.

2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.

3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., NewDelhi.

5. J.S. Singh, S.P. Singh, S.R.Gupta (2015) Ecology ,Environmental Science & Conservation S. Chand Publisher

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Botany Lab. II
SUBJECT CODE: BFBT-1202
SEMESTER: II
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam: 3 Hrs

Practical

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.

2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.

3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.

4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).

(b)Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)

5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (Species to be listed).

6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law

7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):Brassicaceae -Brassica, Alyssum / Iberis; Asteraceae - Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae -Solanum nigrum, Withania; Lamiaceae -Salvia, Ocimum; Liliaceae - Asphodelus / Lilium / Allium.

8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: DIVERSITY OF ANIMAL-II
SUBJECT CODE: BFZO-1201
SEMESTER: II
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hr

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consist three questions of eight marks each from the respective sections of the syllabus

Section-A

Unit 1: Introduction to Chordates

General characteristics and outline classification

Unit 2: Protochordata

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Unit 3: Origin of Chordata

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Unit 4: Agnatha

General characteristics and classification of cyclostomes up to class

Section-B

Unit 5: Pisces

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Unit 6: Amphibia

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Unit 7: Reptilia

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Section-C

Unit 8: Aves

General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Unit 9: Mammals

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Unit 10: Zoogeography

Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Zoology Lab. II
SUBJECT CODE:- BFZO-1202
SEMESTER: II
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

1. Protochordata Balanoglossus, Herdmania, Branchiostoma, Colonial UrochordataSections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules
2. Agnatha,Petromyzon, Myxine
3. Fishes: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. Amphibia: Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
5. Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
6. Aves:Study of six common birds from different orders. Types of beaks and claws
7. Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous.

SUGGESTED READINGS

- Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: ORGANIC CHEMISTRY-II
SUBJECT CODE: BFCH-1205
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Section- A (10 hrs)

Alkanes & Cycloalkanes

IUPAC nomenclature of branced&unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes--nomenclature,method of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.

Alkenes

Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols, dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration.The Saytzeff's rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions Markownikoff's rule, Antimarkownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$.Polymerization of alkenes. Substitution at allylic and vinylic positions of alkenes

Cycloalkenes Methods of formation, conformation and chemical reactions of Cycloalkenes.

Section-B (10 hrs)

Dienes and Alkynes

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization of dienes, Chemical reactions-

I,2 and l,4 additions, Diels-Alder reaction. Nomenclature of alkynes, Methods of formation.Chemical reactions of alkynes, acidity of alkynes.Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation.metal-ammonia reductions, oxidation and polymerization.

Alkyl halides

Nomenclature and classes of alkyl halides, methods of formation including Finkelstein &Hundsdieker reaction, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $S_N2$and S_N1 mechanism with streo-chemical aspects & effect of solvent, nucleophilicsubstitution verses elimination, haloform reaction with mechanistic details.

Section-C (10 hrs)

Aromatic Hydrocarbons

Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions& heterocyclic compounds with suitable examples, antiaromaticity&nonaromaticity; structure & stability of benzene, Electrophilic aromatic substitutions- nitration, halogenation, sulphonation and Friedel-Crafts alkylation/acylation with their mechanism, stability of Wheland intermediates (sigma complex), activation/deactivation of the aromatic ring & directing effects of the groups.

Aryl halides

Nomenclature and classes of alkyl halides, methods of formation, Nucleophilic aromatic substitution, The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides, allyl, benzyl, vinyl and aryl halides towards the nucleophilic substitutions.

Recommended Books:

1. Robert Thornton Morrison and Robert Neilson Boyd, Organic Chemsitry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. I.L. Organic Chemistry (Volume I), Darling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. I.L. Finar, Organic Chemistry (Volume II): Stereochemistry & the chemistry of natural products, Darling Kindersley (India) Pvt. Ltd. (Pearson Education).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: INORGANIC CHEMISTRY-I

SUBJECT CODE: BFCH-1206
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of inorganic chemistry i.e. atomic structure and bonding

Section- A (15 hrs)

Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of, Ψ and , Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curve, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

Chemistry of Noble gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Chemical Bonding - I

Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2 , BF_3 , CH_4, PF_5, SF_6, IF_7, $Sncl_2$, XeF_4, BF_4^-, PF_6^-, $Sncl_6^{-2}$.

Section – B (15 hrs)

Chemical Bonding - II

Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICI_2, and H_2O.MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO, CN, CO^+, NO^+, CO, CN), diatomic molecules, multicenter bonding in electron deficient

molecule (Boranes) percentage ionic character from dipole moment and eIectronegativity difference.

Ionic Solids-

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurzite, CaF_2, and antifluorite), radius ratio rule and coordination number, Limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and bond theories.

Weak Interactions-

Hydrogen bonding, van der Walls forces.

Section – C (15 hrs)

Periodic Properties

Position of elements in the periodic table, effective nuclear charge and its calculations.Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavious.

S-Block Elements

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and arys.

Group No. 13

Comparative study (including diagonal relationship) of groups 13 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13; hydrides of boron-diborane and higher boranes, borazine, borohydrides.

P - Block Elements

Comparative study (including diagonal relationship) of groups 14-l7 elements, compounds like hydrides, oxides, oxyacids and halides of groups 14-17; fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphurtetranitride, basic properties of halogens, interhalogens and polyhalides.

Recommended Books

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBSOxford,1991.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education,Singapore, 1999
3. J.D.Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.
4. Puri Sharma Kalia Principles of Inorganic Chemistry

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: CHEMISTRY LABORTARY-II
SUBJECT CODE: BFCH-1207
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of titrations and kinetics, potentiometry and colorimetry

Inorganic Experiments

Iodometry and Iodimetry Titrations:

(i) Standardisation of sodium thiosphate with $K_2Cr_2O_7$ / KIO_3

(ii) Determination of Cu(II)

(iii) Determination of H_2O_2

(iv) Determination of available chlorine in bleaching powder.

Precipitation Titrations

(i) $AgNO_3$ – standardisation by Mohr's method / by using absorption indicator.

(ii) Determination of chloride.

(iii)Volhard's method for chloride determination.

Physical Chemistry Experiments

Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.
4. To determine the viscosity and surface tension of C_2H_5OH and glycerin solution in water
5. Molecular weight determined by Part method.

Colorimetry

6. To test the validity of Beer Lambert law.

Potentiometry

7. Titration of strong acid solution (HCl) with NaOH solution using quinhydrone electrode.

8. Titration of a mixture of strong and weak acids (HCl + CH_3COOH) and hence the composition of the mixture.

Recommended Books:

1. Vogel's book on Inorganic Qualitative Analysis
2. Advanced Practical Physical Chemistry by J. B. Yadav

SUBJECT TITLE: Criminal Law
SUBJECT CODE: BFFS-1208
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Course Objective: To impart knowledge of Criminology and criminal laws and their role in Criminal Investigation.

Section A

Crime

Criminal Profiling: Introduction, Importance, Profile of the victim and culprit, criminal behavior on the internet, limitations.

Criminology and criminal anthropology

Aim and scope of criminology; Criminal behavior and theories of criminal behavior: classic, Positivist, sociological. Role of correctional institutions analysis.

Meaning and Scope of Victimology.

Special Forms of Crime: Organized Crime: Gangs/Criminal Networks, Socio-Eonomic Crime, Custodial Crime, White-Collar Crime, Crime against Women/Children, Sex Offences.

Correctional Therapy: Probation, Parole, Furlough, Remission and Pardon.

Section B

Criminal Law

Definitions: bailable/non-bailable offences, cognizable/ non-cognizable, summon case and warrant cases.

Criminal Procedure Code: sections- 291,292,293.

Indian Evidence Act: Section 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.

Indian Penal Code sections pertaining offence against property offences against person.

Offences against the person-Sections:- 299, 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375, 376, 377.

Offences against property- Sections:-378, 383, 390, 391, 420, 463, 497, 499, 503 and 511.

Expert testimony.

Section C

Police Administration

History and development of police administration; Police duties, responsibilities and powers. Organization and structure of police station.

People and society: Custodial deaths, Police and Human Rights.

Acts

Introduction to offences and Penalties of following acts: Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act, I.T. Act 2000-

Books Recommended:

1. Arrigo (2002) : Introduction to forensic Psychology.
2. Cooke, G. (1980) : The role of Forensic Psychologist. Chanles C. Thomas.
3. Howitt D : 2002 Forensic and Criminal Psycholgy. Prentic Hall Publications
4. Constitution of India
5. Indian Evidence Act
6. Criminal Procedure code.
7. Indian Penal Code.
8. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adultration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
9. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
10. Barak, Gregg : Integrative Criminology.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Plant Anatomy & Embryology
SUBJECT CODE: BFBT-2301
SEMESTER: III
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter:

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

OBJECTIVE AND OUTCOME OF COURSE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of plant anatomy and embryology of angiosperms.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Section-A

- **Tissues and Organs:** Root and shoot apical meristems; Simple and complex tissues. Structure of dicot and monocot root stem and leaf.
- **Secondary Growth:** Vascular cambium – structure and function, seasonal activity. Secondary growth in root andstem, Wood (heartwood and sapwood).

Section-B

- **Adaptive and protective systems:** Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.
- **Structural organization of flower:** Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac. **Pollination and fertilization:** Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Section-C

- **Embryo and endosperm :** Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship
- **Apomixis and polyembryony:** Definition, types and practical applications.

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
3. J.P. Goyal & Aruna Saini (2016) Angiosperms: Structure, Development & Reproduction Trueman

4. Pc Vasishta (2003). Plant Anatomy. Pradeep Publications

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Botany Lab. III
SUBJECT CODE: BFBT-2302
SEMESTER: III
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

Practical

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent Slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Calculation of percentage of germinated pollen in a given medium.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: PHYSIOLOGY & BIOCHEMISTRY
SUBJECT CODE: BFZO-2301
SEMESTER: III
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit ©
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consist three questions of eight marks each from the respective sections of the syllabus

Section-A

Unit 1: Digestion and Absorption of Food

Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (in brief)

Unit 2: Functioning of Excitable Tissue (Nerve and Muscle)

Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction

Section-B

Unit 3: Respiratory Physiology

Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.

Unit 4: Renal Physiology

Functional anatomy of kidney, Mechanism and regulation of urine formation

Section-C

Unit 5: Cardiovascular Physiology

Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG

Unit 6: Endocrine and Reproductive Physiology

Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Zoology Lab. III
SUBJECT CODE: BFZO-2302
SEMESTER: III
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit ©
0	0	4	2

Duration of Exam: 3 Hrs

1. Preparation of temporary mounts: Neurons and Blood film.

2. Preparation of haemin and haemochromogen crystals.

3. Estimation of haemoglobin using Sahli's haemoglobinometer.

4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and• Physiology, XII Edition, John Wiley and Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human• Physiology, XI Edition, McGraw Hill.
3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII• Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
4. Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley.• Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.•
5. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics,• S. Chand and Company Ltd.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: ORGANIC CHEMISTRY-III
SUBJECT CODE: BFCH-2305
SEMESTER: III
CONTACT HOURS/WEEK: 2

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of organic chemistry i.e. alcohols, aldehydes and ketones

Section – A

Alcohols (10 hrs)

Classification and nomenclature.

Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters.Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [Pb (OAc) and HIO_4] and Pinacol-Pinacolone rearrangement.

Trihydric alcohol-nomenclature, methods off formation and chemical reactions of glycerol.

Section – B

Phenols (10 hrs)

Nomenclature, structure and bonding.Preparation of Phenols, physical properties and acidic character.Comperative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion.Reaction of phcnols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement.Gatterman synthesis, Hauben.Heesch reaction.Lederer-Mianasse reaction and Reimer-Tiemann reaction.

Section – C

Aldehydes and Ketones (10 hrs)

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3- dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties and Mechanism of nucleophillic addition to carbonyl group with particular emphasis ofBenzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

Use of acetals as protecting group.Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.Halogenation of enolizable ketones.

An Introduction to unsaturated aldehydes and ketones, Michael addition.

Recommended Books:

1. Organic Chemistry, Morrison and Boyd, Prentice- Hall.
2. Fundamentals of Organic Chemistry, Solomons , John Wiley.
3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.
4. Organic Chemistry Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley
5. Eastern Ltd (New Age International).
6. Jarry March Mechanisms of Organic Chemistry, Wiley

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: PHYSICAL CHEMISTRY-II
SUBJECT CODE: BFCH-2306
SEMESTER: III
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of thermodynamics, phase equilibria and electro chemistry

Section – A

Thermodynamics-I (15 hrs)

Definition of thermodynamics terms: system, surroundings etc. Types of systems, intensive and extensive properties.State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementry idea of thermochemistry.

First Law of Thermodynimcs : statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Theromodynamics-II (Part-a)

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem.Themodynamic scale of temperature.

Theromodynamics-II (Part-b)

Concept of entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Section – B

Thermodynamics-III (15 hrs)

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A &G as criteria for

thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems. simple eutectic Pb-Ag sytems, desilverisation of lead. Liquid-Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law.Non-ideal system-azeotropes-HCI-HP and ethanol-water systems.

Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation.Nernst distribution law, thermodynamic derivation & applications.

Section –C

Electrochemistry-l (a) (15 hrs)

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.

Migration of ions and Kohlrausch law.Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations.Debye-Huckel-Onsagar's equation for strong electrolytes (elementa treatment only).

Electrochemistry-I (b)

Transport number, definition and deterriilfiafion by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K. of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.

Electrochemistry-II

Types of reversible electrodes--gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes.Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode.potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cell EMF.Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations. Definition of pH and pK., determination of pH using hydrogen, quinhydrone and glass electrodes by potentiomentric methods.

Buffers--mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts, Corrosion-types, theories and methods of combating it.

Recommended Books:

1. Thermodynamics for Chemists, S. Glasstone.
2. Chemical thermodynamics, P.A. Rock.
3. Principles of Physical Chemistry, S.H. Maron& C.F. Prutton.
4. Physical Chemistry, P.W. Atkins.
5. Physical Chemistry, Vol.2, K.L. Kapoor.
6. Physical Chemistry, K.J. Laidler.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: CHEMISTRY LABORTARY-III
SUBJECT CODE: BFCH-2307
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of volumetric analysis and chromatography

Volumetric Analysis and TLC

Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH, Alakanity of water sample.

(b) Determination of alkali content of antacid.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry .

(d) Estimation of hardness of water by EDT A.

(e) Estimation of ferrous and ferric by dichromate method.

(f) Estimation of copper using sodium thiosulphate.

Organic Chemistry

Laboratory Techniques

Thin Layer Chromatography

Determination of R-values and identification of organic compounds.

(a) Separation of green leaf pigments (spinach leaves may be used)

(b) Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenonecyclohexanone using toluene and light petroleum (40: 60).

(c) Separation of a mixture of dyes

Recommended Books:

1. Vogel's book on Inorganic Qualitative Analysis

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Criminalistics
SUBJECT CODE: BFFS-2308
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Section A

Crime Scene Investigation: Types of crime scene, Understanding and purposes of crime scene examination, First responding officers, Protection of the crime Scene, documentation of Crime scene, methods of search for physical clue materials, Reconstruction of Crime scene.
Physical Evidences: Definition, their classification, collection, packing and transportation, chain of custody.
Tool marks: Importance, location, nature, collection and evaluation.
Soil: Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence.
Track marks: Importance, nature, location, collection and evaluation.
Glass: Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.
Paints: Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.

Section B

Road Accidents: Examination of scene, Victim and the vehicle, Collection of the evidence, Examination of skid marks.
Voice Identification: Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography.
Forensic Psychology: Truth &Deception, Psychology of lying, Various methods of lie detection.
Principles of Polygraph, Legal aspects.
Narco analysis:History, Importance as an investigative tool, methods as use of drugs, Limitations and legal aspects.
Hypnosis: introduction, importance, legal aspects.
Brain fingerprinting: Concepts, History, Significance, method, future perspective of the technique, limitations.

Books Recommended:

1. Hess A.K. and Weiner I.B. (2nd Edition) (1999), Handbook of Forensic Psychology, Wiley, John & Sons, Incorporated.
2. Barak G. (1998), Integrative Criminology, Ashgate Pub Ltd.
3. Adler F. (5th Edition) (2004), Criminology, McGraw-Hill.
4. Reid S.T. (12th Edition) (2008), Crime and Criminology, Oxford University Press, USA.
5. Johnson E.H. (4th Edition) (1978), Crime, Correction and Society, Dorsey Press.
6. Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
7. Nicharrs J. (1999), Investigative Forensic Hyponsis. CRC Press LLC.
8. Bodziak W.M (1989), Footwear Impression Evidence, Elsevier Science Publishing Co. New York.
9. Sharma B.R. (1974), Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
10. Lundquest and Curry (1963), Forensic Science, Thomas, Illinosis, USA.
11. Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
12. Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.
13. Kirk (1953), Criminal Investigation, Interscience Publisher Inc. New York.
14. Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE:Criminalistics Lab.
SUBJECT CODE: BFSL-2309
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 6 Hrs

1. Comparison of Soil samples.
2. Comparison of glass pieces.
3. Comparison of Miscellaneous material like Cloth, Bangles, threads etc.
4. To prepare a cast of Shoe prints and their comparison.

SUBJECT TITLE: Plant Physiology & Metabolism
SUBJECT CODE: BFBT-2401
SEMESTER: IV
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

OBJECTIVE AND OUTCOME OF COURSE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of plant physiology and metabolism.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

Section-A

- **Plant-water relations:** Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.
- **Mineral nutrition :** Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.
- **Translocation in phloem:** Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

Section-B

- **Photosynthesis:** Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reactioncenter, antenna molecules; Electron transport and mechanism of ATP synthesis; C_3, C_4 and CAM pathways of carbon fixation; Photorespiration.
- **Respiration:** Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.
- **Enzymes:** Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Section-C

- **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.
  Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.
  Plant response to light and temperature: Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization. Biological nitrogen fixation; Nitrate and ammonia assimilation.
- **Plant growth regulators**
  Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.
- **Plant response to light and temperature (6 Lectures)**
  Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), redvand far red light responses on photomorphogenesis; Vernalization.

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. A.N. Parashar (1985), Plant Physiology. Trueman Book Company

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Botany Lab. IV
SUBJECT CODE: BFBT-2402
SEMESTER: IV
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

Demonstration experiments (any four)

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration
4. R.Q.
5. Respiration in roots.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: PRINCIPLES OF GENETICS
SUBJECT CODE: BFZO-2401
SEMESTER: IV
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consist three questions of eight marks each from the respective sections of the syllabus

Section-A

Unit 1: Mendelian Genetics and its Extension

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance.

Unit 2: Linkage

Crossing Over and Chromosomal Mapping Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Section-B

Unit 3: Mutations

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB methods, attached X method.

Unit 4: Sex Determination

Chromosomal mechanisms of sex determination in Drosophila and Man

Unit 5: Extra-chromosomal Inheritance

Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects

Section-C

Unit 6: Polygenic Inheritance
Polygenic inheritance with suitable examples; simple numericals based on it.
Unit 7: Recombination in Bacteria and Viruses
Conjugation, Transformation, Transduction, Complementation test in Bacteriophage
Unit 8: Transposable Genetic Elements
Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in humans

SUBJECT TITLE: Zoology Lab. IV
SUBJECT CODE: BFZO-2402
SEMESTER: IV
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

PRACTICALS (CREDITS 2)

1. To study the Mendelian laws and gene interactions.

2. Chi-square analyses using seeds/beads/Drosophila.

3. Linkage maps based on data from conjugation, transformation and transduction.

4. Linkage maps based on data from Drosophila crosses.

5. Study of human karyotype (normal and abnormal).

6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of• Genetics. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V• Edition. John Wiley and Sons Inc

3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of• Genetics. X Edition. Benjamin Cummings
4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition.• Benjamin Cummings
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.• Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co
6. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis• Group, New York and London.

COURSE TITLE: ORGANIC CHEMISTRY-IV
SUBJECT CODE: BFCH-2405
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of carboxylic acids, ethers, nitrogen containg compounds

Section – A (10 hrs)

Carboxylic Acids

Nomenclature, structure and bonding.physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation.

Methods of formition and chemical reactions of halo acids.Hydroxyacids, maleic and tartaric acid, citric acids. (Structural Formula only),

Methods of formation and chemical reaction of unsaturated nonocarboxylic acids.Dicaboxylic acids, methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters.amides and cid anhydrides. Relative stability and reactivity of acyl derivatives.

Physical properties, interconversion of acid derivatives by nucleophillic acyl substitution.
Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterfication and hydrolysis (acidic and Basic).

Section-B (10 hrs)

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autooxidation, Ziesel's Method.
Synthesis of epoxide, add and base catalyzed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide.

Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils.Saponification value, iodine value, acid value.Soaps, synthetic detergents, alkyl and aryl sulphonates.

Section-C (10 hrs)

Organic Compunds of Nitrogen

a) Nitro Compounds

Preparation of nitroalkanes and nitroarenes.Chemical reactions of nitroalkanes.Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid.

b) Amines

Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines Separation of a mixture secondary and tertiary amines. Structural features effecting the basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds
Gabriel-phthalimide reaction, Hoffmann bromamideraction.

Recommended Books:

1. Organic Chemsitry, F.A.Carey, McGraw Hill Inc.
2. Organic Chemsitry, Morrison & Boyd, Prentice Hall.

COURSE TITLE: INORGANIC CHEMISTRY-II
SUBJECT CODE: BFCH-2406
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of transition series, lanthanides and actinides

Section-A (15 hrs)

Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

Section-B (15 hrs)

Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states. Magnetic behavior, spectral properties & stereochemistry

Chemistry of Actinides Elements

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Section – C (15 hrs)

Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stabilityto water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases.

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Recommended Books:

1. J.D. Lee, Concise Inorganic Chemistry, 4th Ed.
2. J.E. Huheey, Inorganic Chemistry, Harper & Row.
3. F.A.Cotton and G. Wilinson, Advanced Inorganic Chemistry, Interscience Publishers.
4. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: CHEMISTRY LABORTARY-IV

SUBJECT CODE: BFCH-2407
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of qualitative analysis

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

Recommended Books:

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

2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd

3. Advanced Practical Physical Chemistry By J. B. Yadav

SUBJECT TITLE: Questioned Document Examination
SUBJECT CODE: BFFS-2408
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Course Objective: To impart knowledge of different type of document asked in crime analysis, finger printing and their role in Criminal Investigation.

Section A

Documents in general: Importance, Classification and Preliminary Examination.

Handwriting Characteristics: General Characteristics, Individual Characteristics, Development of Individuality in Handwriting.

Comparison of handwriting:

i) **Natural Variations** in handwriting-Definition and nature, Determination of range of variations (consistency) and its importance for handwriting comparison.

ii) **Fundamental divergences** in handwriting, its interpretation in relation to identification of handwriting, consideration of various writing instruments used in writing.

Section B

Standards for comparison of handwriting.

Principles of handwriting identification.

Forgery: definitions, types and characteristics

Built-up Documents: nature and their examination. Determination of sequence of strokes.

Section C

Indented and Invisible Writings: Alterations in the document: erasures, additions, Overwriting and obliterations: their examination. Advanced methods of examination of alterations as

Projectina/video- spectral comparator (VSC) and ESDA, their working principles and applications

Comparison of type written matter: Working of typewriter, Printing and Machine Defects, alterations in typed text, various type of typewriting devices- check writing machines, electronic typewriter and proportional spacing typewriter.

SUBJECT TITLE: Questioned Document Laboratory
SUBJECT CODE: BFSL-2409
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 6 Hrs

1. To identify handwriting characters.
2. To examine currency notes.
3. To decipher the indented and invisible writings.
4. To study natural variations in handwriting.
5. To compare handwriting samples.

SUBJECT TITLE: Discipline Specific Elective Botany-I
SUBJECT CODE: BFBT-3501
SEMESTER: V
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

OBJECTIVE AND OUTCOME OF COURSE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of plant physiology and metabolism.

- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Cell and Molecular Biology

Section-A

Techniques in Biology : Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

Cell as a unit of Life: The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.
Cell Organelles: Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiotic hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes: Structures and roles.
Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis.
Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular Organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and Ribosome structure (brief).

Section-B

Cell Membrane and Cell Wall : The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.

Cell Cycle: Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.
Genetic material: DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material.

Section-C

DNA replication (Prokaryotes and eukaryotes): bidirectional replication , semi–conservative,semi discontinuous RNA priming , Ø (theta) mode of replication , replication of linear, ds-DNA,replicating the 5′ end of linear chromosome including replication enzymes.
Transcription (Prokaryotes and Eukaryotes): Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.
Regulation of gene expression: Prokaryotes, Lac operon and Tryptophan operon ; and in Eukaryotes.

Suggested Readings

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition.John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition.ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of theCell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

SUBJECT TITLE: Botany Lab. V
SUBJECT CODE: BFBT I-3502
SEMESTER: V
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

Practical

1To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and Electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell and Nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheek epithelial cells using vital stain Janus green.
7. Study of mitosis and meiosis (temporary mounts and permanent slides).
8. Study the effect of temperature, organic solvent on semi permeable membrane.
9. Demonstration of dialysis of starch and simple sugar.
10. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.

11. Measure the cell size (either length or breadth/diameter) by micrometry.
12. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
13. Study DNA packaging by micrographs.
14. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

SUBJECT TITLE: Comparative Anatomy of Vertebrates
SUBJECT CODE: BFZO-3501
SEMESTER: V
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus

Section-A

Unit 1: Integumentary System

Structure, functions and derivatives of integument

Unit 2: Skeletal System

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

Unit 3: Digestive System

Alimentary canal and associated glands, dentition

Section-B

Unit 4: Respiratory System

Skin, gills, lungs and air sacs; Accessory respiratory organs

Unit 5: Circulatory System

General plan of circulation, evolution of heart and aortic arches

Unit 6: Urinogenital System

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Section-C

Unit 7: Nervous System

Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals

Unit 8: Sense Organs

Classification of receptors Brief account of visual and auditory receptors in man

SUBJECT TITLE: Zoology Lab. V
SUBJECT CODE: BFZO-3502
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
3. Carapace and plastron of turtle /tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Dissection of rat to study arterial and urinogenital system(subject to permission)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
7. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

SUGGESTED READINGS ●

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education ●
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies ●
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons ●
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

COURSE TITLE: ORGANIC CHEMISTRY-V
SUBJECT CODE: BFCH-3505
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of basics of spectroscopy & organometallics.

SECTION-A (15hrs)

I. Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromoethane, ethyl acetate, toluene and acetophenone.

II. Electromagnetic spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar

absorptivity, presentation and analysis ofUV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

SECTION – B (5hrs)

III Infrared (IR)

Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of lR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organic compounds.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR, and PMR spectroscopic techniques.

SECTION – C (10hrs)

IV. Organometallic Compounds

Organomagnesium Compounds The Grignard reagents formation, structure and chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

V. Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, and sulphonamides.

Recommended Books:

1. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
2. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.
3. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: PHYSICAL CHEMISTRY-III
SUBJECT CODE: BFCH-3506
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

SECTION-A (20hrs)

I. Elementary Quantum Mechanics

Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids. Sinusoidal wave equation Hamiltonian operator, Schrodingcr wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

II. Spectroscopy

Introduction :

Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.

SECTION-B (20hrs)

III. Rotational Spectrum :

Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect.

IV. Vibrational Spectrum:

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

V. Raman Spectrum :

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

VI. Electronic Spectrum :

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and n M.O.their energy levels and their respective transitions.

SECTION-C (20hrs)

VII. Solid State

Definition of space lattice and unit cell.

Laws of crystallography-(i) Law of constancy of interfacial angles. (ii) Law of rationality of indices (iii) Law of symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure ofNaCI, KCI and CsCI (Laue's method and powder method).

VIII. Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry: Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, non-radiative processes (internal conversion, intersystem crossing), quantumyield, photosensitized reactions- energy transfer processes (simple examples). Basic concepts of Laser and Maser. Photochemistry of vision and colour.

Recommended Books:

1. Physical Chemistry, R.A Alberty, Wiley Eastern Ltd.
2. The Elements of Physical Chemistry, P. W. Atkins, Oxford.

3. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Willey Eastern Ltd.
4. Fundamentals of Photochemistry, Rohtga and Mukherji.

COURSE TITLE: CHEMISTRY LABORTARY-V
SUBJECT CODE: BFCH-3507
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of synthesis of inorganic & organic compounds.

Synthesis and Analysis

(a) Preparation of sodium trioxalatoferrate(III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.
(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]^{2+}$
(c) Preparation of copper tetra-ammine complex. $[Cu(NH_3)_4]SO_4$.
(d) Preparation of cis-and trans-bis(oxalato)diaquachromate(III) ion.

Synthesis of Organic Compounds

(a) Iodoform from ethanol and acetone
(b) Aromatic electrophlic substitution of benzene
1. p-nitroacetanilide

2. 2,4,6-tribromophenol
   Diazotization/Coupling
3. Preparation of methyl orange and methyl red
4. Preparation of benzoic acid from toluene
5. Reduction

Preparation of m-nitroaniline from m-dinitrobenzene

Recommended Books:

1. Vogel's book on Inorganic Qualitative Analysis

2. Vogel's book on Organic Qualitative Analysis

SUBJECT TITLE: Fingerprints Examination
SUBJECT CODE: BFFS-3508
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Section-A

History and development of finger prints as a science for personal, identification, structure of ridged skin, morphological plan of volar pads and configurational areas. Development of volar pads, ridges, factor affecting alignment of ridges, transition of configuration and types.

Classification of finger Prints, 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 finger print, Finger Prints Bureau.

Section-B

Chance Finger Prints: Latent prints, plastic prints, causes, composition of sweat. Development of latent finger prints: Conventional methods as fluorescent powder, magnetic powder. Fuming methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, enhancement of latent prints, application of laser technologies, metal deposition method. Biological methods of development of latent prints on skin.

Section-C

Systematic approach to latent print processing, preserving and lifting of finger prints. Photography of Finger Prints, comparison of finger prints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics.

Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement.

Books Recommended:

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.**

12) H.C. Lee, R.E. Gaensslen and S.R. Ramotowski (3rd Edition) (2013), **Advances in Fingerprint Technology**, CRC Press, Boca Raton.

13) 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.

14) 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.

15) Daluz H.M (2015), **Fingerprint Analysis Laboratory Workbook**, CRC Press.

SUBJECT TITLE:Fingerprints Laboratory
SUBJECT CODE: BFSL-3509
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

1. How to procure fingerprints & method of taking fingerprints manually (rolled & plain).
2. To carry out ten digit classification of fingerprints.
3. To identify different fingerprint patterns.
4. To identify core and delta.
5. To carry out ridge tracing and ridge counting.
6. To investigate physical methods of fingerprint detection.
7. To investigate chemical methods of fingerprint detection.

Books Recommended:

1. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
4. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Discipline Specific Elective Botany-II
SUBJECT CODE: BFBT-3601
SEMESTER: VI
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter:

There are three Sections A, B & C. Section A consists of twelve multiple choice questions carrying 1 mark each. Section B consists of 6 questions carrying 4 marks each. Section C consists of 3 questions carrying 8 marks each. All the sections are compulsory.

OBJECTIVE AND OUTCOME OF COURSE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of economic botany and biotechnology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Economic Botany and Biotechnology

Section-A

Origin of Cultivated Plants: Concept of centres of origin, their importance with reference to Vavilov's work
Cereals: Wheat -Origin, morphology, use
Legumes: General account with special reference to Gram and soybean
Spices: General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Section-B

Beverages: Tea (morphology, processing, uses
Oils and Fats: General description with special reference to groundnut
Fibre Yielding Plants: General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Section-C

Introduction to biotechnology

Plant tissue culture: Micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications
Recombinant DNA Techniques: Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Botany Lab. VI
SUBJECT CODE: BFBT II-3602
SEMESTER: VI
CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

1. Study of economically important plants: Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Developmental Biology
SUBJECT CODE: BFZO-3601
SEMESTER: VI
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40

End Term Exam: 60
Duration of Exam; 3 Hrs

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus

Section-A

Unit 1: Introduction

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Section-B

Unit 3: Late Embryonic Development

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

Section-C

Unit 4: Post Embryonic Development

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories

Unit 5: Implications of Developmental Biology

Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Zoology Lab. VI

SUBJECT CODE: BFZO-3602

SEMESTER: VI

CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Duration of Exam; 3 Hrs

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)

2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)

3. Study of the developmental stages and life cycle of Drosophila from stock culture

4. Study of different sections of placenta (photomicropgraph/ slides)

5. Project report on Drosophila culture/chick embryo development

SUGGESTED READINGS

Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates,• Inc., Publishers, Sunderland, Massachusetts, USA

Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V• Edition, International Thompson Computer Press

Carlson, R. F. Patten's Foundations of Embryology•

Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill• Publishers

Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University• Press

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: ORGANIC CHEMISTRY-VI
SUBJECT CODE: BFCH-3605
SEMESTER: VI
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of heterocyclic compounds, polymers, carbohydrates & amino acids.

SECTION-A (7hrs)

I. Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophlic substitution. Mechanism of nucleophlic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
Introduction to condensed five and six membered heterocycles.Preparation and reactions of indole, quinoline and isoquinoline wi th special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophlic substitution reactions of indole, quinoline and isoquinoline.

SECTION – B (8hrs)

II. Synthesis of Polymers

Ziegler-Natta polymerziation and vinyl polymers. Condensation or step growth polymerziation. Urea formaldhehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

III. Organic Synthesis Via Enolatcs

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation and acylation of enamines.

SECTION – C (15hrs)

IV. Carbohydrates

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.
Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers, and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation.
Structures of ribose and deoxyribose.
An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch and cellulose without involving structure determination.

V. Amino Acids, Pcptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, Constituents of nucleic acids Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Recommended Books:

1. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
2. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.
3. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: INORGANIC CHEMISTRY-III
SUBJECT CODE: BFCH-3606
SEMESTER: VI
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of Transition metal complexes, Bioinorganic chemistry & organometallics.

SECTION-A (15hrs)

I. Metal-ligand Bonding in Transition Metal Complexes.

Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

II. Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

SECTION –B (20hrs)

III. Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes.

IV. Electronic Spectra of Transition Metal Complexes.

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for $d^1$and d^9 states, discussion of electronic spectrum of $[Ti\ (H_2\ O)_6]^{3+}$ complexion.

V. Hard and Soft acids and Bases (HSAB)

Classification of acids and bases as a hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

SECTION –C (25hrs)

VI. Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to

haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{+2}, Nitrogen fixation.

VII. Silicones and Phosphazenes

Silicones and Phosphazenes as examples of inorganic polymers,nature of bonding in triphosphazenes.

VIII. Organometallic Chemistry

Definition, Nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls,of' Li, Al, Hg, Sn and Ti, a brief account of metal-ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Recommended Books

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford,1991.

2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education,Singapore, 1999

3. J.D.Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.

4. Puri Sharma Kalia Principles of Inorganic Chemistry

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

COURSE TITLE: CHEMISTRY LABORTARY-IV
SUBJECT CODE: BFCH-3607
SEMESTER: VI
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of synthesis.

Laboratory Techniques

Column Chromatography

1. Separation of fluorescein and methylene blue.
2. 2. Separation of leaf pigments from spinach leaves.

Physical Experiments

(a) To determine the strength of the given acid conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a given sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To determine the strength of the given acid solution pH- metrically by using standard alkali solution.
(f) To determine the molar refraction of methanol, ethanol and propanol.
(g) To study the distribution of benzoic acid between benzene and water, and ether and water.
(h) Knowledge of Stereochemical Study of Organic Compounds.
Rand S configuration of optical isomers.
E, Z configuration of geometrical isomers.
Conformational analysis of cyclohexanes and substituted cyclohexanes.

Recommended Books:

1. Experiments in Physical Chemistry, R.C. Das, and B. Behra, Tata Mc-graw Hill.
2. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
3. Advanced Exp. Chemistry, Vol. I-Physical, J.N. Gurutu and R. Kapoor, S. Chand & Co.
4. Selected Exp. in Physical Chemistry, N.G. Mukherjee, J.N. Ghose & Sons.
5. Exp. in Physical Chemistry, J.C. Ghosh, Bharti Bhavan.

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE: Cyber Forensics
SUBJECT CODE: BFFS-3508
SEMESTER: VI
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam: 3 Hrs

Instruction of Question Paper setter: The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions(2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

Course Objective: To impart knowledge of the cases which fall under the purview of digital crimes. The types of digital crimes and the elements involved in investigation of digital crimes**.**

Section A

Computer Crimes

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems.

Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs, computer stalking, pornography, hacking, computer terrorism, hate speech, private and national security in cyber space.

An overview of hacking, spamming, phishing and stalking.

Software Piracy: Introduction, types and investigation of pirated discs.

Section B

Computer Forensics Investigations

Protocol to be taken at the scene. Preparation required prior to seizure.

Seizure and collection of suspected computer and its peripheral devices. Treatment of exhibits.

Extraction of information from the from various storage devices.

Creating bitstream of the original media. Legal and privacy issues. Examination and Restoration of deleted files.

Section C

Mobile phone forensics: Crime and mobile phones, forensic procedures for seizing Mobile Phones, Role of IMEI, IMSI, CCICD, CDRs & TDRs in Crime Investigation, Recovery of data available in SIM Card, internal & external memory Phones, Mobile operators systems Logical and Physical dump / imaging.

Biometrics

Definition, Types of Biometrics tools, Fingerprints, Face, Iris and retina scan, Voice, DNA and Handwriting, Relevance in Forensic Science.

Books Recommended:

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).
2. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301

SUBJECT TITLE:Cyber Forensics Laboratory
SUBJECT CODE: BFSL-3609
SEMESTER: VI
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objective: To impart knowledge of cybercrime & biometrics.

1. To identify, seize and preserve digital evidence from crime scenes.
2. To detect deletions, obliterations and modifications of files using encase software.
3. To trace routes followed by e-mails and chats.
4. To identify the IP address of the sender of e-mails.
5. To demonstrate concealment techniques using cryptographic PGP.
6. To identify encrypted files.
7. To identify hidden files.
8. To use digital signatures for securing e-mail and online transactions.
9. To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards.
10. To use symmetric and asymmetric keys for protection of digital record.
11. To carry out imaging of hard disks.

Books Recommended:

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).
2. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).

Program Name: Bachelor of Forensic Science
Program Code: FORS 301