UG Program (4 Years Honors)
CBCS-2020-21

B.Sc.,
B.Sc., Forensic Science

SYLLABUS

PRINCIPAL
Aditya Degree College
KAKINADA

B.Sc (FS)

UG Program (4 years Honors) Structure (CBCS)

2020-21 A. Y., onwards
BACHLOR OF SCIENCE
(3rd and 4th year detailed design will be followed as per APSCHE GUIDELINES)

Subjects/ Semesters		I		II		III		IV		V		VI		
		H/W	C	H/W	C	H/W	C	H/W	C	H/W	C	H/W	C	
Languages												THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester		FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).
English		4	3	4	3	4	3							
Language (H/T/S)		4	3	4	3	4	3							
Life Skill Courses		2	2	2	2	2+2	2+2							
Skill Development Courses		2	2	2+2	2+2	2	2							
Core Papers														
M-1	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1					
M-2	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1					
M-3	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1					
M-1	SEC (C6,C7)									4+2 4+2	4+1 4+1			
M-2	SEC (C6,C7)									4+2 4+2	4+1 4+1			
M-3	SEC (C6,C7)									4+2 4+2	4+1 4+1			
Hrs/ W (Academic Credits)		30	25	32	27	32	27	36	30	36	30	0	12	4	4
Project Work															
Extension Activities (Non Academic Credits)															
NCC/NSS/Sports/Extra Curricular									2						
Yoga							1		1						
Extra Credits															
Hrs/W (Total Credits)		30	25	32	27	32	28	36	33	36	30	0	12	4	4

M= Major; C= Core; SEC: Skill Enhancement Courses

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Marks & Credits distribution: UG-Sciences

Sl. No	Course type	No. of courses	Each course teaching Hrs/wk	Credit for each course	Total credits	Each course evaluation			Total marks
						Conti-Assess	Univ-exam	Total	
1	English	3	4	3	9	25	75	100	300
2	S.Lang	3	4	3	9	25	75	100	300
3	LS	4	2	2	8	0	50	50	200
4	SD	4	2	2	8	0	50	50	200
5	Core/SE -I	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -II	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -III	5+2	4+2	4+1	35	25	75+50	150	1050
6	Summer-Intern	2		4	8		100	200	200
7	Internship/ Apprentice/ on the job training	1		12	12		200	200	200
		38			**159**				**4550**
8	**Extension Activities (Non AcademicCredits)**								
	NCC/NSS/Sports/ Extra Curricular			2	2				
	Yoga	2		1	2				
	Extra Credits								
	Total	**40**			**142**				

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1. LIFE SKILL AND SKILL DEVELOPMENT COURSES

Life /Skill development courses: 4 courses of LSC and 4 courses of SDC with options

Each course of 2 hrs/ week containing 3 units of syllabi for 30 hrs teaching with 2 credits based on 50 marks evaluation. No internal assessment. University sem-end exam:50 marks (2 Hrs)

Question paper would be in two sections (Section A and Section B) for 50 marks

Section A consisting of 8 questions covering two questions from each unit and the remaining to be from any unit. Student has to write 4 questions and each question carries 5 marks (i.e., 5 X 4 = 20 marks). Each question to be answered with 5-7 points/10-15 lines of answer with necessary diagram/equations/ figure/flow charts, if necessary.

Section B consisting of 6 questions covering all units (i.e., from each unit two questions to be given with either or choice). Student has to write 3 questions and Each question carries 10 marks. (i.e., 10 X 3 = 30 marks). Each question to be answered with 10 to 15 points or 20 to 35 lines along with diagrams/equations/ figure/flow charts, if necessary.

List of Life Skill courses

Sem	No. of Courses	Course name	Preferred teaching department
I	1	Human Values and Professional Ethics (HVPE)	English/Telugu/Any Dept
		Entrepreneurship Development (ED)	Commerce
II	1	Information and Communication Technology (ICT)	Computers
		Indian Culture and Science (ICS)	History/Telugu
III	Compulsory	Environmental Education (EE)	Botany/Zoology/Environmental Science/ Any dept.
	1	Personality Development and Leadership (PDL)	English/Any Dept
		Analytical Skills (AS)	Maths/Statistics

List of Skill Development Courses along with their Semester-wise allotment with choices.

SEM	No. of courses	Names of courses		Preferred teaching department
I	One	1. Tourism Guidance (or)		History/Any dept
		2. Plant Nursery (or)		Botany
		3. Electrical Appliances (or)		Physics
		4. Insurance Promotion		Commerce
II	Two (1 from A group and 1 from B Group)	'A' Group	1. Survey & Reporting (or)	Economics/History
			2. Business communication (or)	English
			3. Solar Energy (or)	Physics
			4. Agricultural Marketing	Commerce/Economics
		'B' Group	1. Social Work Methods (or)	Political science/social work
			2. Advertising (or)	Commerce
			3. Dairy Technology (or)	Zoology
			4. Performing Arts	Telugu
III	one	1. Disaster Management (or)		English/Telugu/Any dept
		2. Online Business (or)		Commerce
		3. Poultry Farming (or)		Zoology
		4. Financial Markets		Economics/Commerce

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2. DETAILS OF COURSE TITLES & CREDITS

Sem	Course no.	Course Name	Course type (T/L/P)	Hrs./Week (Science:4+2)	Credits (Science:4+1)	Max. Marks Cont/Internal /Mid Assessment	Max. Marks Sem-end Exam
I	1	Introduction to Forensic Science & Criminology	T	4	4	25	75
		Forensic Science Lab	L	2	1		50
II	2	Crime Scene Management	T	4	4	25	75
		Crime Scene Management Lab	L	2	1		50
III	3	Questioned Documents &Finger Impressions	T	4	4	25	75
		Questioned Documents &Finger Impressions Lab	L	2	1		50
IV	4	Forensic Biology& DNA Fingerprinting	T	4	4	25	75
		Forensic Biology& DNA Fingerprinting Lab	L	2	1		50
	5	Forensic Chemistry & Ballistics	T	4	4	25	75
		Forensic Chemistry & Ballistics Lab	L	2	1		50
V	6A	Instrumentation	T	4	4	25	75
		Instrumentation Lab	L	2	1		50
	7A	Forensic Toxicology	T	4	4	25	75
		Forensic Toxicology Lab	L	2	1		50
	OR						
	6B	Forensic Psychology	T	4	4	25	75
		Forensic Psychology Lab	L	2	1		50
	7B	Narcotic Drugs & Psychotropic Substances	T	4	4	25	75
		Narcotic Drugs & Psychotropic Substances Lab	L	2	1		50
	OR						
	6C	Forensic Physics	T	4	4	25	75
		Forensic Physics Lab	L	2	1		50
	7C	Forensic Engineering	T	4	4	25	75
		Forensic Engineering Lab	L	2	1		50
	OR						
	6D	Forensic Medicine & Anthropology	T	4	4	25	75

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		Forensic Medicine & Anthropology Lab	L	2	1		50
	7D	Wildlife Forensics	T	4	4	25	75
		Wildlife Forensics Lab	L	2	1		50

Note: *Course type code: T: Theory, L: Lab,

Note 1: For Semester–V, for the domain subject **Forensic Science**, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C or 6D&7D. The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSCHE Guidelines.

- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
  - **Credit For Course: 04**

- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
  - **Credit For Course: 04**

- **Third internship/Project work (6th Semester Period):**
  During the entire 6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).
  - **Credit For Course:12**

a. **Proposed combination subjects: Chemistry & Cyber Forensics**
b. Student eligibility for joining in the course:
   Intermediate Examination (10+2) with Botany or Zoology or Mathematics and Chemistry OR
   12th Standard (ICSE/CBSE with Science group)
c. Faculty eligibility for teaching the course:
   M.Sc. in Forensic Science with minimum 60% or above in Forensic Science subjects (Minimum qualification); Ph.D. is desirable.
d. List of Proposed Skill enhancement courses with syllabus, if any

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2. DETAILS OF COURSE TITLES & CREDITS

Sem	Course no.	Course Name	Course type (T/L/P)	Hrs./ Week (Science:4+2)	Credits (Science: 4+1)	Max. Marks Cont/ Internal /Mid Assessment	Max. Marks Sem-end Exam
I	1	Fundamentals of Computer	T	4	4	25	75
		Fundamentals of Computer Lab	L	2	1		50
II	2	Networking and Security	T	4	4	25	75
		Networking and Security Lab	L	2	1		50
III	3	Cyber Security	T	4	4	25	75
		Cyber Security Lab	L	2	1		50
IV	4	Digital Forensics	T	4	4	25	75
		Digital ForensicsLab	L	2	1		50
	5	Mobile Forensics	T	4	4	25	75
		Mobile ForensicsLab	L	2	1		50
V	6A	Cyber Law	T	4	4	25	75
		Cyber Law Lab	L	2	1		50
	7A	Advanced Cyber Forensics	T	4	4	25	75
		Advanced Cyber Forensics Lab	L	2	1		50
	OR						
	6B	Machine Learning for Digital Forensics	T	4	4	25	75
		Machine Learning for Digital Forensics Lab	L	2	1		50
	7B	Multimedia Forensics & Speaker Identification	T	4	4	25	75
		Multimedia Forensics & Speaker Identification Lab	L	2	1		50
	OR						
	6C	Social Media Forensics	T	4	4	25	75
		Social Media Forensics Lab	L	2	1		50
	7C	Network Forensics	T	4	4	25	75
		Network Forensics Lab	L	2	1		50
	OR						
	6D	Reverse Engineering & Malware Analysis	T	4	4	25	75
		Reverse Engineering & Malware Analysis Lab	L	2	1		50
	7D	Vulnerability Assessment and Penetration Testing	T	4	4	25	75
		Vulnerability Assessment and Penetration Testing Lab	L	2	1		50

Note: *Course type code: T: Theory, L: Lab, P:Practical.

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STRUCTURE OF CHEMISTRY CORE SYLLABUS

Sem	Course No	Course Name	Course Type (T/P/L)	Hrs/Week	Credits	Max. Marks	Max. Marks
				Science: 4+2	Science: 4+1	Count/Internal/ Mid Assessment	Sem- End Exam
I	1	Inorganic and Physical Chemistry	T	4	4	25	75
	2	Practical – I Analysis of SALT MIXTURE	L	2	1	-	50
II	3	Organic and General Chemistry	T	4	4	25	75
	4	Practical – II Volumetric Analysis	L	2	1	-	50
III	5	Organic Chemistry and Spectroscopy	T	4	4	25	75
	6	Practical – III Organic preparations and IR Spectral Analysis	L	2	1	-	50
IV	7	Inorganic, Organic and Physical Chemistry	T	4	4	25	75
	8	Practical – IV Organic Qualitative analysis	L	2	1	-	50
	9	Inorganic and Physical Chemistry	T	4	4	25	75
	10	Practical-V Course Conductometric and Potentiometric Titrimetry	L	2	1	-	50

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ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

Skill Enhancement Courses (SECs) for Semester -V,

From 2020-21(Syllabus-Curriculum)

Structure of SECs for Semester–V

(To choose One pair from the Five alternate pairs of SECs)

Univ. Code	Course NO. 6&7	Name of Course	Th.Hrs./ Week	IE Mar-ks	EE Mar-ks	Credits	Prac. Hrs./ Wk	Mar-ks	Credits
	6A	Synthetic Organic Chemistry	3	25	75	3	3	50	2
	7A	Analysis of Organic Compounds	3	25	75	3	3	50	2
		OR							
	6B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
	7B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
		OR							
	6C	Industrial Chemistry-1	3	25	75	3	3	50	2
	7C	Industrial Chemistry-2	3	25	75	3	3	50	2
		OR							
	6D	Environmental Chemistry	3	25	75	3	3	50	2
	7D	Green Chemistry and Nanotechnology	3	25	75	3	3	50	2
		OR							
	6E	Analytical Methods in Chemistry	3	25	75	3	3	50	2
	7E	Cosmetics and Pharmaceutical Chemistry	3	25	75	3	3	50	2

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

***Note**: FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations)

***Note**: THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester

Note-1: For Semester–V, for the domain subject Chemistry, any one of the five pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A&7A or 6B&7B or 6C&7C or 6D&7D or 6E&7E. The pair shall not be broken (ABC allotment is random, not on any priority basis).

***Note-2:** One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.*

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UG(English)	Semester - I	Credits: 03
Course - 1	A Course In Communication And Soft Skills	Hrs/Week: 04

Learning Outcomes:

By the end of the course the learner will be able to :

- Use grammar effectively in writing and speaking.
- Demonstrate the use of good vocabulary
- Demonstrate an understating of writing skills
- Acquire ability to use Soft Skills in professional and daily life.
- Confidently use the tools of communication skills

UNIT I: Listening Skills

i. Importance of Listening
ii. Types of Listening
iii. Barriers to Listening
iv. Effective Listening

UNIT II: Speaking Skills

a. Sounds of English: Vowels and Consonants
b. Word Accent
c. Intonation

UNIT III: Grammar

a) Concord
b) Modals
c) Tenses (Present/Past/Future)
d) Articles
e) Prepositions
f) Question Tags
g) Sentence Transformation (Voice, Reported Speech & Degrees of Comparison)
h) Error Correction

UNIT IV: Writing

v. Punctuation
vi. Spelling
vii. Paragraph Writing

UNIT V: Soft Skills

a. SWOC
b. Attitude
c. Emotional Intelligence
d. Telephone Etiquette
e. Interpersonal Skills

పాఠ్య ప్రణాళిక

యూనిట్-I

రాజనీతి - నన్నయ

మహాభారతం-సభాపర్వం-ప్రథమాశ్వాసం-(26-57 పద్యాలు)

యూనిట్-II

దక్షయజ్ఞం - నన్నెచోడుడు

కుమారసంభవం-ద్వితీయాశ్వాసం-(49-86 పద్యాలు)

యూనిట్-III

ధౌమ్య ధర్మోపదేశము - తిక్కన

మహాభారతం-విరాటపర్వం-ప్రథమాశ్వాసం-(116-146) పద్యాలు

యూనిట్-IV

పలనాటి బెబ్బులి - శ్రీనాథుడు (పలనాటి వీరచరిత్ర-ద్విపద కావ్యం పుట 108-112
'బాలచంద్రుడు భీమంబగు సంగ్రామం బొనర్చుట.. (108)..
..... వెఱగంది కుంది' (112) సం. అక్కిరాజు ఉమాకాంతం
ముద్రణ.వి.కె.స్వామి, బెజవాడ 1911.

యూనిట్-V

సీతారావణ సంవాదం - మొల్ల

రామాయణము-సుందరకాండము-(40-87 పద్యాలు)

✦వ్యాకరణం

సంధులు: ఉత్వ, త్రిక, ద్రుతప్రకృతిక, నుగాగమ,ద్విరుక్తటకారాదేశ, యణాదేశ, వృద్ధి, శ్చుత్వ, జశ్త్వ, అనునాసిక సంధులు.

సమాసాలు: అవ్యయీభావ, తత్పురుష, కర్మధారయ, ద్వంద్వ, ద్విగు, బహువ్రీహి.

అలంకారాలు:

అర్థాలంకారాలు : ఉపమ, ఉత్ప్రేక్ష, రూపక, స్వభావోక్తి, అర్థాంతరన్యాస, అతిశయోక్తి.

శబ్దాలంకారాలు : అనుప్రాస (వృత్యనుప్రాస, ఛేకానుప్రాస లాటానుప్రాస, అంత్యానుప్రాస)

ఛందస్సు

వృత్తాలు: ఉత్పలమాల, చంపకమాల, శార్దూలము, మత్తేభము;

జాతులు : కందం, ద్విపద; ఉపజాతులు : ఆటవెలది, తేటగీతి, సీసం మరియు ముత్యాలసరాలు

UG Courses	Semester - I	Credits:03
Course: 1	Poetry, Prose & Grammar	Hrs/Weeks:04

UNIT – I OLD POETRY: 1. "**Arya Padukabhishekaha**",

Valmiki Ramayanam- Ayodhya Kanda, Sarga-100 Geetha Press, Gorakhpur.

2. " **YakshaPrasnaha**", Mahabharatam of Vedavyasa, Vanaparva, Adhyaya -313, Geeta Press, Gorakhpoor.

UNIT – II MODERN POETRY: 1." **Mevada Rajyastapanam**" 4th Canto, Srimat Pratapa Ranayanam, Mahakavyam, Pt.Ogeti Parikshit sarma, Published by, Pt.Ogeti Parikshitsarma, 10/11, Sakal nagar, Pune, 1989.

2."**VivekanandaSuktayaha**", Vivekanandasuktisudha by Dr.SamudralaLakshmanaiah, Published by Author, 18-1-84, Yasoda Nagar, Tirupati. Selected Slokas 25.

UNIT – III PROSE: 1. "**Atyutkataihi papapunyairihaiva phalamasnute**",

Hitopadesaha-Mitralabha 2 & 3 stories, Pages 61-84.

2. " **Sudraka -Veeravarakatha**", Hitopadesaha-Vigraham, 8th story, Pages 63-70,Chowkhamba krishadas academy,Varanasi, 2006.

UNIT - IV GRAMMAR: 1.**DECLENSIONS**Nouns ending in vowels
Deva, Kavi, Bhanu, Dhatru, Pitru, Go, Ramaa, Mati.

2.CONJUGATIONS

1st Conjugation - Bhoo, Gam, Shtha, Drusir, Labh, Mud.

2nd Conjugation - As. 10th Conjugation – Bhaash.

UNIT – V GRAMMAR: 1. **SANDHI - Swara Sandhi** : Savarnadeergha, ayavayava, Guna,Vruddhi, yaanadesa.
-**Halsandhi**:Schutva, Stutva, Anunasika.2.**SAMASA**
Dwandwa, Tatpurusha, Karmadharaya,, Dwigu.

UG(General HINDI)	Semester - I	Credits:03
Course :1	Prose, Short Stories, Grammar and Letter Writing	Hrs/Weeks:04

UNIT 1

गद्य संदेश (Prose)(सं. डा .वी. एल. नरसिंहन शिवकोटि)

1. साहित्य की महत्ता
2. मित्रता
3.पृथ्वीराज की आँखें

UNIT 2

कथा लोक (Short Stories)(सं. डा. घनश्याम)

1.मुक्तिधन
2.गूदडसाई
3.उसने कहा था

UNIT 3

व्याकरण (Grammar)(सरल हिन्दी व्याकरण, दक्षिण भारत हिन्दी प्रचार सभा,मद्रास)

लिंग, वचन, काल, वाच्य।

UNIT 4

कार्यालयीन शब्दावली : अंग्रेजी से हिंदी और हिंदी से अंग्रजी

(Changing Administrative Terminology Hindi to English and English to Hindi)

UNIT 5

पत्र लेखन : वैयक्तिक पत्र(छुट्टी पत्र, पिता, मित्र के नाम पत्र, पुस्तक विक्रेता के नाम पत्र

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UG- LIFE SKILL COURSE

HUMAN VALUES AND PROFESSIONAL ETHICS (HVPE)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
I	Life skill course	Human values and professional ethics (HVPE)	30	2	2	50 Marks

Objective: Learning Outcome: On completion of this course, the UG students will be able to

- Understand the significance of value inputs in a classroom and start applying them in their life and profession
- Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
- Understand the value of harmonious relationship based on trust and respect in their life and profession
- Understand the role of a human being in ensuring harmony in society and nature.
- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT: 1 - Introduction – Definition, Importance, Process & Classifications of Value Education: Understanding the need, basic guidelines, content and process for Value Education Understanding the thought provoking issues; need for Values in our daily life Choices making – Choosing, Cherishing & Acting, Classification of Value Education: understanding Personal Values, Social Values, Moral Values & Spiritual Values.

UNIT: 2 - Harmony in the Family – Understanding Values in Human Relationships:
Understanding harmony in the Family- the basic unit of human interaction, Understanding the set of proposals to verify the Harmony in the Family; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Present Scenario: Differentiation (Disrespect) in relationships on the basis of body, physical facilities, or beliefs.
Understanding the Problems faced due to differentiation in Relationships. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family.

UNIT: 3 - Professional Ethics in Education: Understanding about Professional Integrity, Respect & Equality, Privacy, Building Trusting Relationships.Understanding the concepts; Positive co-operation, Respecting the competence of other professions. Understanding about Taking initiative and Promoting the culture of openness. Depicting Loyalty towards Goals and objectives.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Bhatia, R. & Bhatia, A (2015) Role of Ethical Values in Indian Higher Education.

References books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, JeevanVidyaEkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

Co-curricular Activities:

1. Visit to an Old Age Home and spending with the inmates for a day.
2. Conduct of Group Discussions on the topics related to the syllabus.
3. Participation in community service activities.
4. Working with a NGO like Rotary Club or Lions International, etc.

UG- LIFE SKILL COURSE
ENTREPRENEURSHIP DEVELOPMENT (ED)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
I	Life skill course	Entrepreneurship Development	30	2	2	50 Marks

Course Objective: A Generic Course that is intended to inculcate an integrated personal Life Skill to the student.

Learning Outcomes:

After successful completion of the course the student will be able to;

- Understand the concept of Entrepreneurship, its applications and scope.
- Know various types of financial institutions that help the business at Central, State and Local Level
- Understand Central and State Government policies, Aware of various tax incentives, concessions
- Applies the knowledge for generating a broad idea for a starting an enterprise/start up
- Understand the content for preparing a Project Report for a start up and differentiate between financial, technical analysis and business feasibility.

Unit-I: Entrepreneurship: Definition and Concept of entrepreneurship - Entrepreneur Characteristics – Classification of Entrepreneurs –Role of Entrepreneurship in Economic Development –Start-ups.

Unit-II: Idea Generation and Project Formulation: Ideas in Entrepreneurships – Sources of New Ideas – Techniques for Generating Ideas – Preparation of Project Report –Contents; Guidelines for Report preparation – Project Appraisal Techniques –Economic Analysis-Financial Analysis-Market Analysis.

Unit-III: Institutions Supporting and Taxation Benefits: Central level Institutions: NABARD; SIDBI,– State Level Institutions –DICs – SFC - Government Policy for MSMEs - Tax Incentives and Concessions.

Reference Books:

1. Arya Kumar, Entrepreneurship, Pearson, Delhi
2. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
3. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
4. KanishkaBedi, Management and Entrepreneurship, Oxford University Press, Delhi
5. Anil Kumar, S., ET.al., Entrepreneurship Development, New Age International Publishers, New Delhi
6. Khanka, SS, Entrepreneurship Development, S. Chand, New Delhi
7. Peter F. Drucker, Innovation and Entrepreneurship
8. A.Sahay, M. S. Chhikara, New Vistas of Entrepreneurship: Challenges &Opportunities
9. Dr B E V L Naidu, Entrepreneurship. Seven Hills Publishers

Suggested Co-Curricular Activities (As far as possible)

1. Group Discussion
2. Debate
3. Seminar
4. Visit to an SSI and preparing of an outline Report
5. Invited Lecture by a Bank Employee on the Bank Support to a Start Up.
6. Chart showing tax concessions to SSI, MSME both direct and indirect.

UG- SKILL DEVELOPMENT COURSE
TOURISM GUIDANCE
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Tourism Guidance	30	2	2	50 Marks

Learning Outcomes:
By successful completion of the course, students will be able to:

- Understand the basic tourism aspects .
- Comprehend the requirements, role and responsibilities of profession of a Tourist Guide
- Apply the knowledge acquired in managing different groups and guiding in a tour
- Explain basic values related to tourism and heritage

Unit I: (06 hrs)
Tourism – What is Tourism - Characteristics of Tourist Places – Guidance in Tourism - Meaning of Guidance – Types of Tour Guidance - Government/Department Regulations

Unit II: (10 hrs)
Types of Guides – Characteristics of a Guide - Duties and Responsibilities of a Guide - The Guiding Techniques –Guide's personality- Training Institutions – Licence.
Leadership and Social Skills - Presentation and Communication Skills - Working with different age and linguistic groups - Working under difficult circumstances – Precautions at the site -Relationship with Fellow Guides and Officials.

Unit III: (10 hrs)
Guest Relationship Management- Personal and Official - Arrangements to Tourists – Coordinating transport - VISA/Passport -Accident/Death -Handling Guests with Special Needs/ Different Abilities – Additional skills required for Special/Adventure Tours - Knowledge of Local Security and Route Chart – Personal Hygiene and Grooming - Checklist - Code of Conduct

Co-curricular Activities Suggested: (04 hrs)

1. Assignments, Group discussion, Quiz etc.
2. Invited lecture/training by local tourism operators/expert/guides
3. Visit to local Tourism Department office and a tourist service office
4. Organisation of college level short-duration tours to local tourist sites.

Reference Books:

1. Jagmohan Negi (2006); Travel Agency and Tour Operations, Kanishka Publishers, New Delhi
2. Mohinder Chand (2009); Travel Agency and Tour Operations: An Introductory Text, Anmol Publications Pvt. Limited, New
3. Pat Yale(1995); Business of Tour Operations, Longman Scientific & Technical, New Delhi
4. Websites on Tourism guidance.

UG- SKILL DEVELOPMENT COURSE
PLANT NURSERY
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Plant Nursery	30	2	2	50 Marks

Learning Outcomes: On successful completion of this course students will be able to;

- Understand the importance of a plant nursery and basic infrastructure toestablish it.
- Explain the basic material, tools and techniques required for nursery.
- Demonstrate expertise related to various practices in a nursery.
- Comprehend knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.

Unit-1: Introduction to plant nursery: **(06 Hrs)**

1. Plant nursery: Definition, importance.
2. Different types of nurseries –on the basis of duration, plants produced, structure used.
3. Basic facilities for a nursery; layout and components of a good nursery.
4. Plant propagation structures in brief.
5. Bureau of Indian Standards (BIS-2008) related to nursery.

Unit- 2: Necessities for nursery: **(09 Hrs)**

1. Nursery beds – types and precautions to be taken during preparation.
2. Growing media, nursery tools and implements, and containers for plant nursery, in brief.
3. Seeds and other vegetative material used to raise nursery in brief.
4. Outlines of vegetative propagation techniques to produce planting material.
5. Sowing methods of seeds and planting material.

Unit-3: Management of nursery: **(09 Hrs)**

1. Seasonal activities and routine operations in a nursery.
2. Nursery management – watering, weeding and nutrients; pests and diseases.
3. Common possible errors in nursery activities.
4. Economics of nursery development, pricing and record maintenance.
5. Online nursery information and sales systems.

Suggested Co-curricular activities: **(6 Hrs)**

1. Assignments/Group discussion/Quiz/Model Exam.
2. Demonstration of nursery bed making.
3. Demonstration of preparation of media for nursery.
4. Hands on training on vegetative propagation techniques.
5. Hands on training on sowing methods of seeds and other material.
6. Invited lecture cum demonstration by local expert.
7. Watching videos on routine practices in plant nurseries.
8. Visit to an agriculture/horticulture /forest nursery.
9. Case study on establishment and success of a plant nursery.

Reference books:

1. Ratha Krishnan, M., et.al. (2014) *Plant nursery management: Principles and practices,* Central Arid Zone Research Institute (ICAR), Jodhpur, Rjasthan
2. Kumar, N., (1997) *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil.
3. Kumar Mishra, K., N.K. Mishra and Satish Chand (1994) *Plant Propagation*, John Wiley & Sons, New Jersey.

UG- SKILL DEVELOPMENT COURSE
ELECTRICAL APPLIANCES
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Electrical Appliances	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:

- Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
- Understand the working principles of different household domestic appliances.
- Check the electrical connections at house-hold but will also learn the skill to repair the electrical appliances for the general troubleshoots and wiring faults.

UNIT-I : **(6 hrs)**

Voltage, Current, Resistance, Capacitance, Inductance, Electrical conductors and Insulators, Ohm's law, Series and parallel combinations of resistors, Galvanometer, Ammeter, Voltmeter, Multimeter, Transformers, Electrical energy, Power, Kilowatt hour (kWh), consumption of electrical power

UNIT-II : **(10 hrs)**

Direct current and alternating current, RMS and peak values, Power factor, Single phase and three phase connections, Basics of House wiring, Star and delta connection, Electric shock, First aid for electric shock, Overloading, Earthing and its necessity, Short circuiting, Fuses, MCB, ELCB, Insulation, Inverter, UPS

UNIT-III: **(10 hrs)**

Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances, IS codes & IE codes.

Co-curricular Activities (Hands on Exercises): **(04 hrs)**

[Any four of the following may be taken up]

1. Studying the electrical performance and power consumption of a given number of bulbs connected in series and parallel circuits.
2. Measuring parameters in combinational DC circuits by applying Ohm's Law for different resistor values and voltage sources
3. Awareness of electrical safety tools and rescue of person in contact with live wire.
4. Checking the specific gravity of lead acid batteries in home UPS and topping-up with distilled water.
5. Identifying Phase, Neutral and Earth on power sockets.
6. Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.
7. Observing the working of transformer under no-load and full load conditions.
8. Observing the response of inductor and capacitor with DC and AC sources.
9. Observing the connections of elements and identify current flow and voltage drops.
10. Studying electrical circuit protection using MCBs, ELCBs
11. Assignments, Model exam etc.

Reference Books:

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications
5. Consumer Electronics, S.P.Bali, Pearson
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

UG- SKILL DEVELOPMENT COURSE
INSURANCE PROMOTION
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Insurance Promotion	30	2	2	50 Marks

Learning Outcomes:
By successful completion of the course, students will be able to;

- Understand the field level structure and functioning of insurance sector and it's role in protecting the risks.
- Comprehend pertaining skills and their application for promoting insurance coverage
- Prepare better for the Insurance Agent examination conducted by IRDA
- Plan 'promoting insurance coverage practice' as one of the career options.

UNIT I:
Section I: **(06 Hrs)**
Introduction of Insurance - Types of insurances. Growth of Insurance sector in India - Regulatory mechanism (IRDA) - Its functions

UNIT II:
Section II: **(10 Hrs)**
Life Insurance plans. Health insurance plans. Products and features. Contents of documents– Sales Promotion methods - Finding prospective customers –Counselling – Helping customers in filing - Extending post-insurance service to customers.

UNIT III:
Section III: **(10 Hrs)**
General Insurance - It's products (Motor, Marine, Machinery, Fire, Travel and Transportation) and features. Contents of documents. Dealing with customers – Explaining Products to Customers - Promoting Customer loyalty. Maintenance of Records.

Co-curricular Activities Suggested: **(4 hrs)**

1. Collection of pamphlets of various insurance forms and procedures
2. Invited Lectures by Development Officers concerned
3. Mock practice of selling of insurance products
4. Preparation of working documents
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Principles of Insurance, Himalaya publishing House
2. Principles and Practice of Insurance, "
3. Fundamentals of insurance, "
4. Life and General Insurance Management, "
5. Financial services, Tata McGraw hill
6. Insurance Principles and Practices, Sultan Chand &Sons
7. Websites on insurance promotion

DETAILS OF COURSE-WISE SYLLABUS

4. Details of course-wise Syllabus

B.Sc.	Semester: I	Credits: 4
Course: 1	Introduction to Forensic Science & Criminology	Hrs/Wk: 4

Aim and objectives of Course: Students will understand history of forensic science, development and its role in criminal investigation.

Learning outcomes of Course: After studying this course the students will know-

- The significance of Forensic Sciences to the Criminal Justice System.
- The working conditions of Forensic Science Laboratory.
- The importance of criminology and penology for crime detection.
- The working of Indian courts and role of criminal justice system in crime detection.

UUNIT I:

Forensic science- Introduction – History & Development in India & Worldwide. Basic terminology. Principles of Forensic science with Examples - Allied institutions - CFPB, BPR&D, CDFD, CDTI, NIA, CCMB, LaCONES, IICT, NIN, NCB. Different agencies involved in Crime Detection- History-Development of- Police, Central Bureau of Investigation (CBI), Crime Investigation Department (CID), Intelligence Bureau (IB), Research & Analysis Wing (RAW), CRPF, BSF, SPG etc.

Forensic Science Laboratories - DFSS, SFSL, CFSLs. Various Divisions of FSLs- Functions and types of cases dealt in various divisions, ISO-17025, NABL Accreditations, etc. Opinion/ Reports from FSL's.

UNIT II:

Criminal Justice System in India- Introduction, Administration of Civil and Criminal Laws. Introduction to constitution of India- Fundamental Rights, Indian Penal Code (IPC), Criminal Procedure Code (Cr. PC), Indian Evidence Act (IEA), IT Act-2000, Wild Life Protection Act-1972, POCSO Act, etc. Indian Courts- Introduction, Hierarchy of courts- Powers of courts, types of courts, Lok Ayukta & Lok Adalat, etc. Role and responsibilities of Public Prosecution – Defense Council -Admissibility of Expert Testimony.

UNIT III:

Instrumentation: Introduction, Working Principle & Applications of various Instruments / Techniques used in Forensic Science – TLC, HPLC, GC, GC-MS, LC-MS, Microscopes-Stereo, Comparison, SEM, TEM, VSC, RUVIS, AAS, AES, EMR, Cyanoacrylate Fuming Chamber, Iodine Fuming Chamber, UV-Spectrophotometer, PCR, etc.

UNIT IV:

Criminology – Introduction - Definitions, Development and Scope of Criminology. Crime – Definitions, Characteristics and Classification of Crime: Classification by Pioneers, Classification under law: IPC. Professional & Organized Crime: Characteristics and Types.

Penology- Introduction- Punishment: Definition, Types and Theories of Punishment. Institutional system of correction: Prison – types, Functions – Prison Labor, Prison Education and Prison Discipline. Non-Institutional system of correction: Probation & Parole - Principles, advantage & Limitation. Victimology: Definition, Historical developments. Classification of Victims, Victimizing factors & Restitution.

UNIT V:

Criminal Psychology: Introduction, Definition & Scope. Mc. Naughten Rule, Insanity in IPC, Sensation and Perception. Gestalt principle of perceptual process. Personality – definition, traits and approaches. Freuds psychoanalytical theory. Personality disorders, delusional disorder, anti-social personality. Psychological Motives and its impact on behavior. Mental disorder and Mental deficiency as factor in the causation of Crime. Psychological methods of control and rehabilitation of offenders – Psychotherapy and counselling – Victims, Witnesses and Suspects. Polygraphy, Narcoanalysis& BEOS in the Criminal Justice System.

REFERENCE BOOKS:

1. Forensic Science in Criminal Investigation in trials – B.R.Sharma
2. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
3. Encyclopedia of Forensic Science Vol I, II& III, - Siegel.J.A , Sukoo.R.J and Knufer
4. Forensic Science: Advanced investigations, Cengage learning – Brown & Davenport.
5. Criminology The basics – Taylor & Francis – SandraWalklate
6. Criminology – Ram Ahuja
7. Criminal major acts – Padala Rama Reddi – Asian law house 27thedition
8. The Indian Penal code. 28th edition – Rattan lal and Dhirajlal
9. Forensic Science, Its Techniques & Court Evidence
10. An Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G.Sunil Babu , Dr.Navjot Kaur Kanmai
11. Challenges to Internal Security of India – Ashok – Spectrum Publications

Suggested Co-Curricular Activities:

- Visit to FSL and Allied institutions.
- Quiz and seminars on Forensic Science.
- Jurisdiction & Powers of various courts in India.
- Study projects on instruments & techniques used in Forensic Science.
- Debate on Criminology & its importance
- Case studies and assignments on criminal psychology.

B.Sc.	Semester: I	Credits: 1
Course: 1	Forensic Science Lab	Hrs/Wk: 2

List of Experiments:

1. Experiments on Locard's principle of Exchange
2. Experiments on working principle of TLC, HPLC, GCMS, VSC, RUVIS.
3. Case studies - Civil and Criminal cases
4. Demonstration of Instruments and specimens
5. Internal – External locus of control scale

a. Self – Concept Questionnaire.

DETAILS OF COURSE WISE SYLLABUS

4. Details of course-wise Syllabus

B. Sc.	Semester: I	Credits: 4
Course: 1	**Fundamentals of Computer**	Hrs/Wk: 4

Aim and objectives of Course: The objective of the course is to give basic competency in application of a computer to everyday tasks using standard procedures.

Learning outcomes of Course: After studying this Course the students will know-

- Demonstrate on Computer and its components
- To identify Basic input and output devices
- Demonstrate on Types of printers and its configuration
- The Assembling and Dissembling of computer
- To identify Preventive Maintenance and Troubleshooting process

UNIT I:

Basic Computer Knowledge Computer organizations, types of computers, Components of computer, Input Devices Key board, mouse, touch pad and other pointing Devices, Desktop Icons and control panel objects, Operating system types, Creating Files and Folders, Exploring the folders, files, and programs, Editing a document file.

UNIT II:

Introduction to Computer Networks: Computer networks, Intranet, Surfing the Internet, ISPs and connection types, Search, Email, Virtual communities, Social Networks, Tools on the web.

UNIT III:

Components of Computer and Printers Introduction to the Computer Hardware, Power Supplies, Motherboards, Internal PC Components, External Ports and Cables, Input and Output Devices, Select Computer Components, Safe Lab Procedures, Procedures to Protect Equipment and Data, Proper Use of Tools, Software Tools, Antistatic Wrist Strap, Printers, Installing and Configuring Printers, Configuring Options and Default Settings, Optimizing Printer Performance, Sharing Printers, Print Servers, Maintaining and Troubleshooting Printers, Troubleshooting Printer Issues, Common Problems and Solution

UNIT IV:

Computer Assembly: Assemble the Computer, Computer Disassembly, Install the Motherboard, Install Drives, Install Cables, Install the Adapter Cards, Install the Adapter Cards, BIOS Beep Codes and Setup, BIOS and UEFI Configuration, Upgrade and Configure a Computer, Storage Devices, Peripheral Devices

UNIT V:

Preventive Maintenance and Troubleshooting, Preventive Maintenance and the Troubleshooting Process, PC Preventive Maintenance, Benefits of Preventive Maintenance, Preventive Maintenance Tasks, Clean the Case and Internal Components, Inspect Internal Components, Identify the Problem, Probable Cause, Test the Theory to Determine, Plan of Action to Resolve the Problem and Implement the Solution.

REFERENCE BOOKS:

1. Introduction to IT essentials Version 6 by CISCO
2. Fundamentals of Computers by Balagurusamy, McGraw Hill by: Balagurusamy
3. Fundamentals of computers by Rajaraman
4. Computer Fundamentals Courseback by Anita Goel
5. Computer Fundamentals 6th Ed by P.K. Sinha
6. Fundamentals of Computers by Rajaraman V

Suggested Co-Curricular Activities: NA.

B. Sc.	Semester: I	Credits: 1
Course: 1	**Fundamentals of Computer Lab**	Hrs/Wk: 2

List of Experiments:

1. Basic Computer Knowledge
2. Introduction to Computer Networks
3. Components of Computer and Printers
4. Computer Assembly
5. Preventive Maintenance and Troubleshooting

B.Sc.	Semester - I	Credits: 4
Course: 1	Inorganic and Physical Chemistry	Hrs/Wk: 4

Course outcomes:

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

- Understand the basic concepts of p-block elements
- Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
- Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses.

UNIT I:

INORGANIC CHEMISTRY :Chemistry of p-block elements

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides $\{(PNCl_2)_n$ where n=3, 4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

UNIT II:

1. Chemistry of d-block elements:

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. Chemistry of f-block elements:

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

3. Theories of bonding in metals:

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

UNIT III: PHYSICAL CHEMISTRY

Solid state

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT IV:

1. Gaseous state

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule- Thomson effect. Inversion temperature.

2.Liquid state

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT V:SOLUTIONS, IONIC EQUILIBRIUM & DILUTE SOLUTIONS

1. Solutions

Azeotropes- HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic equilibrium

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

3. Dilute solutions

Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester- end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J. E. Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Voge
9. Atkins, P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
10. Castellan, G.W.Physical Chemistry4th Ed. Narosa (2004).
11. Mortimer, R. G.Physical Chemistry3rdEd. Elsevier: NOIDA, UP(2009)
12. Barrow, G.M. PhysicalChemistry

B.Sc.	Semester - I	Credits: 1
Course: 1(L)	Analysis of SALT MIXTURE LAB	Hrs/Wk: 2

LABORATORY COURSE -I **30**hrs (2 h / w)

Qualitative inorganic analysis (Minimum of Six mixtures should be analyzed) 50 M

Course outcomes:

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

- Understand the basic concepts of qualitative analysis of inorganic mixture
- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Analysis of SALT MIXTURE **50 M**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

UG(English)	Semester -II	Credits: 03
Course - 2	A Course In Reading & Writing Skills	Hrs/Week: 04

Learning Outcomes:

By the end of the course the learner will be able to :

- Use reading skills effectively
- Comprehend different texts
- Interpret different types of texts
- Analyse what is being read
- Build up a repository of active vocabulary
- Use good writing strategies
- Write well for any purpose
- Improve writing skills independently for future needs

UNIT I:

Prose : 1. How to Avoid Foolish Opinions Bertrand Russell
Skills : 2. Vocabulary: Conversion of Words
: 3. One Word Substitutes
: 4. Collocations

UNIT II:

Prose : 1. The Doll's House Katherine Mansfield
Poetry : 2. Ode to the West Wind P B Shelley
Non-Detailed Text : 3. Florence Nightingale Abrar Mohsin
Skills : 4. Skimming and Scanning

UNIT III:

Prose : 1. The Night Train at Deoli Ruskin Bond**Poetry** : 2. Upagupta Rabindranath Tagore
Skills : 3. Reading Comprehension
: 4. Note Making/Taking

UNIT IV

Poetry : 1. Coromandel Fishers Sarojini Naidu
Skills : 2. Expansion of Ideas
: 3. Notices, Agendas and Minutes

UNIT V:

Non-Detailed Text : 1. An Astrologer's Day R K Narayan
Skills : 2. Curriculum Vitae and Resume
: 3. Letters
: 4. E-Correspondence

పాఠ్య ప్రణాళిక

యూనిట్-I : ఆధునిక కవిత్వం

1. ఆధునిక కవిత్వం- పరిచయం
2. కొండవీడు - దువ్వూరి రామిరెడ్డి
   ('కవికోకిల' గ్రంథావళి-ఖండకావ్యాలు-నక్షత్రమాల సంపుటి నుండి)
3. మాతృసంగీతం - అనిసెట్టి సుబ్బారావు ('అగ్నివీణ' కవితాసంపుటి నుండి)
4. 'తాతకో నూలుపోగు' - బండారు ప్రసాదమూర్తి ('కలనేత' కవితాసంపుటి నుండి)

యూనిట్-II: కథానిక

5. తెలుగు కథానిక - పరిచయం
6. భయం (కథ) - కాళీపట్నం రామారావు
7. స్వేదం ఖరీదు....? - (కథ) - రెంటాల నాగేశ్వరరావు

యూనిట్-III : నవల

8. తెలుగు 'నవల' - పరిచయం
9. రథచక్రాలు (నవల) - మహీధర రామ్మోహన రావు (సంక్షిప్త ఇతివృత్తం మాత్రం)
10. రథచక్రాలు (సమీక్షా వ్యాసం) - డా॥ యల్లాప్రగడ మల్లికార్జునరావు

యూనిట్-IV: నాటకం

11. తెలుగు 'నాటకం' - పరిచయం
12. యక్షగానము (నాటిక) - ఎం.వి.ఎస్. హరనాథరావు.
13. "అపురూప కళారూపాల విధ్వంసదృశ్యం 'యక్షగానము' (సమీక్షా వ్యాసం)"
    -డా॥కందిమళ్ళసాంబశివరావు

యూనిట్-V: విమర్శ

14. తెలుగు సాహిత్య విమర్శ - పరిచయం
15. విమర్శ-స్వరూప స్వభావాలు; ఉత్తమ విమర్శకుడు-లక్షణాలు

UG(General HINDI)	Semester - II	Credits:03
Course : 2	Prose, Short Stories, Grammar and Letter Writing	Hrs/Weeks:04

Unit 1

गद्य संदेश (Prose) (सं. डा.वी.एलण्णरसिंहम शिवकोटि)

1. बिंदा

2. भारत एक है

3.एच.आई.वी/एड्स

Unit 2

कथा लोक (Short Stories) (सं. डा. घनश्याम)

1.भूख हडताल

2.परमात्मा का कुत्ता

3.और वह पढ गई...

Unit 3

व्याकरण (Grammar) (सरल हिन्दी व्याकरण, दक्षिण भारत हिन्दी प्रचार सभा,मद्रास)

संधि विच्छेद, वाक्यों की शुद्धि

Unit 4

कार्यालयीन हिंदी : पदनाम .. हिंदी से अंग्रेजी और अंग्रेजी से हिंदी

(Changing Administrative Terminology Hindi to English and English to Hindi)

Unit 5

पत्र लेखन : **(Letter Writing)**

नौकरी केलिए आवेदन पत्र

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UG Courses	Semester - II	Credits:03
Course: 2	Poetry, Prose & Grammar	Hrs/Weeks:04

UNIT – I OLD POETRY:

1. "**Indumateeswayamvaram**", Raghuvamsam of kalidasa, 6th canto, Chowkhamba krishadas academy, Varanasi-2012.
2. "**Deekshaapradanam**", Buddacharitam of Aswagosha, 16th canto. Selected verses.

UNIT – II MODERN POETRY:

1. "**Gangavataranam**", Bhojas Champu Ramayanam, Balakanda.
2. "**Mohapanodaha**", 4th cant. Dharma Souhrudam by P.Pattabhi Ramarao, , Published by Author, Ramanth Nagar.
3. "**VandeKasmeerabharatam**", by Doolypala Ramakrishna from Samskrita pratibha, sahitya academy , New Delhi -2018.

UNIT – III PROSE:

1. "**Avantisundarikatha**", 5th Chapter. Dasakumara Charitam, Purva peetika.
2. "**Charudattacharitam**", Bhasakathasaraha by Y.Mahalingasastry.

UNIT - IV GRAMMAR:

1. **DECLENSIONS** :Nouns ending in vowels
   Nadee, Janu, vadhoo, Matru, Phala, Vaari & Madhu.
2. **CONJUGATIONS**
   III Conjugation- Yudh, IV Conjugation- Ish, VIII Conjugation- Likh, Kru, IX Conjugation-Kreen X, Conjugation-Kath, Ram, Vand.

UNIT – V GRAMMAR:

1. **SANDHI** - Halsandhi : Latva, Jastva
   -Visarga sandhi: Utva, Visargalopa, Rephadesa, Ooshma.

2.**SAMASA**
Avyayeebhava, Bahruvrihi.

UG- LIFE SKILL COURSE
INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
II	Life skill course	Information and Communication Technology (ICT)	30	2	2	50 Marks

Objectives: This course aims at acquainting the students with basic ICT tools which help them in their day to day and life as well as in office and research.

Course outcomes: After completion of the course, student will be able to;

- Understand the literature of social networks and their properties.
- Explain which network is suitable for whom.
- Develop skills to use various social networking sites like twitter, flickr, etc.
- Learn few GOI digital initiatives in higher education.
- Apply skills to use online forums, docs, spreadsheets, etc for communication, collaboration and research.
- Get acquainted with internet threats and security mechanisms.

UNIT-I:Fundamentals of Internet: What is Internet?, Internet applications, Internet Addressing – Entering a Web Site Address, URL–Components of URL, Searching the Internet, Browser–Types of Browsers, Introduction to Social Networking: Twitter, Tumblr, LinkedIn, Facebook, flickr, Skype, yahoo, YouTube, WhatsApp.

UNIT-II: E-mail: Definition of E-mail -Advantages and Disadvantages –User Ids, Passwords, Email Addresses, Domain Names, Mailers, Message Components, Message Composition, Mail Management. G-Suite: Google drive, Google documents, Google spread sheets, Google Slides and Google forms.

UNIT-III: Overview of Internet security, E-mail threats and secure E-mail, Viruses and antivirus software, Firewalls, Cryptography, Digital signatures, Copyright issues. What are GOI digital initiatives in higher education? (SWAYAM, Swayam Prabha, National Academic Depository, National Digital Library of India, E-Sodh-Sindhu, Virtual labs, e-acharya, e-Yantra and NPTEL).

RECOMMENDED CO-CURRICULAR ACTIVITIES: Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/ independent and group learning.

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz and Group Discussion
4. Slip Test
5. Try to solve MCQ's available online.
6. Suggested student hands on activities:

a. Create your accounts for the above social networking sites and explore them, establish a video conference using Skype.
b. Create an Email account for yourself- Send an email with two attachments to another friend. Group the email addresses use address folder.
c. Register for one online course through any of the online learning platforms like NPTEL, SWAYAM, Alison, Codecademy, Coursera. Create a registration form for your college campus placement through Google forms.

Reference Books:

1. In-line/On-line: Fundamentals of the Internet and the World Wide Web, 2/e –By Raymond Green law and Ellen Hepp, Publishers: TMH
2. Internet technology and Web design, ISRD group, TMH.
3. Information Technology – The breaking wave, Dennis P.Curtin, Kim Foley, Kunai Sen and Cathleen Morin, TMH.

UG- LIFE SKILL COURSE
INDIAN CULTURE AND SCIENCE(ICS)
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam(2 Hrs)
II	Life skill course	Indian culture and science(ICS)	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:

- Understand the evolution of India's culture
- Analyze the process of modernization of Indian society and culture from past to future
- Comprehend objective education and evaluate scientific development of India in various spheres
- Inculcate nationalist and moral fervour and scientific temper

Unit – I: Unity in Diversity in India: **(09 hrs)**

Coexistence of various religions since ancient times - Hinduism, Buddhism, Jainism and Atheism, and later Sikhism, Islam and Christianity The Bhakti (Vishnavite and Saivaite) and Sufi Movements. The concepts of seela, karuna, kshama, maitri, vinaya, santhi and ahimsa Achievements in Literature, Music, Dance, Sculpture and Painting - Craftsmanship in cloth, wood, clay, metal and ornaments Cultural diversity, Monogamy, Family system, Important seasonal festivals

Unit – II: Social Reforms and Modern Society: **(09 hrs)**

Reforms by Basaveswara - Raja Rama Mohan Roy – Dayananda Saraswathi –Swamy Vivekananda –Mahatma Gandhi - B. R. Ambedkar - Reforms in Andhra by Vemana,Veerabrahmam, Gurajada, Veeresalingam and Gurram Jashua (only reforms in brief, biographies not needed). Modern Society: Family unity, Community service, Social Harmony, Civic Sense, Gender Sensitivity, Equality, National Fervor

Unit – III: Science and Technology: **(11 hrs)**

Objectivity and Scientific Temper – Education on Scientific lines (Bloom's Taxonomy) - Online Education. Developments in Industry, Agriculture, Medicine, Space, Alternate Energy, Communications, Media through ages

Co-curricular Activities Suggested: Assignments, Group discussions, Quiz etc

1. Invited Lecture by a local expert
2. Visit to a scientific institutions, local heritage sites, museums, industries etc.

Reference Books:

1. History of India and Culture (Upto 1526 A.D), Telugu Academy
2. History of India and Culture (1526 A.D to 1964), Telugu Academy
3. Basham, A.L (ed), A Cultural History of India
4. Hana S. Noor Al-Deen&J.A.Hendricks, Social Media : Usage and Impact
5. Bipan Chandra, Aditya Mukherjee, Mridula Mukherjee, India After Independence
6. S.K.Thakur, ISRO: History and Achievements
7. V. Ramakrishna, Social Reform Movement Andhra, Vikas Publications

UG- SKILL DEVELOPMENT COURSE

SURVEY & REPORTING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Survey & Reporting	30	2	2	50 Marks

Learning Outcomes:

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

- Understand the basics of survey and reporting needs and methods
- Comprehend designing of a questionnaire
- Conduct a simple and valid survey and Collect data
- Organize and interpret data and Prepare and submit report.

Unit I: (08Hrs)

Survey: Meaning and Definition –Identifying need for survey - Identifying Sample –Characteristics of Sample - Types of Survey – Survey Methods – Advantages and Disadvantages of Survey – Essential Steps in Survey – Online Survey.

Unit II: (09Hrs)

Preparing Questionnaire: Types and Parts of Questionnaire – Qualities of good Questionnaire – Precautions in Preparing Questionnaire. Administering/Piloting Questionnaire –Collection of data - Dealing with People – Maintaining objectivity/neutrality.

Unit III: (10 Hrs): Methods of Organizing data – Forms of data presentation - Tables and Figures – Basic Statistical Methods of Analysis of data –Percentages - Mean, Mode and Median –Simple Ways of showing Results– Tables/Graphs/Diagrams

Report Writing: Forms of Reporting - Parts of a Report - Title page to Acknowledgements - Characteristics of a Good Report – Style of language to be used - Explaining Data in the Report – Writing fact-based Conclusions – making Recommendations – Annexing required material.

Recommended Co-curricular Activities (3 hrs):

1. Invited Lecture/Training by a Local Expert
2. Collection and study of questionnaires
3. Preparation of sample questionnaire and conduct a live sample survey
4. Preparation of a sample Report
5. Assisting a real time field survey and report writing
6. Assignments, Group discussion, Quiz etc.

Reference books:

1. Denscombe M., The Good Research Guide: For Small-Scale Social Research Projects, Open Uni. Press, 1998
2. Sudman S &Bradburn N.M., Asking Questions, 1973

UG- SKILL DEVELOPMENT COURSE
BUSINESS COMMUNICATION
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/ Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Business Communication	30	2	2	50 Marks

Learning Outcomes:
After successful completion of this course, students will be able to;

- Understand the types of business communication and correspondence
- Comprehend the processes like receiving, filing and replying
- Acquire knowledge in preparing good business communications
- Acquaint with organizational communication requirements and presentations.

UNIT I: **(06hrs)**
Introduction and Importance of communication an overview - meaning and process of communication - organizational communication and its barriers.

UNIT II: **(10hrs)**
Types of Business Communications –Categories, methods and formats - Business vocabulary - Business idioms and collocations – Organisational Hierarchy - Various levels of communication in an organization – Top-down, Bottom-up and Horizontal-Business reports, presentations– Online communications.

UNIT III: **(10hrs)**
Receiving business communications -Filing and processing -Sending replies. Routine cycle of communications – Writing Communications - Characteristics of a good business communication - Preparation of business meeting agenda – agenda notes - minutes –circulation of minutes – Presentations of communication using various methods.

Recommended Co-curricular Activities **(04hrs):**
1. Collection of various model business letters
2. Invited lecture/field level training by a local expert
3. Reading of various business reports and minutes and its analysis
4. Presentations of reports, charts etc.
5. Assignments, Group discussion, field visit etc.

Reference books:

1. Chaturvedi. P.D.Chaturvedi.M - Business Communication concepts, Cases and applications - Pearsons Education.
2. Kaul Asha - Effective Business Communication - PHI Learning pvt Ltd .
3. www.swayam.gov.in
4. Websites on business communication

UG- SKILL DEVELOPMENT COURSE
SOCIAL WORK METHODS
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course	'B'	Social work Methods	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:
- Understand the basic concepts relating to social work practice, values, principles of social work and social problems in India
- List out different approaches of providing help to the people in need.
- Acquaint the process of primary methods of social work
- Get to know the skills of working with individuals, groups and communities.

Unit-I: (07Hrs)- Introduction to social work and concepts related to social work : Introduction to Social Work- Definition- Scope- objectives - Functions- social service, social welfare services, social reform, major social problems in India; Social work philosophy, values, objectives, principles, methods and fields of social work.

Unit-II: (09Hrs) Methods of Working with Individuals and Groups
Social case work –Definition-scope and importance of social case work, principles and process of social case work -Tools and techniques in social case work- Counselling skills.
Social Group Work-Definition-scope- the need for social group work –Group work process - Principles of Group Work -Stages of Group Work-Facilitation skills and techniques.

Unit-III: (09Hrs) Working with Communities and Field Work in social work
Community – definition - characteristics- types- community organisation as a method of social work-definition-objectives-principles- phases of community organization - 3 concepts of community development, community participation and community empowerment.
Field work in social work – Nature, objectives and types of field work - Importance of field work supervision.

Suggested Co-curricular Activities: (05 hours)
1. Divide the students into groups, each group containing not exceeding 10 students depending upon the total number of students in a class or section. Each group can search in internet about any one of the institutions which work for the welfare of children or women or elderly or scheduled caste and scheduled tribe children or differently abled persons or Juvenile homes or Correctional homes or hospitals or Mahila Pragathi pranganam or Swadhar project or any social welfare project or non governmental organizations (NGOs) to have an idea about welfare agencies working for the needy.
2. Ask each group to exchange and discuss the information with other groups in the classroom with the information they collected on Internet.
3. Group Discussion with the students- what type of community problems they observe in their villages/towns/cities? Ask them to tell what are the line departments which will help to solve the problems of their communities and suggest them what type strategies help the communities to empower.
4. Invited lectures/Training by local experts
5. Visit to a community
6. Assignments, Quiz etc.

Reference books:

1. Chowdhary, Paul. D. (1992). Introduction to Social Work. New Delhi: Atma Ram and Sons.
2. Friedlander W.A. (1955). Introduction to social welfare, New York, Prentice Hall.
3. Government of India, (1987). Encyclopedia of Social Work in India (Set of 4 Volumes). New Delhi, Publications Division, Ministry of Information and Broadcasting.
4. Lal Das, D.K. (2017). Practice of Social Research – Social Work Perspective, Jaipur, Rawat Publications.
5. Madan, G.R. (2009). Indian Social Problems (Volume 1 & 2). New Delhi: Allied publishers Private Limited.
6. Siddiqui, H.Y. (2007). Social Group Work. Jaipur: Rawat Publications
7. Pasty McCarthy &Carolin Hatcher, (2002). Presentation skills. The Essential Guide for Students. New Delhi, Sage Publications.
8. Websites on Social work methods.

UG- SKILL DEVELOPMENT COURSE

SOLAR ENERGY

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Solar Energy	30	2	2	50 Marks

Learning Outcomes: After successful completion of the course, students will be able to:

- Acquire knowledge on solar radiation principles with respect to solar energy estimation.
- Get familiarized with various collecting techniques of solar energy and its storage
- Learn the solar photovoltaic technology principles and different types of solar cells for energy conversion and different photovoltaic applications.
- Understand the working principles of several solar appliances like Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses

UNIT-I – Solar Radiation: **(6 hrs)**

Sun as a source of energy, Solar radiation, Solar radiation at the Earth's surface, Measurement of Solar radiation-Pyroheliometer, Pyranometer, Sunshine recorder, Prediction of available solar radiation, Solar energy-Importance, Storage of solar energy, Solar pond

UNIT-II – Solar Thermal Systems: **(10 hrs)**

Principle of conversion of solar radiation into heat, Collectors used for solar thermal conversion: Flat plate collectors and Concentrating collectors, Solar Thermal Power Plant, Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses.

UNIT-III – Solar Photovoltaic Systems: **(10 hrs)**

Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping

Co-curricular Activities (Hands on Exercises): **(04 hrs)**

[Any four of the following may be taken up]

1. Plot sun chart and locate the sun at your location for a given time of the day.
2. Analyse shadow effect on incident solar radiation and find out contributors.
3. Connect solar panels in series & parallel and measure voltage and current.
4. Measure intensity of solar radiation using Pyranometer and radiometers.
5. Construct a solar lantern using Solar PV panel (15W)
6. Assemble solar cooker
7. Desigining and constructing photovoltaic system for a domestic house requiring 5kVA power
8. Assignments/Model Exam.

Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modeling& applications, G.N. Tiwari, Narosa Pub., 2005.
3. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata Mc-Graw Hill Publishers,1999.
4. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
5. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications, 2004.

UG- SKILL DEVELOPMENT COURSE

AGRICULTURAL MARKETING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/ Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Agricultural Marketing	30	2	2	50 Marks

Learning Outcomes:

By the successful completion of this course, the student will be able to;

- Know the kinds of agricultural products and their movement
- Understand the types, structure and functioning of agricultural marketing system
- Comprehend related skills and apply them in sample situations
- Extend this knowledge and skills to their production/consumption environment

Unit- I: **(06hrs)**

Introduction of Agriculture and agricultural products (including agriculture, horticulture, sericulture, floriculture, aquaculture- genetic culture and dairy product) - Agricultural Marketing - Role of marketing - Concepts - Goods and services - Movement of product from farm to consumer –Middlemen – Moneylenders - Types of agricultural markets (basic classification).

Unit- II: **(09hrs)**

Basic structure and facilities of an agricultural market – Primary, secondary and tertiary markets– Functioning of Market Yards–Market information – Rythu Bharosa Kendras (RBK) – Govt market policies and regulations- Contract farming -Govt Apps for marketing of agri products.

Unit- III: **(10hrs)**

Planning production – assembling – grading - transportation– storage facilities. Price fixation. Dissemination of market information –and role of ICT. Marketing - Mix- Product element- Place element- Price element- Promotion element. Selection of target market. Government programs in support of Agricultural marketing in India.

Suggested Co-curricular Activities: **(05hrs)**

1. Study visit to agricultural markets and Rythu Bharosa Kendras (RBK)
2. Invited lecture by field expert
3. Survey of various involved activities e.gassembling, grading, storage, transportation and distribution
4. Identify the demand for food processing units
5. Application of Govt Apps as one Nation and one Market
6. Assignments, Group discussion, Quiz etc.

Reference books:

1. S.S.Acharya & N.L.Agarwala, Agricultural Marketing in India - Oxford and IBH Publications
2. K.S.Habeeb - Ur - Rahman Rural Marketing in India - Himalaya publishing
3. S.S.Chinna Agricultural Marketing in India - KALYANI publishers
4. Publications of National Institute of Agricultural Marketing, Odisha
5. Wikiepedia and other websites on Agricultural Marketing.

UG- SKILL DEVELOPMENT COURSE
ADVERTISING
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course	'B'	Advertising	30	2	2	50 Marks

Learning Outcomes:
After Successful completion of this course, the students are able to;

- Understand the field of Advertising
- Comprehend opportunities and challenges in Advertising sector
- Prepare a primary advertising model
- Understand applying of related skills
- Examine the scope for making advertising a future career

UNIT I: **(06hrs)**
Introduction of advertising concepts- functions - Types of advertising - Creative advertising messages - Factors determining opportunities of a product/service/Idea

UNIT II: **(10 hrs)**
Role of advertising agencies and their responsibilities - scope of their work and functions - - Ethical issues - Identifying target groups -Laws in advertising. Advertising Statutory Bodies in India - Role of AAAI (Advertising Agencies Association of India), ASCI (Advertising Standard Council of India)

UNIT III: **(10hrs)**
Types of advertising – Basic characteristics of a typical advertisement –Reaching target groups - Local advertising – Feedback on impact of advertisement - Business promotion.

Recommended Co-curricular Activities: **(04 hrs)**

1. Collection and segmentation of advertisements
2. Invited Lectures/skills training on local advertising basics and skills
3. Visit to local advertising agency
4. Model creation of advertisements in compliance with legal rules
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Bhatia. K.Tej - Advertising and Marketing in Rural India - Mc Millan India
2. Ghosal Subhash - Making of Advertising - Mc Millan India
3. JethWaneyJaishri& Jain Shruti - Advertising Management - Oxford university Press Publications of Indian Institute of Mass Communications
4. Websites on Advertising

UG- SKILL DEVELOPMENT COURSE

DAIRY TECHNOLOGY

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'B'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Dairy Technology	30	2	2	50 Marks

Learning Outcomes:

After successful completion of the course, students will be able to;

- Understand the pre-requisites for starting a Dairy farm
- Recognize different breeds of Cows & buffaloes following safety precautions.
- Prepare and give recommended feed and water for livestock
- Maintain health of livestock along with productivity
- Vaccination of cattle, nutrients requirements
- Entrepreneurship i.e., Effectively market dairy products
- Ensure safe and clean dairy farm and Standard safety measures to be taken Efficiently start and manage to establish or develop a Dairy Industry

Unit- I (Introduction and Establishment of a Dairy Farm): **(05 Hrs)**

1.1 Dairy development in India – Dairy Cooperatives (NDRI, NDDB, TCMPF) (1hr)

1.2 Constraints of Present Dairy Farming and Future Scope of Dairy Farmer. (1 hr)

1.3 Selection of site for dairy farm; Systems of housing – Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm. (2 hrs)

Unit - II (Livestock Identification and Management): **(13 Hrs)**

2.1 Breeds of Dairy Cattle and Buffaloes – Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals. (5 hrs)

2.2 Systems of inbreeding and crossbreeding. (2 hrs)

2.3 Weaning of calf, Castration, Dehorning, Deworming and Vaccination programme (3 hrs)

2.4 Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks.(3 hrs)

Unit- III (Feed Management, Dairy Management, Cleaning and Sanitation): **(8 Hrs)**

3.1 Basic Principles of Feed, Important Feed Ingredients, Feed formulation and Feed Mixing (2 hrs)

3.2 Operation Flood –Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients –Per Capita Milk production and availability in India and Andhra Pradesh – Methods of Collection and Storage of Milk–Labelling and Storage of milk products (4 hrs)

3.3 Cleaning and sanitation of dairy farm – Safety precautions to prevent accidents in an industry. (2 hrs)

Co-curricular Activities Suggested: (4 hrs)

1. Group discussion & SWOT analysis
2. Visit to a Dairy Farm
3. Visit to Milk Cooperative Societies
4. Visit to Feed Milling Plants
5. Market Study and Identification of Government Schemes, Insurance and Bank Loans in relation

.Reference books:

1. Dairy Science: Petersen (W.E.) Publisher – Lippincott & Company
2. Principles and practices of Dairy Farm –Jagdish Prasad
3. Text book of Animal Husbandry - G C Benarjee
4. Hand book of Animal Husbandry - ICAR Edition
5. Outlines of Dairy Technology – Sukumar (De) – Oxford University press
6. Indian Dairy Products – Rangappa (K.S.) & Acharya (KT) – Asia Publishing House.
7. The technology of milk Processing – Ananthakrishnan, C.P., Khan, A.Q. and Padmanabhan, P.N. – Shri Lakshmi Publications.
8. Dairy India 2007, Sixth edition
9. Economics of Milk Production – Bharati Pratima Acharya Publishers.
10. http://www.asci-india.com/BooksPDF/Dairy%20Farmer%20or%20Entrepreneur.pdf
11. https://labour.gov.in/industrial-safety-health

UG- SKILL DEVELOPMENT COURSE

PERFORMING ARTS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'B'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Performing Arts	30	2	2	50 Marks

Learning Outcomes:

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

- Acquire the basic knowledge in performing arts
- Understand the modern stage and performance on the stage
- Comprehend and improve the skills related to performing arts on the stage
- Understand various Telugu folk arts and their significance
- Know the modes of presentation and skills pertaining to folk arts.

Unit-I: Introduction to performing Arts (06 Hrs)

Arts – and its definition; Fine Arts; Arts - Learning &Imitation – Rasaas, Bhaavas and Rasa Sutra. Dasaroopakaas; Nrittha, Nrithya,Natya; Action – Kinds of Actions; Ancient Costume style

Unit-II: Performing Arts – Stage Arts (10 Hrs)

Origin of Drama (Theatre); Features of Stage; Varieties of Modern Telugu Drama; Famous Telugu Dramas. Stage performance; Dramatic Actor and its definition; Actor–characteristics, Functions and Responsibilities. Traits of an Actor – Diction, Articulation, Dialogue modulation, Time sense, Observation, Mime, Improvisation, Commentary, Dress code, Make-up, lighting &Stage Direction.

Unit-III: Performing Arts – Forms (10 Hrs)

Folk Arts, their nature and significance – Brief introduction to Pagativeshaalu, Bommalaatalu, Veedhinaatakaalu, Yakshagaanaalu, Harikathalu, Burrakathalu, Oggukathalu, Chindu,Yakshagaanam, KolaatamandPulivesham.

Co-curricular Activities Suggested: (4 hrs)

1. Collection of information on modern stage plays, natakasamajams and audio visual material.
2. Providing training classes/inviting lectures with the help of local artists
3. Visit to a real time performing folk arts, if possible.
4. Mock experience classes of Stage plays and Folk arts.
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Andhra Naataka Ranga Charithra –Mikkilineni Radha Krishna Murthy
2. Telugu SahithyaSameeksha (Vol-II) – Dr. G. Nagaiah
3. Telugu NaatakaVilaasam – Dr.P.S.RAppa Rao
4. Telugu JaanapadaVignanam – Prof. Tangirala Venkata Subba Rao
5. JaanapadaVignandhyayanam – Prof. G.S. Mohan
6. NaatyaSasthramu (VisleshanathmakaAdhyayanam) – Dr.P.S.RAppa Rao
7. SahithyaSilpaSameeksha – Prof. PingaliLakshmikantham
8. Nurella Telugu NatakaRangam – Prof. ModaliNagabhushanaSarma
9. Websites on Performing Arts.

B.Sc.	Semester: II	Credits: 4
Course: 2	**Crime Scene Management**	Hrs/Wk: 4

Learning objectives: Crime scene is the key point for the entire investigation and this course emphasizes the need to effectively protect and process various physical evidences.

Outcomes: After studying this Course the students will know-.

- The importance of protection of crime scene.
- The significance of photography and videography at scene of crime.
- The importance of physical evidences.
- The Integrity of chain of custody.
- The role of crime scene reconstruction in crime investigation.

UNIT I:
Crime Scene- Definition, Types- Primary, Secondary & Tertiary. Crime scene safety: Golden rules, Types of hazards- Biological & Chemical. General precautions- Personal protective equipment. Processing of Crime Scene- Where, What & How to search. Search Methods – Strip/ Lane, Spiral, Wheel/Radial, Zone, Methods, etc.

UNIT II:
Crime Scene Photography & Sketching: Introduction, History -cardinal rules, Basic principles– Macro & Micro Photography- Forensic photogrammetry Variations of Photography- Mid range, Close-up, Aerial & over all Photography – EMR photographic techniques – SWGIT – Photo images as evidences – Documentation of Crime scene Photography – Forensic Videography. Sketching of Crime Scene- Rough Sketch & Fine Sketch- Rectangular Coordinate Method, Polar method, Baseline Method, Triangulation Method etc. optical methods of mapping, 3D laser Scanning.

UNIT III:
Physical Evidence- Definition, Importance, Types – Biological, Chemical, Digital Evidence and their handling- Identification of Physical Evidence - Trace Evidence. Type of information to be elicited from various types of Physical Evidence. General precautions while collecting Physical Evidence– Evidence collection equipments, techniques. Chain of Custody of Physical Evidence.

UNIT IV:
Packing Materials of Physical Evidence, Importance of Packing & Packing Materials. Sealing, Marking, & labelling of various physical evidence, Letter of Advice, Precautions while transporting Physical Evidence. General precautions - Types of Preservatives for various Physical Evidence- Biological, Chemical & Digital Evidence, etc.

UNIT V:
Crime Scene Reconstruction- Definition – Nature & Importance - Types of Crime Scene Reconstructions - Role of pattern analysis in reconstruction - Blood stain pattern, Glass fracture pattern, Fire burn or smoke patterns, Gait Pattern, Tyre impression patterns, Furniture pattern. Sequence of events – Recording, Documentation required for Crime Scene Reconstruction. CAD etc.

REFERENCE BOOKS:

1. Criminal Investigation - Karen M Hess & Christine Hess Orthmann.
2. Techniques of Crime Scene Investigation - Barry A.J. Fisher.
3. Criminal Investigation: The Art & the Science - Michael D.Lynn
4. Forensic Science in Criminal Investigation in trials – B.R.Sharma
5. Crime Scene Management – Dr.M.S.Rao & Dr.B.P.Mathil
6. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
7. Encyclopedia of Forensic Science Vol I, II & III, - Siegel. J. A, Sukoo. R. J and Knufer
8. Physical Evidence – Lee – Elsevier 2000
9. Forensic science: Advanced investigations, Cengage learning – Brown &Davenport.
10. Criminalistics – An introduction to Forensic science 5th edition –Saferstein
11. Introduction to criminalistics: Foundation of Forensic science – Elsevier2009
12. Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G.Sunil Babu , Dr.Navjot Kaur Kanmai
13. Forensic Digital Photo Imaging – PatrickJones.
14. Crime Scene Photography – Robinson 3rd ed
15. The Practical Methodology of Forensic Photography – Red Sicker.D.R – CRCPress

Suggested Co-Curricular Activities:

- Flow chart preparation-Crime scene investigation
- Poster making –Photographic skills
- Seminar on crime scene management
- Collection of samples-for museum
- Simulation of various crime scenes
- Workshop on crime scene sketching techniques

B.Sc.	Semester: II	Credits: 1
Course: 2	**Crime Scene Management Lab**	Hrs/Wk: 2

List of Experiments:

1. Search methods for the Identification of physical evidence.
2. Handling, Lifting & Packing of physical evidence.
3. Sealing, Labelling & Preservation of different physical evidence.
4. Methods for sketching the crime scene- Rough & Fine Sketch
5. Mapping techniques of crime scene- Baseline, Rectangular, Triangulation & Polar techniques.
6. Crime scene Photography
7. Mock crime scene analysis

B.Sc.	Semester: II	Credits: 4
Course: 2	**Networking and Security**	Hrs/Wk: 4

Learning Objective: Networking and Security concerns with gathering, monitoring and analyzing of network activities to uncover the source of attacks, viruses, intrusions or security breaches that occur on a network or in network traffic.

Outcomes: After studying this course the students will know-

- Installation of various operating systems, and configuration
- Demonstrate on various protocols
- Troubleshooting of laptops and mobile devices
- Demonstrate on network and network types
- Understanding of OSI Model
- Troubleshooting Computer Networks

UNIT I:

Operating Systems and Installation: Windows Installation, Operating System Terms and Characteristics, Types of Operating Systems and Operating Systems Upgrade, Operating System Installation, Storage Device Setup Procedures, Custom Installation Options, Boot Sequence and Registry Files, Multiboot Procedures, Disk Management Utility, Windows Configuration and Management, Windows Desktop, Tools and Applications, Control Panel Utilities, Administrative Tools, Secure System Configurations, Disk Defragmenter and Disk Error- Checking Tool, Command Line Tools, Client-Side Virtualization, Common Preventive Maintenance Techniques for Operating Systems, access control considerations, Anti-virus installations and configuration, Desktop level windows/linux builtin firewall configurations, enabling logging options in operating systems (event log in windows and syslog in linux).

UNIT II:

Applied Computer Networking: Computer Networks, Types of Networks, OSI Reference Models, Wired and Wireless Ethernet Standards, Physical Components of a Network, Hubs, Bridges, Switches, Rourters, Firewalls and Intrusion Detection/Prevention Systems (IDS/IPS), Cables and Connectors, Basic Networking Concepts and Technologies, IP Addresses, IPv4 vs. IPv6, Static Addressing, Dynamic Addressing, Transport Layer Protocols, TCP, UDP, Port Numbers, Computer to Network Connection, Wireless and Wired Router Configurations, Network Sharing, Remote Connections, ISP Connection Technologies, Internet Technologies, Networked Host Services, Common Preventive Maintenance Techniques Used for Networks, Basic Troubleshooting Process for Networks, secret communication, convert communication and applications of secret/covert communication.

UNIT III:

Laptops and Mobile Devices: Laptops and Mobile Devices, Laptop Components, Laptop Displays, Laptop Configuration, Wireless Configuration, Laptop Hardware and Component Installation and Configuration, Replacing Hardware Devices, Mobile Device Hardware, Common Preventive Maintenance for Laptops and Mobile Devices, Basic Troubleshooting Process for Laptops and Mobile Devices, Mobile, Linux, and OS X Operating Systems, Mobile Operating Systems, Methods for Securing Mobile Device, Mobile Device Synchronization, Configuring Email, Linux and OS X Operating Systems,Basic Troubleshooting Process for Mobile, Linux, and OS X O/S, Common Problems andSolutions for Mobile, Linux, and OS X O/S. Trouble shooting of network issues.

UNIT IV:

Network Security: Introduction to Security, Security vulnerabilities, Security Threats & attacks such as Denial of Service/Distributed Denial of Service (DDoS), Side channel attacks, DNS reflection & amplification attacks and others, Security Procedures, best practices, Intrusion detection and response, Securing Web Access, Protecting Data, Protection Against Malicious Software, Security Techniques, Protecting Physical Equipment, Common Preventive Maintenance Techniques for Security, Basic Troubleshooting Process for Security

UNIT V:

Troubleshooting Computer Networks: Apply Troubleshooting Process to Networks, Apply Troubleshooting Process to Security, Identify and Troubleshooting LAN problems, Cyber warfare and Network Attacks, Mitigating Cyber Attacks, Troubleshoot Security Problems, Security Assessment, Testing and Evaluation, Security information and event management.

REFERENCE BOOKS:

1. Introduction to IT essentials version 6 by CISCO
2. https://www.webopedia.com/TERM/N/network.html
3. Network Forensics: Tracking Hackers Through Cyberspace by Sherri Davidoff, PearsonIndia by Sherri Davidoff
4. https://www.cloudflare.com/learning/ddos/glossary/open-systems-interconnection-model
5. Network Forensics by Ric Messier
6. Learning Network Forensics by Samir Datt
7. Introduction to Security and Network Forensics by Willian J. Buchanan
8. Hands-On Network Forensics by Salman Arthur

Suggested Co-Curricular Activities: NA

B.Sc.	Semester: II	Credits: 1
Course: 2	**Networking and Security Lab**	Hrs/Wk: 2

List of Experiments:

1. Operating Systems and Installation
2. Applied Computer Networking
3. Laptops and Mobile Devices
4. Network Security
5. Troubleshooting Computer Network
6. Working with Nessus and NMAP tools
7. Network packet analysis through Wireshark,
8. Configuration of intrusion detection system through Snort (Linux)
9. Experiments on Open Source SIEM tools
10. Experiments on assessing network vulnerabilities
11. Experiments on Detection of DoS/DDoS attacks

B.Sc.	Semester - II	Credits: 4
Course: 2	Organic & General Chemistry	Hrs/Wk: 4

Course outcomes:

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

- Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
- Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved
- Learn and identify many organic reaction mechanism including Free Radical Substitution, Electrophonic Addition and Electrophonic Aromatic Substitution.
- Correlateanddescribethestereochemicalpropertiesoforganiccompoundsand reactions.

UNIT I: ORGANIC CHEMISTRY

Recapitulation of Basics of Organic Chemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)

General methods of preparation of alkanes- Wurtz and Wurtz-Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenations, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane) General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT II: Carbon-Carbon pi Bonds(Alkenes and Alkynes)

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1 cb reactions, Saytzeff and Hofmann eliminations, Electrophilic Additions ,mechanism (Markovnikov/Anti Markovnikov addition) with suitable examples,, *syn and anti-addition*; additionofH_2,X_2, HX. Oxymercuration, demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT III: Benzene and its reactivity

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic).

Orientation of

i. Amino, methoxy and methyl groups
ii. Carboxy, nitro, nitrile, carbonyl and sulfonic acid groups
iii. Halogens (Explanation by taking minimum of one example from each type)

UNIT IV: GENERAL CHEMISTRY

1. Surface chemistry and chemical bonding Surface chemistry

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding

Valence bond theory, hybridization, VB theory as applied to ClF3,Ni(CO)**4**, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules(N2,O2,CO and NO).

3. HSAB

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT V:

Stereochemistry of carbon compounds

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. **Optical isomerism**: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Practical:

1. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
2. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Additional Resources:

1. Solomons, T. W. G.; Fryhle, C. B. &Snyder, S. A. Organic Chemistry, 12th Edition, Wiley. Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.
2. Clayden, J.; Greeves, N.&Warren, S. Organic Chemistry, Oxford. Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, NewAge International.
3. Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

B.Sc.	Semester - II	Credits: 1
Course: 2(L)	Volumetric Analysis Lab	Hrs/Wk: 2

Course outcomes:

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

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria
- Learn and identify the concepts of a standard solutions, primary and secondary standards
- Facilitate the learner to make solutions of various molar concentrations.
- This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis **50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard.
3. Determination of Cu (II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$

UG(English)	Semester -III	Credits: 03
Course - 3	A Course In Conversational Skills	Hrs/Week: 04

Learning Outcomes

By the end of the course the learner will be able to :

- Speak fluently in English
- Participate confidently in any social interaction
- Face any professional discourse
- Demonstrate critical thinking
- Enhance conversational skills by observing the professional interviews

UNIT I:

Speech : 1. Tryst with Destiny Jawaharlal Nehru
Skills : 2. Greetings
: 3. Introductions

UNIT II:

Speech : 1. Yes, We Can Barack Obama
Interview : 2. A Leader Should Know How to Manage Failure Dr.A.P.J.Abdul Kalam/ India Knowledge at Wharton
Skills : 3. Requests

UNIT III:

Interview : 1. Nelson Mandela's Interview With Larry King
Skills : 2. Asking and Giving Information
: 3. Agreeing and Disagreeing

UNIT IV:

Interview : 1. JRD Tata's Interview With T.N.Ninan
Skills : 2. Dialogue Building
: 3. Giving Instructions/Directions

UNIT V:

1. **Speech** : 1. You've Got to Find What You Love Steve Jobs
Skills : 2. Debates
: 3. Descriptions
: 4. Role Play

పాఠ్య ప్రణాళిక

యూనిట్-I: వ్యక్తీకరణ నైపుణ్యాలు

1. భాష-ప్రాథమికాంశాలు: భాష-నిర్వచనం, లక్షణాలు, ఆవశ్యకత, ప్రయోజనాలు
2. వర్ణం-పదం-వాక్యం', వాక్య లక్షణాలు, సామాన్య-సంయుక్త-సంశ్లిష్టవాక్యాలు
3. భాషా నిర్మాణంలో 'వర్ణం-పదం-వాక్యం' ప్రాధాన్యత

యూనిట్-II సృజనాత్మక రచన

4. కవితా రచన : ఉత్తమ కవిత - లక్షణాలు
5. కథారచన : ఉత్తమ కథ - లక్షణాలు
6. వ్యాస రచన : ఉత్తమ వ్యాసం-లక్షణాలు

యూనిట్-III: అనువాద రచన

7. అనువాదం-నిర్వచనం, అనువాద పద్ధతులు,
8. అనువాద సమస్యలు-భౌగోళిక,భాషా,సాంస్కృతిక సమస్యలు, పరిష్కారాలు
9. అభ్యాసము : ఆంగ్లం నుండి తెలుగుకు,తెలుగు నుండి ఆంగ్లానికి ఒక పేరానుఅనువదించడం

యూనిట్ IV మాధ్యమాలకు రచన-1 (ముద్రణామాధ్యమం/ప్రింట్ మీడియా)

10. ముద్రణామాధ్యమం (అచ్చుమాధ్యమం) : పరిచయం, పరిధి, వికాసం
11. వివిధ రకాల పత్రికలు-పరిశీలన, పత్రికాభాష, శైలి, వైవిధ్యం
12. పత్రికా రచన : వార్తా రచన, సంపాదకీయాలు, సమీక్షలు-అవగాహన

యూనిట్ V మాధ్యమాలకు రచన-2 (ప్రసార మాధ్యమం/ఎలక్ట్రానిక్ మీడియా)

13. ప్రసారమాధ్యమాలు : నిర్వచనం, రకాలు, విస్తృతి, ప్రయోజనాలు
14. శ్రవణ మాధ్యమాలు - రచన: రేడియో రచన, ప్రసంగాలు, నాటికలు, ప్రసార సమాచారం
15. దృశ్యమాధ్యమాలు - రచన: వ్యాఖ్యానం (యాంకరింగ్), టెలివిజన్ రచన

UG(General HINDI)	Semester III	Credits:03
Course : 3	Old and Modern Poetry, History of Hindi Literature ,Essays (Translation and Functional Hindi)	Hrs/Weeks:04

Unit 1

1. काव्यदीप (Ancient and Modern Poetry) (सं.बी.राधाकृष्णमूर्ति)

साखी...1..10 दोहे

सूरदास...बाल वर्णन

मातृभूमि...मैथिलीशरण गुप्त

तोडती पत्थर...सूर्यकांत त्रिपाठी निराला

भारतमाता...सुमित्रानंदन पंत

Unit 2

2. हिंदी साहित्य का इतिहास (History of Hindi Literature) (डा. बाबू गुलाबराय)

हिंदी साहित्य का काल विभाजन (डा. रामचन्द्र शुक्ल)

भक्तिकाल की विशेषताएँ

ज्ञानाश्रयी शाखा ... कबीर

प्रेमाश्रयी शाखा ... जायसी

Unit 3

3. निबंध (General Essays)

1.समाचार पत्र 2.बेकारी समस्या

3.पर्यावरण और प्रदूषण 4. साहित्य और समाज

Unit 4

4. अनुवाद (Translation) अंग्रेजी से हिंदी (Five Simple Sentences)

Unit 5

5. प्रयोजनमूलक हिंदी (Functional Hindi)

राष्ट्रभाषा, राजभाषा, संपर्क भाषा

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UG Courses	Semester - III	Credits:03
Course: 3	Drama, Upanishad, Alankara and History of Literature.	Hrs/Weeks:04

UNIT – I : OLD DRAMA

1."**Madhyamavyayogaha**". Bhasa Natakachakram.
krishadas academy, Varanasi 1998.

UNIT – II :MODERN DRAMA

"Sankalpabalam" by Prof.G.S.R.Krishna Murthy,
Published by Semushi, R.S.Vidyapeetam, Tirupati-2019.

UNIT – III :UPANISHAD

1. **"Sishyanusasanam"** – Sikshavalli of Taittireeyopanishad.

2. **"Sraddatrayavibhagayoga"**,

17th Chapter, Bhagavadgita, Geetapress, Gorakhpoor.

UNIT - IV : 1. ALANKARAS:

1. Upama 2. Ananvaya 3. Utpreksha 4. Deepakam

5. Aprastutaprasamsa 6.Drushtanta 7. Prateepa.

2.HISTORY OF SANSKRIT LITERATURE

1.Panini 2.Kautilya 3.Bharatamuni 4. Bharavi 5.Magha

6.Bhavabhuti 7. Sankaracharya, 8.Jagannatha. 9. Dandi.

UNIT – V : HALANTA SABDAS

1.Jalamuch 2.Vaach 3.Marut 4.Bhagavat 5.Bhavat

6.Pachats 7. Naman 8.Rajan 9.Gunin 10.Vidwas 11. Manas.

UG- LIFE SKILL COURSE

ENVIRONMENTAL EDUCATION (EE) (Mandatory)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Life skill course	Environmental Education(EE)	30	2	2	50 Marks

Course objective: A Generic Course intended to create awareness that the life of human beings is an integral part of environment and to inculcate the skills required to protect environment from all sides.

Learning outcomes: On completion of this course the students will be able to .....

- Understand the nature, components of an ecosystem and that humans are an integral part of nature.
- Realize the importance of environment, the goods and services of a healthy biodiversity, dependence of humans on environment.
- Evaluate the ways and ill effects of destruction of environment, population explosion on ecosystems and global problems consequent to anthropogenic activities.
- Discuss the laws/ acts made by government to prevent pollution, to protect biodiversity and environment as a whole.
- Acquaint with international agreements and national movements, and realize citizen's role in protecting environment and nature.

Unit 1: Environment and Natural Resources: **(06hrs)**

1. Multidisciplinary nature of environmental education; scope and importance.
2. Man as an integral product and part of the Nature.
3. A brief account of land, forest and water resources in India and their importance.
4. Biodiversity: Definition; importance of Biodiversity - ecological, consumptive, productive, social, ethical and moral, aesthetic, and option value.
5. Levels of Biodiversity: genetic, species and ecosystem diversity.

Unit-2: Environmental degradation and impacts: **(10hrs)**

1. Human population growth and its impacts on environment; land use change, land degradation, soil erosion and desertification.
2. Use and over-exploitation of surface and ground water, construction of dams, floods, conflicts over water (within India).
3. Deforestation: Causes and effects due to expansion of agriculture, firewood, mining, forest fires and building of new habitats.
4. Non-renewable energy resources, their utilization and influences.
5. A brief account of air, water, soil and noise pollutions; Biological, industrial and solid wastes in urban areas. Human health and economic risks.
6. Green house effect - global warming; ocean acidification, ozone layer depletion, acid rains and impacts on human communities and agriculture.
7. Threats to biodiversity: Natural calamities, habitat destruction and fragmentation, over exploitation, hunting and poaching, introduction of exotic species, pollution, predator and pest control.

Unit 3: Conservation of Environment: **(10hrs)**

Concept of sustainability and sustainable development with judicious use of land, water and forest resources; a forestation.

1. Control measures for various types of pollution; use of renewable and alternate sources of energy.
2. Solid waste management: Control measures of urban and industrial waste.
3. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
4. Environment Laws: Environment Protection Act; Act; Wildlife Protection Act; Forest Conservation Act.
5. International agreements: Montreal and Kyoto protocols; Environmental movements: Bishnois of Rajasthan, Chipko, Silent valley.

Suggested activities to learner: (4 hours)

1. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural site.
3. Study of common plants, insects, birds and basic principles of identification.
4. Study of simple ecosystems-forest, tank, pond, lake, mangroves etc.
5. Case study of a Forest ecosystem or a pond ecosystem.

Suggested text book:

1. Erach Barucha (2004) *Text book of Environmental Studies for Undergraduate courses* (Prepared for University Grants Commission) Universities Press.
2. Purnima Smarath (2018) *Environmental studies* Kalyani Publishers, Ludhiana

Reference books:

1. Odum, E.P., Odum, H.T. & Andrews, J. (1971) *Fundamentals of Ecology*. Philadelphia: Saunders.
2. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. (2011). *Environmental and Pollution Science*. Academic Press.
3. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012) *Environment. 8th edition*. John Wiley & Sons.
4. Singh, J.S., Singh, S.P. and Gupta, S.R. (2014) *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
5. Sengupta, R. (2003) Ecology and economics: An approach to sustainable development. OUP.
6. Wilson, E. O. (2006) *The Creation: An appeal to save life on earth*. New York: Norton.
7. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll (2006) *Principles of Conservation Biology*. Sunderland: Sinauer Associates.

UG- LIFE SKILL COURSE
PERSONALITY ENHANCEMENT AND LEADERSHIP (PDL)
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam(2 Hrs)
III	Life skill course	Personality enhancement and leadership(PDL)	30	2	2	50 Marks

Learning Outcomes:

By successful completion of the course, students will be able to:

- Develop comprehensive understanding of personality
- Know how to assess and enhance one's own personality
- Comprehend leadership qualities and their importance
- Understand how to develop leadership qualities

Unit – I: (7 hrs)

Meaning of Personality – Explanations of Human Personality – Psychodynamic Explanations – Social Cognitive Explanation – Big Five traits of Personality

Unit – II: (8 hrs)

Assessment of Personality - Projective& Self Report Techniques - Building Self-Confidence – Enhancing Personality Skills

Unit – III: (10 hrs)

Leadership Characteristics – Types of Leaders – Importance of Leadership – Leadership Skills – Building and Leading Efficient Teams – Leadership Qualities of Abraham Lincoln, mahatma Gandhi, Prakasam Pantulu, Dr. B. R. Ambedkar & J.R.D.Tata

Co-curricular Activities Suggested: (05 hrs)

- Assignments, Group discussions, Quiz etc
- Invited Lecture by a local expert
- Case Studies (ex., on students behavior, local leaders etc.)

Reference Books:

1. Girish Batra, Experiments in Leadership, Chennai: Notion Press, 2018
2. Mitesh Khatri, Awaken the Leader in You, Mumbai: Jaico Publishing House, 2013
3. Carnegie Dale, Become an Effective Leader, New Delhi: Amaryllis, 2012
4. Hall, C.S., Lindzey. G. & Campbell, J.B Theories of Personality. John Wiley & Sons,1998

UG- LIFE SKILL COURSE

ANALYTICAL SKILLS(AS)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Life skill course	Analytical skills(AS)	30	2	2	50 Marks

Course Objective: Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

Course Outcomes:

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

- Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
- Acquire competency in the use of verbal reasoning.
- Apply the skills and competencies acquired in the related areas
- Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

UNIT – 1: (10 Hrs)

Arithmetic ability: Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD(HCF).

Verbal Reasoning: Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.

UNIT – 2: (10 Hrs)

Quantitative aptitude: Averages, Ratio and proportion, Problems on ages, Time-distance–speed.

Business computations: Percentages, Profit & loss, Partnership, simple compound interest.

UNIT – 3: (07 Hrs)

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.

Recommended Co-Curricular Activities (03 Hrs)

Surprise tests / Viva-Voice / Problem solving/Group discussion.

Text Book:

Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

Reference Books:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw Hill Publications.

UG- SKILL DEVELOPMENT COURSE
DISASTER MANAGEMENT
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Disaster Management	30	2	2	50 Marks

Learning Outcomes:
After successful completion of the course, the students are able to;

- Understand the nature, cause and effects of disasters
- Comprehend the importance of Disaster Management and the need of awareness
- Acquire knowledge on disaster preparedness, recovery remedial measures and personal precautions
- Volunteer in pre and post disaster management service activities

UNIT-I: **(06 hrs)**
Introduction of Disaster - Different types of disasters- Natural- (flood, cyclone, earthquake, famine and pandemic) - Accidental- (Fire, Blasting, Chemical leakage, Rail, Aviation, Road boat tragedies and nuclear pollution) - Disaster Management Act 2005

UNIT-II: **(09hrs)**
Causes and immediate effects of Disasters - Preparedness of disasters –Precautions – Dissemination of information - Nature and concepts - Role of National Disaster Management Authority and Role of Government and non governmental organizations in protecting human livestock and natural resources.- Use of technology -Role of Citizens and Youth in the prevention.

UNIT-III: **(09 hrs)**
Post disaster effects - short term - Procedures for Rehabilitation and Recovery - Role of volunteers and Safety Precautions - Long term remedial and preventive measures – Collection, filing and storage of information - Case studies

Suggested co curriculum Activities: **(06 hrs)**

1. Invite lectures by local experts
2. Training on preparedness, post disaster services
3. Analysis of Case studies
4. Visit to a disaster management office and facility
5. Assignments, Group discussion, quiz etc.

Reference books:

1. Jagbirsingh - Disaster Management Future challenges and opportunities- - K.W.Publishers
2. GOI - UNDP Disaster Management Guidelines
3. J.P.Singhal - Disaster Management - Laxmi Publications
4. www. ndma. gov.in
5. Wikipedia and other websites on Disaster management.

UG- SKILL DEVELOPMENT COURSE

ONLINE BUSINESS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Online Business	30	2	2	50 Marks

Learning Outcomes:

After successful completion of the course, students will be able to;

- Understand the online business and its advantages and disadvantages
- Recognize new channels of marketing, their scope and steps involved
- Analyze the procurement, payment process, security and shipping in online business
- Create new marketing tools for online business
- Define search engine, payment gateways and SEO techniques.

Unit-I: **(06 Hrs)**

Introduction to Online-business-Definition-Characteristics-Advantages of Online Business-Challenges-Differences between off-line business, e-commerce and Online Business.

Unit-II: **(10 Hrs)**

Online-business Strategies-Strategic Planning Process- Procurement -Logistics & Supply Chain Management- Customer Relationship management.

Unit-III: **(10 Hrs)**

Designing Online Business Website – Policies - Security & Legal Issues - Online Advertisements - Payment Gateways - Case Study

Co-curricular Activities Suggested: **(4 hrs)**

1. Assignments, Group discussion, Quiz etc.
2. Short practical training in computer lab
3. Identifying online business firms through internet
4. Invited Lectures by e-commerce operators
5. Working with Google and HTML advertisements.
6. Visit to a local online business firm.

Reference books:

1. David Whiteley, "E-Commerce", Tata McGraw Hill, 2000.
2. E Business by Jonathan Reynolds from Oxford University Press.
3. Soka, From EDI to Electronic Commerce, McGraw Hill.
4. Websites on Online business.

UG- SKILL DEVELOPMENT COURSE

POULTRY FARMING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Poultry Farming	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to;

- Understand the field level structure and functioning of insurance sector and it's role in protecting the risks
- Comprehend pertaining skills and their application for promoting insurance coverage
- Prepare better for the Insurance Agent examination conducted by IRDA
- Plan 'promoting insurance coverage practice' as one of the career options.

Unit I (Introduction to Poultry Farming): **(10Hrs)**

1.1 General introduction to poultry farming -Definition of Poultry; Past and present scenario of poultry industry in India.

1.2 Principles of poultry housing. Poultry houses. Systems of poultry farming.

1.3 Management of chicks, growers and layers. Management of Broilers.

1.4 Preparation of project report for banking and insurance

Unit II (Feed and Livestock Health Management): **(10 Hrs):**

2.1 Poultry feed management – Principles of feeding, Nutrient requirements for different stages of layers and broilers. Feed formulation and Methods of feeding.

2.2 Poultry diseases – viral, bacterial, fungal and parasitic(two each); symptoms, control and management; Vaccination programme.

Unit III (Harvesting of Eggs and Sanitation): **(10 Hrs)**

3.1 Selection, care and handling of hatching eggs. Egg testing. Methods of hatching.

3.2 Brooding and rearing. Sexing of chicks.

3.3 Farm and Water Hygiene, Recycling of poultry waste.

Co-curricular Activities Suggested: **(4 hrs)**

1. Group discussion& SWOT analysis
2. Visit to a poultry farm
3. Invited Lectures by Concerned officers of government or private farms
4. Cheap and Healthy Feed preparation by students based on government standards
5. Market study and Survey (Monitoring of daily price hike in poultry market and analysis)
6. Online Swayam Moocs course on poultry farming (see reference 9 below)

Reference books:

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
2. 2. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi"
3. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow.
4. Life and General Insurance Management
5. Financial services, Tata McGraw hill
6. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
7. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
8. http://ecoursesonline.iasri.res.in/course/view.php?id=335
9. https://swayam.gov.in/nd2_nou19_ag09/preview

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UG- SKILL DEVELOPMENT COURSE

FINANCIAL MARKETS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Financial Markets	30	2	2	50 Marks

Learning Outcomes:

After successful completion of this course, the students will be able to;

- Acquire knowledge of financial terms
- Know the concepts relating to and markets and different avenues of investment
- Understand the career skills related to Stock Exchanges
- Comprehend the personal financial planning and money market skills

UNIT-I: **(06hrs)**

Indian Financial System- its components - Financial markets and institutions

UNIT-II: **(10hrs)**

Capital Market - its function - organizations - elements - (shares, debentures, bonds, mutual funds) debt market - Equity market (SEBI) and secondary market (NSE)

UNIT-III: **(10hrs)**

Money market - Organized - Unorganized - Sub market (call money, commercial bills, Treasury bill, Certificate of Deposit, Commercial papers)

Co-curricular activities: **(04 hrs)**

1. Collection and study of pamphlets, application forms etc.
2. Invited lectures on the field topics by local experts
3. Introducing Online classes from NSE
4. Field visit to mutual fund offices/share brokers
5. Observation, study and analysis of selected companies share prices
6. Assignments, Group discussion, quiz etc.

Reference books:

1.T.R. Jain R.L.Sarma - Indian Financial System- VK Global publisher
2. Jithendra Gala - Guide to Indian Stock markets Buzzing Stock publishing house
3. Saha Siddhartha- Indian financial System- and Markets - McGraw hill
4. Websites on Indian Financial markets.

B.Sc.	Semester: III	Credits: 4
Course: 3	Questioned Documents and Finger Impressions	Hrs/Wk: 4

Learning objectives: Documents and Finger impressions are very important areas in forensic field to investigate the crime in right direction. Documents and finger impressions can be used for the identification of culprit.

Outcomes: After studying this course the students will know-

- The significance of questioned document examination.
- The handwriting analysis and its importance in detecting the culprit.
- The various techniques used for examination of questioned documents.
- The role of fingerprints and poroscopy in crime investigation.

UNIT I:

Document Examination- Introduction, History & Development of Document examination. Classification of Documents- Questioned & Standard Documents. Various types of documents – Property, Educational, Security, Travel, Business or Financial transactions, etc. Types of documents in various crimes- Frauds in co-operative societies, Lottery tickets, Vigilance cell cases, Marks list, Passports, Chit fund frauds, R.C. books, Registered documents, Postal frauds, Insurance frauds, Threatening letters etc.

UNIT II:

Handwriting Examination–Definition, Development & Evolution of Handwriting. General & Individual characteristics of handwriting. Factors affecting handwriting, Principles of Handwriting. Disguised writing and anonymous letters. Comparison of Handwriting- Questioned writings, Standard writings -Admitted or Non-requested, Specimen or requested writings. Examination of signatures. Characteristics of forged and genuine signatures. Types of forgeries. Instrumentation and Principles of Electrostatic Detection Apparatus, Video Spectral Comparator, Stereomicroscope, TLC.

UNIT III:

Types of Frauds. Examination of alterations, erasures, over writings, additions and obliterations in various disputed documents. Decipherment of secret writings, indented writings and writings on charred documents. Examination of seals, impressions and mechanical impressions.

Examination of black and white, colour photocopies, carbon copies and fax messages- Examination of type writings, various printed documents-dot matrix, ink-jet and laser printers, electronic type writers, security documents, Security features of currency notes. Examination of counterfeit currency, passports, visa, stamp Courses, postal stamps etc.

UNI IV:

Fingerprints-History, Evaluation and Contributions to fingerprint science - Galton, Herschel, Faulds Henry, Aziz-ul-Haque and Hema Chandra Bose. Poroscopy & Edgeoscopy, Classification of Fingerprint Patterns, Systematic methods of classification of Fingerprints. Types of Fingerprints- Visible, Plastic, & Latent. Development of Latent Fingerprints by Physical, Chemical & Modern methods. Recording & lifting of Fingerprints -Collection of Fingerprints at Scene of crime, from Victims, Suspects andCadavers.

UNIT V:

Papillary ridge, methods of comparison of papillary ridges, need of comparison and marking of ridge characteristics in identical and non-identical prints. Ridge counting and tracing. Computerization of Fingerprints- Evolution & History of AFIS, FACTS, Modern AFIS Manual Fingerprint and AFIS; live scanner (FED) and AFIS comparison. Advantages of AFIS, NIST & WSQ standards.

REFERENCE BOOKS:

1. Cross Examination of handwriting Expert – B.Lal & R.Chandra
2. Forensic Science in Criminal Investigation in trials – B.R.Sharma
3. Scientific Examination of Documents Methods and techniques – David Ellen _ 3rd ed
4. Forensic Document examination: Fundamentals & Current Trends – Jane A.Lewis
5. The Problem of Proof – A.S.Osborn – Universal Law
6. Typewriting Identification ISQD – Thomas CC – Billy Prior Bates1971
7. Suspect Documents: Their Scientific Examination, Universal Law Publishers
8. Forensic Handwriting Identification Fundamental Concepts and Principles – Morris, Ron – Academic Press.
9. Biometrics & Fingerprint Analysis – Mrs. Indira Sudha
10. Fingerprints Analysis & Understanding– Mark Hawthorne
11. Graphology & Fingerprinting – Gupta & Agarwal.
12. Fundamentals of Fingerprint Analysis- Hillary Moses Daluz

Suggested Co-Curricular Activities:

- Assignments on questioned documents examination
- Visiting of Course Manufacturing companies
- Collection of various types of inks
- Seminars on latent finger print development
- Crime scene visit for latent finger prints on various objects
- State Finger Print Bureau visit

B.Sc.	Semester: III	Credits: 1
Course: 3	Questioned Documents and Finger Impressions Lab	Hrs/Wk: 2

List of Experiments:

1. Detection of types of Forgeries.
2. Examination of rubber stamps and seals.
3. Examination of Printed Material
4. Examination of Alterations, Additions, Erasures, Obliterations and over writings by VSC.
5. Deciphering of indented writing, secret writing and charred documents
6. Examination of inks by TLC.
7. Examination of inks & Course by VSC
8. Examination of security features in Currency notes, Passports, Visas, Stamp Courses, Educational certificates, Driving License by VSC.
9. Development of Finger prints by Physical & Chemical methods
10. Lifting of developed Latent Fingerprints
11. Collection of Plain & Rolled Fingerprints

B.Sc.	Semester: III	Credits: 4
Course: 3	**Cyber Security**	Hrs/Wk: 4

Learning Objective: Cyber Security is one of the immense rising area in the world, which guide us how to defend how to protect ourselves from various kinds of cyber-attacks.

Outcomes: After studying this course the students will know-

- To Create Solutions in Incident Handling
- Demonstrate the methods and techniques, best practices to protect against variouskind of cyber- attacks.
- Describes Indian IT Act 2008
- Demonstrate CIA Traid and Security measures.
- Understand Secure Software Design and Secure Practices
- Impact of Cyber security risk in an Ethical, Social, and Professional Manner
- Compare and contrast the three basic cryptographic functions.
- Describe how cryptographic functions can be used to strengthen security of data and

UNIT I :

Need of Cyber Security- Introduction to Cyber Security -The Cyber World, Security Vulnerabilities, issues & threats, trends in cyber- attack trends, Cybersecurity Domains Overview of the Cybersecurity Domains, Examples of Cybersecurity Domains, The Growth of the Cyber Domains, Cybersecurity Criminals versus Cyber security Specialists, Cybersecurity Criminals, Who Are the Cyber Criminals? Cyber Criminal Motives, Intentions techniques, Cybersecurity Specialists, Why Become a Cybersecurity Specialist? Thwarting Cyber Criminals Digital Forensic and Cyber Crime-Understanding Cyber Crime. Indian IT Act 2008 and amendment, sections, provisions, rules and guidelines, categories of cybercrimes i.e., unauthorized access and hacking

UNIT II:

E-mail related crimes, Internet relay, chat relating crimes, sale of illegal articles, online gambling, phishing, Intellectual property crimes, web defacement, unauthorized network scanning/probing, malware related attacks, financial frauds, social media related attacks such as cyber stalking, fake news, propaganda, Computer hardware/Software: Hardware- Storage related simple problems, OCR, OMR, BAR Code, QR Codes etc., Memory Hierarchies : Basics of Semiconductor Memories, Circuits, Address Decoding, Access Time, Examples of Integrated Circuit ROMs, PROMs, EPROMs, EEPROM, Components of CPU, Register, Accumulator, Software System-application Software and their Examples in real life. Operating System and their usage. Multitasking –Multiprogramming- Multiprocessing Operating System.

UNIT III:

Foot printing & Social engineering, Information gathering methodologies, Competitive Intelligence, DNS Enumerations, Social Engineering attacks, Analysis of Deep web/ dark web analysis, investigations and case studies such as silk road, Working with Windows and DOS Systems, Understanding File Systems, Exploring Microsoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption, Understanding the Windows Registry, Understanding Microsoft Startup Tasks, Understanding MS-DOS Startup Tasks, Understanding Virtual Machines. Examining UNIX and Linux Disk Structures and Boot Processes,

Understanding Other Disk Structures, Free space Management Bit-Vector Linked List Grouping Counting Efficiency Performance Recovery Physical Damage, Physical Damage Recovery Logical Damage, Logical Damage Recovery.

UNIT IV:

Ethical Hacking terminology, various tools & techniques to hack/compromise system/server and learning how to apply counter measures to protect against hacker attempts: Five stages of hacking, Vulnerability Research, Legal implication of hacking, Impact of hacking, System Hacking, Password cracking techniques, Key loggers, Escalating privileges, Hiding Files, Steganography, The Cybersecurity Cube, Three Dimensions of the Cybersecurity Cube, The Principles of Security, Cybersecurity Safeguards, CIA Triad, Confidentiality, The Principle of Confidentiality, Protecting Data Privacy, Controlling Access-Laws and Liability Integrity Principle of Data Integrity, Need for Data Integrity Integrity Checks, Availability, The Principle of Availability, Ensuring Availability

UNIT V:

States of Data: Data at Rest, Types of Data Storage, Challenges of Protecting, Stored Data, Data In-Transit, Methods of Transmitting Data, Challenges of Protecting, Stored Data, Data In-Transit, Methods of Transmitting Data, Challenges of Protecting Data In-Transit, Data in Process, Forms of Data Processing and Computation, Challenges of Protecting Data In- Process, Cybersecurity Countermeasures

REFERENCE BOOKS:

1. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students andPractitioners,2nd Edition, Springer's, 2010
2. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures forEthical Hackers & IT Security Experts, Ali Jahangiri, 2009
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series:Computer Forensics), 2010
4. Hacking Exposed™ Computer Forensics Second Edition- Aaron Philipp David CowenChris Davis (2010)
5. http://cybercrime.planetindia.net/email_crimes.htm
6. https://swansoftwaresolutions.com/the-three-dimensions-of-the-cybersecurity-cube/
7. https://www.upguard.com/blog/cybersecurity-important
8. Comptia Cyber Security Analyst Certification by Fernando J Mayme
9. Computer Evidence: Collection and Preservation, Second Edition Christopher L. T. Brown
10. https://www.geeksforgeeks.org/cryptography-and-its-types/
11. Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software (Courseback) by … Michael Sikorski
12. Cryptography and Network Security by Atul Kahate
13. Cyber Security, Cyber Crime and Cyber Forensics by Raghu T. Santanam (Editor), M. Sethu madhavan (Editor)

Suggested Co-Curricular Activities:

1. Visiting of Cyber Crime Stations
2. Visiting of Cyber Crimes Tracking Network System
3. Visiting of National Crime Records Bureau

B.Sc.	Semester: III	Credits: 1
Course: 3	**Cyber Security Lab**	Hrs/Wk: 2

List of Experiments:

1. Write Blocking
2. Study of HTML
3. Fake Email & other scams
4. VM Ware Installations
5. Understanding Kali linux for ethical hacking experiments
6. Key - Loggers & Key Scramblers
7. Information gathering
8. Detection of vulnerability (vulnerability assessment)
9. Testing by exploiting the vulnerability
10. Applying patches, fixing vulnerability (experiments)
11. Steganography
12. Email Tracing
13. Bit locker
14. Dumpit
15. FTK

B.Sc.	Semester - III	Credits: 4
Course: 3	Organic chemistry & Spectroscopy	Hrs/Wk: 4

Course outcomes:

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

- Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
- Use the synthetic chemistry learnt in this course to do functional group transformations.
- To propose plausible mechanisms for any relevant reaction

UNIT I: ORGANIC CHEMISTRY

Chemistry of Halogenated Hydrocarbons: Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

1. Alcohols & Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid Andlead Tetraacetate,Pinacol- Pinacolone Rearrangement;

Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism;

UNIT II:

Carbonyl Compounds: Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with $LiAlH_4$ &$NaBH_4$). Addition Reactions Of α, β-unsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism. Preparation And Synthetic Applications Diethyl malonate and ethyl acetoacetate.

UNIT III:

Carboxylic Acids and their Derivatives : General methods of preparation, physical properties and reactions of monocarboxylic acids, effect ofsubstituent acidic strength. Typical reactions of icarboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

UNIT IV: SPECTROSCOPY

Molecular Spectroscopy: Interaction of electromagnetic radiation with molecules and various types of spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational Spectroscopy: Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT V: Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring The Progress Of student's learning Class Tests, Worksheets and Quizzes, Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. A TextBook of Organic Chemistry by Bahl and Arunbahl
2. A Textbook of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
11. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry,5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis, University Press (2000)

B.Sc.	Semester - III	Credits: 1
Course: 3(L)	Organic preparations and IR Spectral Analysis Lab	Hrs/Wk: 2

Course outcomes:

On the completion of the course,the student will be able to do the following:

1. how to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

Organic preparations: **40M**

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, p- toluidine and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzoylation of one of the following amines

(aniline, o-, m-, p- toluidine and o-, m-, p-anisidine)

a. Nitration of any one of the following:Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

IR Spectral Analysis **10M**

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups

b) Carbonyl groups

c) Amino groups

d) Aromatic groups

B.Sc.	Semester: IV	Credits: 4
Course: 4	Forensic Biology & DNA Fingerprinting	Hrs/Wk: 4

Learning objectives: Understand the importance of biological evidences encountered in crime scene investigation.

Outcomes: After studying this course the students will know-

- The various techniques used for examination of biological evidences.
- Applications of entomology in death investigation
- Importance of Wildlife Forensics in Wildlife Protection and Conservation
- Forensic examination of bodily fluids of human body
- DNA fingerprinting technology in crime investigation.
- Laws related to DNA technology in India and other countries.

UNIT I:

The Cell Theory, Structure of Prokaryotic & Eukaryotic cells (Plant & Animal), Structural organization and functions of plasma membrane and cell wall. Cell-organelles and cytoskeletal elements (Microtubules, microfilaments and intermediate filaments); Biomolecules – Proteins (Amino acids, Enzymes), Nucleic acids, Carbohydrates, Lipids; Minerals & Vitamins.

Immunity: Definition, Types: Innate - physical & chemical barriers, Acquired, Active, Passive. Immunogens & Antigens - Definition, types of antigens, factors influencing antigenicity; Antibody - Definition, structures, types, properties and functions of immunoglobulin. Antigen - Antibody Reactions –Agglutination & Precipitation.

Human Physiology: Introduction to Nervous system, Respiratory system, Circulatory system, Endocrine system, Excretory system & Digestive system

UNIT II:

Biological Evidence – Nature, Importance and Identification of Blood, Semen, Vaginal fluids, Saliva, Urine, Feces, Sweat, Skin, Nails, Tissues, Tooth, Bones, Uterine fluids, Vomit, Vitreous humor, CSF, Colostrum.

Diatoms – Structure, Identification Tests & Importance. Hair – Structure & growth - Differences between human & animal hair. Fibre - Classification of fibres- Identification and comparison of fibres by Physical & Chemical methods - Forensic Significance.

Blood and its function, Composition of blood, Formation of Blood cells, Types of Blood cells and blood groups, (ABO systems & Rh factor).

UNIT III:

Wildlife Forensics – Importance, Wildlife Crimes - Smuggling & Poaching. Wildlife Products and articles – illegal possession. Organizations involved in Wildlife Protection & Conservation. Wildlife Protection Act- 1972- Important Schedules & Endangered Species.

Forensic Entomology: Introduction, importance. Life cycle of insects, Role of insects in decomposition of human body- collection of insects.

UNIT IV:

Basics of Genetics - Mendelian principles, Sex determination and Sex-linked inheritance Prokaryotic & Eukaryotic Genetic material: Discovery, Experiments, Composition and Structure of DNA & RNA, Organization of DNA in Chromosomes, DNA replication, Genetic code, Proteins synthesis, Introduction to recombinant DNA technology - its Forensic applications.

DNA isolation, Extraction methods – Phenol Chloroform, Chelation, Differential & Silica based. DNA Quantification – Slot blot Assay, FID Assay & PCR Amplification.

UNIT V:

DNA Separation techniques – Supporting matrices, Gel & Capillary Electrophoresis. Advances in DNA testing: VNTR, STR, STR multiplex, STR Polymorphism, SNPs, mtDNA, Y - chromosome analysis; DNA profiling and applications. Rapid DNA Testing. DNA Database & Databank – CODIS. Human Genome Project. Admissibility of DNA evidence in court of law. The DNA legislation-India, USA, UK. The DNA Profiling Regulation bill. Application of DNA Fingerprinting in Wildlife Forensics.

REFERENCE BOOKS:

1. Forensic Biology – Richard Li
2. Forensic DNA collection at Death Scenes - Rhonda Williams & RogerKahn
3. Forensic DNA Analysis: Current Practices and Emerging Technologies – Jaiprakash G. Shewale.
4. Forensic DNA Evidence Interpretation - Jhon S. Buckley on, Jo-Anne Bright, Duncan Taylor.
5. Forensic Biology - Dr. (Mrs) Rukmani Krishnamurthy, Sharikant H.Lade, Dr. Trupti Khedkar
6. Encyclopedia of Forensic Science Vol I, II & III, - Siegel.J.A , Sukoo.R.J and Knufer
7. Forensic Science in Criminal Investigation in trials – B.R.Sharma
8. Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G.Sunil Babu , Dr.Navjot Kaur Kanmai
9. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
10. Criminalistics – An Introduction to Forensic science 5th edition –Saferstein
11. Statistical Methods in Human Population Genetics, ISI,1988 – Malhotra.K.C
12. An Introduction to Software tools for Biological Applications -Jambeck, P &Gibas.C
13. Bioinformatics Basics: Applications in Biological Sciences and Medicine - Rashidi, HH &Bueler.

Suggested Co-Curricular Activities:

- Seminars on wild life forensics
- Assignments on cell structure & cell organelles

B.Sc.	Semester: IV	Credits: 1
Course: 4	Forensic Biology & DNA Fingerprinting Lab	Hrs/Wk: 2

List of Experiments:

1. Serological Test – ABO Blood grouping
2. Identification tests for other bodily fluids.
3. Antigen - Antibody reactions – Agglutination and Precipitation
4. Identification of Diatoms & Pollen grains
5. Morphological Examination of Human Hair, Animal hair & Fibres
6. Isolation & Extraction of DNA from Blood
7. Gel electrophoresis of DNA
8. Gel electrophoresis of Protein.
9. Identification of Diatoms

B.Sc.	Semester: IV	Credits: 4
Course: 5	**Forensic Chemistry and Ballistics**	Hrs/Wk: 4

Learning objectives: Applications of Chemistry and Ballistics for criminal investigation. Understand the principles of several chemical methods for analysis of evidence.

Outcomes: After studying this course the students will know-

- The roles of chemistry and Ballistics in Forensic Science.
- The classification and characteristics of NDPS.
- The analysis of drugs and its importance in detecting the culprit.
- The introduction to explosives and petroleum products.
- Classification of Firearms, bullets &cartridges

UNIT I:

Forensic Chemistry: Introduction & Significance, Qualitative analysis of Precious metals –Gold, Silver & Platinum, Agrochemicals, Industrial chemicals. Chemical Etching techniques. Bribe Trapping by Phenophthalein.

Chemistry of fire – Fire triangle. Definition of Arson & Incendiary Fire. Motive of Arson – Indicators of arsons in SoC. Collection for Evidence. Chemical analysis of Arson residues & Charred debris. Relevant IPC sections – 285,435, 436 & IEA 113B.

UNIT II:

Narcotic Drugs and Psychotropic Substances- Classification- Sedatives, Stimulants, Hallucinogens, Solvents, Designer Drugs and Miscellaneous – Fentanyl, GHB, LSD. Physiological & Psychological effects of drugs. Crimes related to NDPS – Drug abuse, Illegal cultivation, Possession, Smuggling, and Clandestine laboratory operations. Role of NCB & CBN in NDPS crime control. Acts: NDPS Act 1985, Drugs and Cosmetics act – 1945 & Drug Control Act -1940.

Chemical screening of Drugs – Colour tests, Microcrystal techniques. Examination of Morphological characters in Cannabis, Cocoa, Poppy and *Ephedra* plants. Screening of Controlled substances – Phenethylamines – Methyl derivatives, Hydroxyl derivatives, Ketone derivatives, Methylene dioxy & Methoxy derivatives. Tertiary Amines & Tryptamines – Natural & Synthetic.

UNIT III:

Beverages: Classification & Composition of Alcoholic & Non-Alcoholic beverages. Collection of samples for identification of alcohols – Blood, Urine, Vitreous fluid, Brain, Liver etc. Tests and Evaluation - Blood alcohol content (BAC), Urine Alcohol Content (UAC), Breath Analysis. Clinical Features, Diagnosis and Treatment for Chronic and Acute effects of Alcohol. Relevance of Central Excise Act -1944 on Beverages. Motor Vehicles Act - 1988 (Penalties for Drunk n Drive).

UNIT IV:

Explosives - Definition of Explosives & Explosion. Combustion, Deflagration and Detonation. Classification & Composition of Explosives. Components of Military & Industrial Explosive Devices and Improvised Explosive devices. Approach to SOC – Post blast Residues Collection – Analysis of Explosives and explosive substances. Explosives act & Explosive substances act.

Adulteration of Petrol & Petroleum products & Substance. Distillation and fractionation of petroleum products and BIS. Properties & Examination of Petroleum products. Petroleum act - 1934. Essential Commodities Act - 1955

UNIT V:

Forensic Ballistics & Firearms: History, classification of firearms. Ammunition- classification, types of cartridges. Gunshot Residue-types, collection, Methods - Dry and wet, Identification tests- dermal nitrate test, Walker's test, Harrison and Gilroy's test, price's spot test. Internal and external ballistics - Range of fire-, Scorching, Blackening, Tattooing. Terminal Ballistics, Wound ballistics- entry and exit wounds. Different types of marks- firing pin marks, breech, face marks, chamber marks, extractor and ejector marks.

REFERENCE BOOKS:

1. Analytical chemistry: An Introduction – Skoog, D.A.West.D.M,Holler
2. Fuels and Combustion – Sarkar – Orient longmann1990
3. Modern Techniques of Bomb Detection and Disposal & Security– Narayanan,T.V.
4. The Analysis of Explosives, - Yinon, J. and Zitrin –Oxford
5. Kirks Fire Investigation – Dettean, J.D – Prentice Hall2002
6. Bureau of Indian standards: Specifications and Methods of Analysis for Alcoholic Beverages
7. Bureau of Indian standards: Specifications and Methods of Analysis for Petroleum Products
8. Explosive act with Amendments
9. Explosive Substances act with Amendments
10. Working Procedure Manual: Chemistry, Explosives & Narcotics, BPRd2000
11. Forensic Science in Criminal Investigation in trials – B.R.Sharma
12. Forensic Biology - Dr. (Mrs) Rukmani Krishnamurthy, SharikantH.Lade, Dr. Trupti Khedkar
13. Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G.SunilBabu , Dr.Navjot KaurKanmai
14. Encyclopedia of Forensic Science Vol I,II & III, - Siegel.J.A , Sukoo.R.J andKnufer
15. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
16. Criminalistics – An Introduction to Forensic science 5th edition –Saferstein
17. Analytical chemistry: An Introduction – Skoog, D.A.West.D.M,Holle

Suggested Co-Curricular Activities:

- Seminars on explosives
- Assignments on screening of drugs
- Quiz on various 'Acts'.
- Examination of various ballistics wounds.
- Visit of Bell of Arms.

B.Sc.	Semester: IV	Credits: 1
Course: 5	**Forensic Chemistry and Ballistics Lab**	Hrs/Wk: 2

List of Experiments:

1. Analysis of alcohol as per BIS Specifications
2. Detection of Methanol, Chloral Hydrate, Diazepam & Alprazolam in Alcoholic Liquors
3. Density/ Specific gravity Determination of petroleum products by Hydrometer
4. Filter Course test for detecting adulteration of petrol
5. Phenolphthalein test for Bribe Trap cases
6. Preliminary examination of Explosives (tests for nitrite, nitrate, thiocynate, chlorate, Thiosulphate, Perchlorate, Sulphite, Phosphate etc.)
7. Identification tests-GSR
8. Demonstration of Bullets, Cartridge cases, etc.

B.Sc.	Semester: IV	Credits: 4
Course: 4	**Digital Forensics**	Hrs/Wk: 4

Learning objectives: Basic investigation techniques, requirement and analysing of digital evidences are covered.

Outcomes: After studying this course the students will know-

- The role of investigator and lab requirements in Digital Forensics.
- Data Acquisition methods, tools and storage formats of digital evidence.
- Collecting, Preserving and Seizing of various digital evidences.
- Validating and Testing of evidences using various methods.
- The techniques in developing standard methods of network forensics.

UNIT I:

Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations, Taking A Systematic Approach, Procedure for Corporate High- Tech Investigations, Understanding Data Recovery Workstations and Software Office and Laboratory: Understanding Forensics Lab Certification Requirements Determining the Physical Requirements for a Computer, Forensics Lab Selecting a Basic Forensic Workstation

UNIT II:

Data Acquisition: Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisition, Performing RAID Data Acquisition, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools

UNIT III:

Processing Crime and Incident Scenes: Identifying Digital Evidence, Collecting the Evidencein Private-Sector Incident Scenes, Processing law Enforcement Crime Scenes, preparing fora Search, Securing a Computer Incident or Crime Scene, Seizing Digital evidence at the crime Scene, Storing Digital evidence, Obtaining a Digital Hash, Current Computer Forensics Tools, Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools.

UNIT IV:

Validating and Testing Forensics Software Computer Forensics Analysis and Validation, Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition, data carving, Recovering Graphics and Network Forensics, Recognizing a Graphics File, Understanding Data Compression, Locating and Recovering Graphics Files, live Memory forensics (RAM), Understanding Copyright Issues with Graphics, Network Forensic, social media forensics.

UNIT V:

Developing Standard Procedure for Network Forensics, Using Network Tools, Examining Honeynet Project, E-mail Investigations, Cell Phone and Mobile Device Forensics, Exploring the Role of E- mail in Investigations, Exploring the Role of Client and Server in E-mail, Investigating E-mail Crimesand Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Understanding Mobile Device Forensics, Understanding Acquisition Procedure for Cell Phones andMobile Devices

REFERENCE BOOKS:

1. Guide to computer forensics and investigation 3rd or 4th edition by Amelia Philips, Bill Nelsonand Christopher Steuart.
2. https://www.intaforensics.com/2012/01/20/understanding-the-computer-forensics-process/
3. https://www.coursehero.com/file/p3ip151/Understanding-Data-Recovery-Workstations-and-Software-Investigations-are/
4. study.com/academy/lesson/raid-acquisitions-in-digital-forensics-definition-process.html
5. https://prezi.com/ebwye4gtrmyj/chapter-9-computer-forensics-analysis-validation/
6. https://www.thebalancesmb.com/copyright-definition-2948254
7. https://www.ques10.com/p/24610/explain-a-standard-procedure-for-network-forensics/?
8. https://www.makeuseof.com/tag/technology-explained-how-does-an-email-server-work/

Suggested Co-Curricular Activities: NA

B.Sc.	Semester: IV	Credits: 1
Course: 4	**Digital Forensics Lab**	Hrs/Wk: 2

List of experiments:

1. Disk Imaging (2types)
2. FTK Imager
3. Cyber check suite and other forensic tools from CDAC
4. Forensic Imaging of Virtual Machines
5. Live Acquisition
6. Live Incident Response
7. Live Memory Forensics (Volatility framework)
8. Scalpel, Autopsy
9. Network Minor

B.Sc.	Semester: IV	Credits: 4
Course: 5	**Mobile Forensics**	Hrs/Wk: 4

Learning objectives: Introduction to various platforms of mobile devices and its analysis in a forensically manner.

Outcomes: After studying this course the students will know-

- Basics and important terminology of the mobile devices.
- Different types of acquisition methods on various platforms.
- Internal working structure of the various mobile platforms.
- Data recovery techniques and Data extraction techniques on various mobileplatforms.
- Different forensic tools that are used for various mobile platforms.

UNIT I:

Introduction to Mobile Forensics – I - Mobile Phone Basics, components Inside Mobile devices, Crimes using mobile phones, SIM Card, SIM Security, Mobile forensics, Mobile forensic & its challenges, Mobile phone evidence Extraction process. The evidence intake phase, The identification phase, The preparation phase, The isolation phase, The processingphase, The verification phase, The document and reporting phase, The presentation phase.

UNIT II:

Introduction to Mobile Forensics – II - Potential evidence stored on mobile phones - Rules of evidence, Admissible, Authentic, Complete, Reliable, and Believable. Good forensic practices- Securing the evidence, preserving the evidence, documenting the evidence, documenting all changes. Windows OS based mobile Phone Forensics- Windows Phone OS,Windows Phone file system, Data acquisition. BlackBerry Forensics- BlackBerry OS, Data acquisition, BlackBerry analysis

UNIT III:

Android Forensics - I - The Android models- The Linux kernel layer, Libraries, Dalvik virtual machine, the application framework layer, the applications layer. Android security - Secure kernel, the permission models, Application sandbox, Secure inter process communication, Application signing. Android file hierarchy-Android file system, Viewing file systems on an Android device, Extended File System –EXT, File system analysis, App analysis, detection of malware activities, identification of malicious applications, live memory forensics.

UNIT IV:

Android Forensics–II: Android Forensic Setup and Pre-Data Extraction Techniques, A forensic environment setup, Screen lock bypassing techniques, Gaining root access. Android Data Extraction Techniques - Imaging an Android Phone, Data extraction techniques. Android Data Recovery Techniques, Data recovery. Android App Analysis and Overview of Forensic Tools- Android app analysis, Reverse engineering Android apps, Forensic tools overview, Cellebrite – UFED, MOBIL edit, and Autopsy

UNIT V:

Understanding the Internals of iOS Devices, iPhone models, iPhone hardware, iPad models, File system, The HFS Plus file system, Disk Layout, iPhone operating system, data Acquisition via a custom ram disk, Acquisition via jail breaking, data Acquisition from iOS backups, iTunes backup, iCloud backup.

Reference Books:

1. Practical Mobile Forensic by Satish Bommisetty, Rohit Tamma and Heather Mahalikunder Packet Publishing
2. https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/how-cellphone-works-inside-components.php
3. https://pavanduggalonmobilelaw.wordpress.com/kinds-of-mobile-crimes/
4. https://resources.infosecinstitute.com/windows-phone-digital-forensics/
5. https://www.gillware.com/phone-data-recovery-services/windows-phone-forensics/6. https://link.springer.com/chapter/10.1007/978-3-642-39891-9_15
7. https://www.nist.gov/system/files/documents/forensics/5-Punja-nist-2014-bb-forensics- FULL.pdf
8. https://en.wikipedia.org/wiki/List_of_Android_smartphones
9. subscription.packtpub.com/book/application_development/9781783288311/10
10. https://study.com/academy/lesson/data-extraction-techniques-for-android-devices- manual-logical-physical.html#:~:text=Gaining%20root%20access%20to%20the,%2Doff%2C%20and% 20micro%20read.

Suggested Co-Curricular Activities: NA

B.Sc.	Semester: IV	Credits: 1
Course: 5	**Mobile Forensics Lab**	Hrs/Wk: 2

List of Experiments:

1. Installation of Android Studio
2. Working on Open source android forensic tool kit (OSAF-TK)
3. Santoku Linux
4. Andriller and other tools
5. Extraction of mobile data using Oxygen forensic suit
6. Physical Extraction of Data from mobile device using UFED Touch
7. Analyzing data of android mobile using MOBILedit
8. Analyzing android device using autopsy forensic tool

B.Sc.	Semester - IV	Credits: 4
Course: 4	Inorganic, Organic and Physical Chemistry	Hrs/Wk: 4

Course outcomes:

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

- To learn about the laws of absorption of light energy by molecules and subsequent photochemical reactions.
- To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

UNIT I:

Organ metallic Compounds: Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls:18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT II:

Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection And Conformational Structures ;Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary Treatment Of Maltose, lactose and sucrose. Polysaccharides–Elementary Treatment Of starch.

UNIT III:

Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, - dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT IV:

Nitrogen Containing Functional Groups: Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

1. Nitro hydrocarbons

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines:

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method And Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction,Carbylamine Reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, amino and nitro compounds. Coupling Reactions Of Diazonium Salts (preparation of azo dyes).

UNIT V:

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics: The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality

Semester-end Examination: critical indicator of student's teachers throughout the semester.

REFERENCE BOOKS:

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L FinarVol I
10. A Text Book of Organic chemistry by I L FinarVol II
11. Advanced physical chemistry by Gurudeep Raj

B.Sc.	Semester - IV	Credits: 1
Course: 4(L)	Organic Qualitative analysis Lab	Hrs/Wk: 2

Course outcomes:

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

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Determine melting and boiling points of organic compounds
- Understand Application of concepts of different organic reactions studied in theory part of organic chemistry

Organic Qualitative analysis **50 M**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

B.Sc.	Semester - IV	Credits: 4
Course: 5	Inorganic & Physical Chemistry	Hrs/Wk: 4

Course outcomes:

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

- Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
- Application Of Quantization To Spectroscopy.
- Various types of spectra and their use in structure determination.

UNIT I: INFORMATION CHEMISTRY

Coordinator Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

UNIT II:

1. Inorganic Reaction Mechanism:

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN^1 and SN^2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

2. Stability of metal complexes:

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium / K - pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

UNIT-III: PHYSICAL CHEMISTRY

1 .Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT IV:

Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations.Electrochemical Cells- Single electrode

potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications

UNIT V:

Chemical Kinetics :

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity,factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.de Atkin's Physical Chemistry Ed., Oxford UniversityPress 10thEd(2014)
11. Castellan,G.W.PhysicalChemistry4thEd.Narosa(2004)
12. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).
13. Barrow, G.M.Physical Chemistry

B.Sc.	Semester - IV	Credits: 1
Course: 5(L)	Conductometric and Potentiometric Titrimetry Lab	Hrs/Wk: 2

Course outcomes:

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

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Apply concepts of electrochemistry in experiments
- Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry **50 M**

1. **Conductometric titration**- Determination of concentration of HCl solution using standard NaOH solution.
2. **Conductometric titration**- Determination of concentration of CH_3COOH Solution using standard NaOH solution.
3. **Conductometric titration**- Determination of concentration of CH_3COOH and HCl in a mixture using standard NaOH solution.
4. **Potentiometric titration**- Determination of Fe (II) using standard $K_2Cr_2O_7$ solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6A	Instrumentation	Hrs/Wk: 4

Learning Outcomes:

1. The students will be able to understand about the principle and working of optical and electronic microscope used for characterization of micro evidences.
2. Students will be able to gain knowledge about the concept of different chromatographic techniques which are used to separate chemical compounds.
3. Students will be aware about the basics of Spectroscopy, sources of radiation, their utility and limitations.
4. Student will able to recognize the best suited techniques to be employed for examination of evidence.

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Microscopy: Principles and techniques: Light Microscope, Phase contrast, Fluorescence, stereomicroscope, polarizing, comparison and Electron Microscope (Scanning, Transmission), Forensic and their applications.

UNIT II: Chromatography: Basic principles. Thin Layer Chromatography Theory and Instrumentation, HPLC - Principle and Instrumentation application, HPTLC, densitometer, applications.
Gas chromatography: Principle and Instrumentation, types of GC (GLC, and GSC) and column types, Detectors for GC -TCD,FID, ECD, NPD etc, Pyrolysis GC, GC-MS; applications.

UNIT III: Spectroscopy: Spectrum of EMR, Interaction of EMR with matter, Source of radiations wavelength selector, Optical detector UV-Visible, IR and Raman spectroscopy Principle of single and double beam spectrophotometer, Instrumentation of IR, UV, spectroscopy qualitative and quantitative analysis of spectroscopy and their Forensic applications.

UNIT IV: Mass Spectroscopy: Principle, instrumentation, ion sources, types mass analyser-quadrupole time of flight, double focusing, tandem mass spectroscopy, detectors for mass spectroscopy their applications.

UNIT V: NMR Spectroscopy, Neutron Activation Analysis: Principle, techniques and Forensic application. X-rays spectroscopy: Principles of X ray diffraction and X ray florescence technique, their forensic applications.

TEXT BOOKS:

1. Instrumental Methods Forensic Science Analysis 2022 Dr A K Jaiswal
2. Forensic Science UGC Net / JRF MCQ's Dr Anusinghla
3. Past 10 Years Question Bank with Answers UGC Net / JRF Khushal Singh
4. Question Answers Criminology & Forensic Science UGC Net/ JRF V N Sehgal
5. Forensic Science UGC Net / JRF MCQ s Anil Kumar Sigh
6. Barbara Wheeler and Lori J. Wilson. Practical Forensic Microscopy: A Laboratory Manual,Wiley
7. Lee and Caensstem. Advances in Forensic Science, Vol. 2. Instrumental Analysis.
8. B. K. Sharma. Instrumental Methods of Chemical Analysis, Goel Publishing House, 26thEdition (2007).

9. D. A. Skoog, D. M. West, F. James Holler and S. R. Crouch, Fundamentals of AnalyticalChemistry, 8th Edition, Thomson, 2004.
10. G.Chatwal and S. Anand, Instrumental Methods of Chemical Analysis, 7 Edition HimalayaPublishing House.
11. Hobart H. Willard, Instrumental Methods of Analysis (Chemistry) Wadsworth PublishingCompany.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6A	Instrumentation Lab	Hrs/Wk: 2

Instrumentation Practicals:

1. Separation of various compounds by TLC
2. Separation and identification of various compounds by HPLC
3. Separation of various volatile compounds by GC
4. Microscopic examinations of hair and fibers.

Suggested Co-Curricular Activities:

- Visit to IICT, NIN, CDFD, CCMB

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7A	Forensic Toxicology	Hrs/Wk: 4

Learning Outcomes:

1. Able to describe the major effects on the rate of absorption of alcohol from the stomach into the bloodstream
2. Students will be able to classify various poisons depending on their toxicity
3. Will be able to answer different techniques to detect poisons in viscera sample
4. Post-mortem appearances of poisons in the body
5. Antidotes for lethal poisons

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Introduction to Forensic Toxicology - History & Development. Poisons Act 1919, Sections
– IPC 193, 201, 202, 270, 271, 272, 273, 274, 275, 276, 277, 278, 284, 328. Cr.P.C. 39, 40, 175. National Poisons Information Centre (NPIC). Definitions – Toxins, Drug, Toxicodynamics, Toxicokinetics, Dose, Lethal Dose, LD50, Tolerance, Role of Forensic Toxicologist in Criminal Justice System.

UNIT II: Poisons – Definition, Forms of Poison – Physical, Chemical & Mechanical state. Classification – Corrosives/caustics – Strong acids & Alkalis, Irritants – Organic (Plant & Animal) Inorganic (Metallic & Non Metallic). Neurotoxic Poisons – Cerebral & Spinal. Cardiovascular Poisons. Asphyxiants. Pesticides.

UNIT III: Toxicokinetics. Routes of Administration of poisons - Inhalation, Ingestion, Injection, Topical etc. Mode of Action, Clinical features, Elimination of poisons - Urinary excretion, Faecal Excretion, and other routes of elimination. Definition of Antidote– Types of antidotes.

UNIT IV: Post mortem Toxicology – Types of samples. Collection of visceral samples, other body fluids - Blood, Saliva, Urine, and Stomach washes etc. their Preservation.

UNIT V: Toxicology of alcohol – Alcohol testing for intoxication. Alcohol in Circulatory system. i.e., Mode of Action. Analysis of alcohol samples. Analytical Toxicology – Isolation and Purification, Screening tests, Methods of Identification, Quantitative estimation of individual poisons.

SUGGESTED READINGS:

1. Analytical Methods in Forensic Toxicology Dr S N Tiwari
2. Practical Book for Forensic Chemistry and Toxicology Dr Ashok Jaiswal
3. Forensic Toxicology Dr S P Singh
4. Handbook of Environmental Chemical Toxicology Dr B Singh
5. Practical Manual of Food Chemistry and Nutrition Dr Neetu Singh
6. Environmental Administration in India Dr Namita Gupta
7. Environmental Studies Systems & Solutions Dr Archana Mishra
8. Biochemistry U. satyanarayan
9. Practical crime scene analysis and reconstruction Ross m gardner , tom bevel
10. Concise book of forensic medicine and toxicology R.K Sharma
11. Bloodstain pattern analysis Tom bevel
12. Introduction to spectroscopy Pavia
13. Techniques of crime scene investigation Barry A.J fisher
14. Principles of forensic toxicology Nicholas lappas
15. Review of forensic medicine and toxicology Gautam biswas

16. Essentials of forensic medicine and toxicology Anil aggrawal

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7A	Forensic Toxicology Lab	Hrs/Wk: 2

Forensic Toxicology Practicals

1. Preliminary tests for various poisons smell of metallic, Pesticides and Alcohols etc.
2. Detection of Ethanol by Kozelka & Hine Method
3. Identification of pesticides by TLC
4. Separation of Pesticides by HPLC

Suggested Co-Curricular Activities:

- visits to Forensic science Laboratories for detection of different lethal poisons
- visits to botanical gardens containing poisonous plants
- simulation of animal poisoning and their treatment technique

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6B	Forensic Psychology	Hrs/Wk: 4

Learning Outcomes:

1. Description of different interviewing techniques
2. The science of lying
3. Psychophysiological aspect of speech and deception
4. Polygraphy technique of lie detection
5. Brain signature profiling
6. Law related to mental health and psychology
7. Different interrogation techniques
8. Deception Detection Techniques.
9. Legal aspects of Psychology.

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Interviewing and Interrogation Techniques: Importance of Investigative Interviewing, Influence of Psychology, P.E.A.C.E Model of Interviewing, Cognitive Interviewing, Ethical Interviewing, Other Interviewing Techniques.

UNIT II: Interrogation and the related Techniques, Brain Electrical Oscillation Signature Profiling (BEOS), Voice-Stress Analysis/ Layered Voice Analysis, Reliability, Limitations, NHRC Guidelines, Admissibility in the Court, Case Studies.

UNIT III: Polygraph/Lie Detector Test: Objectives, theoretical basis, stages of examination (Pre- test, In-test. post-test), Questioning techniques, Stim test, Limitations, Admissibility in the court oflaw, NHRC guidelines, case studies, etc.

UNIT IV: Brain Fingerprinting/Brain-Mapping: Principle, Importance, History, Process, brain waves (P300, delta, theta, gamma, alpha), reliability, case studies, admissibility, etc. Narco-analysis: Principle, History, drugs used, procedure, reliability, admissibility, limitations, Indian scenario. case studies, etc.

UNIT V: Legal & Correctional Aspects: The mentally ill, Competency to stand trial Mental Health Act, 1987: (Object, Relevant Definitions, Central & State authority, Reception Orders, Human Rights of Mentally ill persons, Penalties & Case-Studies), Indian Penal Code, 1860 Relevant general exceptions. Rehabilitation & Correctional Treatment of Offender(s)/ Victim(s). Techniques, Strategies and Types of Treatments.

READING BOOKS:

1. Handbook of Forensic Psychology Prof. (Dr) Vimala Veeraraghavan
2. Criminology Prof. (Dr) Vimala Veeraraghavan
3. Organized Crime Dr Minakshi Sinha
4. 'Handbook of Forensic Psychology, Prof Dr. Vimala Veeraraghwan, Edition 1st , 2009,Selective and Scientific Books Publications, New Delhi.
5. 'Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M.Bartol, Editon 2nd, 2008,Sage Publication.
6. Psychology, (2006) Ciccarelli, S. K. & Meyer G. E. New Delhi; Perason Education
7. Criminology and Penology', Mittal S., Saxena S. K., [2012], Commonwealth

PublishersPvt. Ltd., New Delhi.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6B	Forensic Psychology Lab	Hrs/Wk: 2

Forensic Psychology Practicals:

1. NEO-PI
2. Minnesota Multiphasic Personality Inventory-2/A (MMPI-2/A)
3. Rorschach Test
4. Bhatia's Battery for Intelligence
5. Thematic Apperception Test
6. Word Association Test
7. Polygraphy / Psychological evaluation test

Suggested Co-Curricular Activities

- Visit to police stations to know the procedure of interrogation
- Visit to polygraphy unit at Forensic Science Laboratory
- Visit to mental hospitals and juvenile courts

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7B	Narcotic Drugs & Psychotropic Substances	Hrs/Wk: 4

Learning Outcomes:

1. To differentiate between various classes of illicit drugs
2. The concept of analytical techniques for analysis of drugs
3. The laws related to narcotic drugs
4. Classification of NDPS and their effect on the human body
5. Trend cases of NDPS in India

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*
UNIT I: Narcotics- Introduction, Legal Definitions, Classification- Sedatives, Stimulants, Hallucinogens, Synthetic Narcotics, Designer Drugs.

UNIT II: Drugs and crimes- nonviolent crimes, violent crimes, drug problems in India-cannabis and poppy cultivation – illegal possession – Smuggling – Transportation – Drug Profiling – Clandestine laboratories – Drug abuse in sports – Preliminary tests for Narcotic Drugs and Psychotropic Substances (NDPS).

UNIT III: Sedatives-opium and opium derivatives- Morphine- Administration, Physiological Effects, Addiction, Identification - Heroin- Abuse, Physiological Effects and Identification - Barbiturates- Nature, Administration and Identification.

UNIT IV: Stimulants: Cocaine, Amphetamine, Benzodiazepines and their Use, Abuse, Physiological, Psychological, Effects, Addiction, and Identification. Hallucinogens: Cannabis, Quinazolones- Administration, Effects, Addiction and Identification- LSD (Lysergic Acid Diethylamide), Psylocybin, Mescaline and MDMA: Administration, Effects, Addiction and Identification.

UNIT V: NDPS Act 1985 - Drug law enforcements in India- Narcotic control bureau, Central Bureau of Narcotics, Narcotics Control and Intelligence Bureau– Prevention of Drug trafficking - Penalties for NDPS related offenses – NDPS Amendments 2014 – United Nations Drugs Conventions.

SUGGESTED READINGS:

1. Pharmacological classification of drugs K . D Tripathi
2. Essentials of medical pharmacology K . D Tripathi
3. Chromatographic analysis of pharmaceuticals John a adamovics
4. Pharmaceutical analysis David G watson
5. Pharmaceutical chemical analysis: methods for identification and limit test Olepederson
6. Drug testing in alternate biological specimens Amanda j. jenkins

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7B	Narcotic Drugs & Psychotropic Substances	Hrs/Wk: 2

Narcotic Drugs & Psychotropic Substances Practicals:

Detection of following of Narcotic Drugs & Psychotropic Substances by spot/colour test

a. Opiates

b. Barbiturates

c. Benzodiazepines

d. Amphetamines and Cannabis

Suggested Co-curricular activities:

- Visit to narcotics control bureau
- Visits to Rehabilitation Centers

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6C	Forensic Physics	Hrs/Wk: 4

Learning Objectives: After studying this paper the students learn about

1. Types of glass and their composition.
2. Photographic examination of tool marks.
3. Able to determine direction of force on a piece of glass
4. Able to describe the common methods for the analysis of soil
5. Different types of tools involved in criminal activity
6. How other types of polymer-based evidences are analyzed
7. How paint evidence is encountered, collected and preserved

UNIT I: Soil, Cement and Concrete - Types and composition of soil, sample preparation, molecular particle size distribution, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis, interpretation of soil evidence. Cement bromoform test, fineness test, ignition-loss test. Identification of adulterated cement. Mortar and concrete analysis.

UNIT II: Paint - Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis- solubility test, pyrolysis gas chromatography, IR spectroscopy and X-ray diffraction, elemental analysis, interpretation of paint evidence.

UNIT III: Types of fibres, forensic aspects of fibre examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. IR-micro spectroscopy, Py-MS. Difference between natural and man-made fibres.

UNIT IV: Glass - Types of glass and their composition-soda-lime, boro-silicate, safety glass, laminated, light sensitive, tampered/ toughened, wire glass, coloured glass. Forensic examinations of glass fractures- rib marks, hackle marks, cone fracture, wavy, backward fragmentation, concentric and radial fractures. Refractive index, density gradient, becke-line, specific gravity examination.

UNIT V: Toolmarks - Types of toolmarks- compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks. Restoration of crased/ obliterated marks- Method of making-cast, punch, engrave, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc.

SUGGESTED READINGS:

1. Physical Evidence in Criminal Investigation and Trials Dr B P Maithil
2. Forensic Evidence Real Cash Study Dr H K Pratihari
3. Introduction to Forensic Science in Crime Investigation Dr Rukmani Krishnamurty
4. Caddy, B; Forensic Examination of Glass and Paint Analysis and Interpretation, CRCPress, New York, 2001.
5. Shaw, D; Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17,1976.
6. Saferstein, R; Forensic Science Handbook. Vol. I,II, (Ed.), Prentice Hall, New Jersey, 1988.
7. Working Procedure Manual; Physics BPR&D Publication, 2000.

8. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), UniversalLaw Publishing Co., New Delhi, 2001.
9. Working Procedure Manual- Physics, BPR&D Publication. 2000
10. Hess, K.P; Textile Fibers and their Use, 6th Edn, Oxford and IBH Publishing Co., 1974.
11. Trace Evidence By Max M. Houck.
12. Laboratory Procedural manual , Physics Section, DFSL, Mumbai.
13. Forensic science in criminal investigation and trail by B R Sharma
14. Forensic Science in Criminal Investigation & Court Evidence V N Sehgal

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6C	Forensic Physics	Hrs/Wk: 2

Forensic Physics Practicals:

1. Microscopic examination of soil.
2. Particle size distribution of soil sample.
3. Density gradient method for soil
4. Microscopic examination of Paint.
5. Examination of glass fracture.
6. Examination and Comparison of tool marks.
7. Restoration of erased/obliterated punch marks.

Suggested co-curricular activities

- Visit to glass manufacturing units
- Examination of window glass, or car front glass

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7C	Forensic Engineering	Hrs/Wk: 4

Learning Outcomes:

1. This paper describes and explains the investigation of various accidents.
2. Use of forensic investigation techniques to determine of causes failure.
3. assess vulnerable engineering details such as electrical MCB Circuit, eccentric connections, rating criteria of electrical appliances, using well documented failure casestudies.
4. Rigorous assessment and evaluation of engineering mistakes such as fire cases .
5. Causes of arson -automotive failure- vehicular fire

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Introduction to Forensic Engineering and Various Types of Failures, Initiation of Failures and associated investigations (Electrical, Mechanical, Structural)- An overview of Electrical System failure (House hold materials such as cables, wires, switchboards/MCBs, MCB faults, Improper Ratings/layout of appliance fitting according to safety criterion etc.) Mechanical Failures manufacturing defects, inadequate quality control measures,

Structural Failures (Structural material composition analysis leading to failures, an investigation view of multi components failures due to any one module manufacturing defects, etc.)

UNIT II: Investigation of Arson and Incendiary Fires - General - Arsonist Profile - Typical Characteristics of an Arson or Incendiary Fire Daisy Chains and Other Arson Precursors - Liquid Accelerant Pour Patterns, Spalling, Detecting Accelerants after a Fire

Automotive Fire Failure: General, Vehicle Arson and Incendiary Fires, Electrical and Mechanical Causes

UNIT III: Traffic, Road Safety Failures - Vehicle Performance: Engine Limitations, Deviation fromTheoretical Mode, Peel Out, Lateral Tyre Friction, Bootlegger's Turn

UNIT IV: Traffic Accidents: General, Basic Momentum Equations, Properties of an Elastic Collision, Coefficient of Restitution, Properties of Plastic Collision, Analysis of Forces during Fixed Barrier Impact, Energy Losses, Centre of Gravity, Moment of Inertia, Torque, Angular Momentum, Simple Skids, Tyre Friction, Skid Deceleration and Speed Reduction, Brake Failure, Low Velocity Impacts, Measuring Roadway Curvature, Motorcycle Turns, Simple Vehicular Falls

UNIT V: Investigation of Civil and Structural Failures - Forensics of Building Failure - Forensics of Bridge Failure - Forensics of Civil Engineering Materials Failure (Bricks, Mortar, Concrete etc.) Buildings/ Bridges / Flyovers / Roads Multi storeyed Buildings / Parking Lots - Surface Inadequacies of Road Profile- Airport Runways and Railway Tracks - Forensics of Civil Engineering Structures after Natural Disasters

Building Collapses, Bridge Collapses - Activities in the Investigation Process, Site Investigation and Sample Collection

SUGGESTED READING:

1. Structure Elucidation of Organic Compounds by Spectroscopic TechniquesDr. Pradip V Tekade
2. Crime Scene Management A Forensic Approach Dr M S Rao
3. Recurrent Neural Network and Application Neeraj Sahu

4. Network Analysis Technique for Project Management Dr R K Tewari
5. Forensic Engineering Fundamentals By Harold Franck.
6. Elements of Civil Engineering By Mimi Das Saikia
7. Electronic Principles By Albert Malvino and D. J. Bates.
8. Electronics Communication Systems By Kennedy and Davis
9. Measurement, Instrumentation and Experiment Design in Physics and Engineering ByMichael Sayer and Abhaaiman Singh.
10. Randall K. Noon: Forensic Engineering Investigation CRC Press, 2000
11. Robert R.: Forensic Structural Engineering Handbook. 2a edn. McGraw-Hill, 2009
12. Robert D.: Forensic Geotechnical and Foundation Engineering, 2a edn. McGraw-Hill, 2011
13. Stephen E. P.: Forensic Engineering: Damage assessments for Residential and CommercialStructures. CRC Press. 1° edn, 2013
14. Kennet L. C.: Forensic Engineering, (Civil engineering- Advisors). 2nd edn. 1998
15. Harol F., Darren F.: Forensic Engineering Fundamentals. CRC Press. 1" edn. 2012

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7C	Forensic Engineering Lab	Hrs/Wk: 2

Forensic Engineering Practicals

1. Analysis of fire debris by GC
2. Collection of samples at scene of fire
3. Analysis of cement samples
4. Examination of mortar samples
5. Examination of bricks samples

Suggested curricular activities:

- Accident Reconstruction Project
- Road accident crime scene visits
- Learning Techniques of collection of tyre impressions from RTO offices
- Visits to RTO offices
- Visits to fire station
- Guest lectures on structural failures on building
- Learning the rules for prevention of automotive accident

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6D	Forensic Medicine &Anthropology	Hrs/Wk: 4

Learning Outcomes:

1. Able to define the postmortem interval and explain how short- and long-term PMIs are estimated
2. Able to define and describe the medicolegal autopsy and explain when a coroner or medical examiner must perform an autopsy
3. Define and distinguish between the cause of death and the manner of death
4. Able to describe the development and structure of bones
5. The various anthropological tests that can be done on skulls to help identify them
6. Able to describe how bones are individualized

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Introduction to Forensic Medicine – Pathology, Medical Jurisprudence. Medical Law and Ethics. Introduction, History & Development of Forensic Anthropology & Archaeology, F.Odontology & F.Taphonomy. Role of Anthropologist.

UNIT II: Introduction to Human anatomy and Physiology- Axial Skeleton- Skull, Sutures of skull, Cranial bones, Facial bones, Sternum, thoracic bones, vertebral column, Appendicular Skeleton- Bones of Upper limbs, Lower limbs, Pelvic Girdle etc. Determination of sex & age from skull, mandible, pelvis, Femur, scapula etc.

UNIT III: Medico-legal Autopsy- Death and its Causes- External examination of deceased body – Internal Examination- Determination of time since death and cause of death- Injuries - classification- Medico-legal aspects of injuries- Postmortem changes. Exhumation process and its importance.

UNIT IV: Sexual offences- rape- unnatural sexual offences- sexual perversions- Abortion- Infancide- foeticides- impotence and sterility- virginity, Thermal deaths- eletrocution- starvation Asphyxia- Drowning deaths.

UNIT V: Forensic Odontology- Basic principles, Applications in crime investigations- Bite mark Analysis, Age estimation etc., Development of teeth- Dentition, Architecture of teeth, growth of teeth- Milk, Permanent. Dentition Library, Forensic Odontology limitations

SUGGESTED READING:

1. Forensic Medicine and Toxicology S N Tiwari
2. A Handbook of Forensic Anthropology Meenal Dhall Renu Tyagi Prof. Anup KumarKapoor
3. Handbook for Forensic Odontology Dr Vikram Ahuja
4. Anthropology and Forensic Science the Current Dynamism Prof. Anup Kumar Kapoor
5. Practical Manual on Human Physiology Prof. Sunita Mishra
6. Nutrition Health and Life Style ManagementPro Sunita Mishra
7. Forensic Science in India, A Vision for the Twenty first Century B B Nanda
8. Forensic Biology Dr Rukmani Krishnamurty

9. Forensic Serology & Blood Examination Dr Archana Tripathi
10. An Introduction to Forensic Hair Examination Shubhra Goutam
11. Women Victimization Dr Deepti
12. Forensic Science for Criminal Justices System Dr Anu Singhla
13. An Interdisciplinary Approach to Forensic Science Dr P K Janjua
14. Women Nutrition and Health Dr Neetu Sing
15. Perceived Status of Women in India Prof. Vimala Veerarghavan
16. Introduction to Forensic Anthropology, Steven N. Byers, Pearson/Allyn and Bacon, 2011.
17. Forensic Anthropology Laboratory Manual, Steven N. Byers, Pearson Education, USA,2011.
18. Forensic Anthropology: Current Methods and Practice, Angi M. Christensen, Nicholas V.Passalacqua and Eric J. Bartelink, Academic Press, USA, 2014.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6D	Forensic Medicine &Anthropology Lab	Hrs/Wk: 2

Forensic Medicine & Anthropology Practicals

1. Autopsy

   i) External Examination of Deceased body

   ii) Internal Examination of Deceased body

   iii) Post-mortem Changes

2. Collection and Preservation of Visceral Samples.
3. Identification and differentiation of Human Bones (Male & Female)

   iv) Skull

   v) Pelvis

   vi) Upper limbs

   vii) Lower limbs

Suggested co curricular activities:

- visits for post-mortem autopsy
- visits to clinical laboratories for testing procedures
- handling and studying human skeleton

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7D	Wildlife Forensics	Hrs/Wk: 4

Learning Outcomes:

1. To be able to define entomology and forensic entomology and give example
2. To be able to list and describe the various types of arthropods that invade a body afterdeath
3. to be able to describe the contributions of forensic entomology to the determination of the presence of drugs and poisons in a body
4. able to classify endangered species of animal wildlife.
5. To identify the natural habitat of different species
6. To investigate the drowning cases using diatoms
7. Analysis of Botanical evidences

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Wildlife Forensics - Importance of wildlife and Environment; Wildlife (Protection) Act-1972, Protected and endangered species of animals and plants; Sanctuaries and their importance; Types of wildlife crimes, Recovering evidence at poaching scenes, locating the burial: Wild animals as pharmacopeias, Wildlife artifacts (Bones, skin, fur, hair, nails, blood, feather, etc.), Trade in wild animals.

UNIT II: Entomology – introduction, Insects & their Biography, the life cycle of insects, collecting insects at the scene of crime, the PMI, classification of insects, rearing insects' calculation if PMI, other Forensic use and case study.

UNIT III : Forensic Botany, Botonical Evidence - Introduction, types, location, collection evaluation and forensic significance of fungi and plants in forensic science, wood and pollen grains, Methods of identification and comparison, various types of planktons and diatoms and their forensicimportance; Limnology.

UNIT IV: Environmental Forensics - Introduction to Environmental Forensics. Mercury-Natural and anthropogenic sources, detecting mercury in indoor environment and forensic aspects. Asbestos-sources and detection in air, water, fibres etc. Arsenic- sources, compounds, analytical methods and forensic aspects.

UNIT V: Environment and Ecosystems - Concept of biosphere, communities and ecosystems; Ecosystem characteristics structure and function; Xenobiotic and recalcitrance, Bioremediation using microorganisms and plants, Genetically Modified Organisms to treat effluents; introduction to BOD and COD, use of biosensors, bioremediation of solid waste, industrial effluent containing organic pollutants and metal ions. Environmental Management Introduction and scope of environmental management, basic concepts of sustainable development, Environmental Impact Assessment. Wildlife Protection Act 1972, Forest Conservation Act 1981, Environment (protection) Act 1986.

SUGGESTED READINGS:

1. Forensic biology – Richard Li
2. Forensic Medicine – P.V. Guharaj & M. R. Chandran
3. A textbook of Medical jurisprudence and toxicology- Modi
4. Wildlife forensic investigation-Principles and practice: Cooper and Cooper, CRCpress
5. Forensic Palynology in the United States of America (1990)- Bryant, V.M. Jr, Mildenhall, D.C.and Jones, J.G.14.PP.193-208
6. Textbook of Pollen Analysis 4th Edition- Faegri, K. Iverson, J. and Krzywinski, K. John Wiley& Sons, New York 1989.
7. Microbial forensics -Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier AcademicPress
8. The Forensic Laboratory Handbook Procedures and Practice - Ashraf Mozayani, CarlaNoziglia. 2nd edition. 2011. Human Press.
9. Forensic Science in Wildlife Investigations - Adrian Linacre Taylor and Francis,2009
10. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature B Donna M.
11. Jackson, Wendy Shattil, Bob Rozinski Universal Athenaeum (Denver, CO, U.S.A.)
12. Forensic palynology Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006
13. Forensic palynology: an in-depth look at its indispensable value National University,SanDiego,2002
14. Medical microbiology by Ananthnaraya.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7D	Wildlife Forensics Lab	Hrs/Wk: 2

Wildlife Forensics Practicals

1. Identification of starch granules
2. Identification and classification of diatoms
3. Identification of pollen grains to genus level
4. Identification of wood using physical and anatomical features
5. Section and cutting of plant material and their examination
6. Staining techniques and laboratory exercises for identification of different plant cell types
7. Collection and packaging of wildlife evidences.
8. Extraction of plant poisons
9. Separation of plant poisons by TLC.
10. Quantification of plant poisons by UV-Visible spectrophotometer

Suggested co-curricular activities

- Visits to wildlife sanctuaries and zoos
- Visits to botanical gardens for poisonous plants
- Visits to LaCONES, CCMB & CDFD
- Collection of pollen grains related to criminal activities

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6A	Cyber Law	Hrs/Wk: 4

Learning Outcomes:

1. Overview of Indian Legal System
2. Overview of Cyber Space
3. Information Technology Act, 2000 and its Amendments (till date)
4. Outline of Electronic Governance
5. Copyright infringements
6. Incident Response Team Development
7. Identify, Interpret and Evaluate Laws, Government Regulations and International Legal Systems Pertinent to Ecommerce
8. Explain and Evaluate Emerging Legal and Ethical Issues in Ecommerce
9. Analyze Ethical Problems That Arise in The E-Commerce Context Through the Examination of Case Studies

Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)*

UNIT I: Cyber crimes and related offences and penalties: Introduction to Cybercrimes, Classification of cybercrimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc.
Provisions in Indian Laws in dealing with Cyber Crimes and its critical analysis, Information Technology Act, 2000, Penalties under IT Act, Offences under IT Act, Offences and Analysis related with Digital Signature and Electronic Signature under IT Act, Statutory Provisions, Establishment of Authorities under IT Act and their functions, powers. Cyber crimes under IPC.

UNIT II: Electronic Governance – Legal Recognition of Electronic Records and Electronic Evidence -Digital Signature Certificates - Securing Electronic records and secure digital signatures - Duties of Subscribers - Role of Certifying Authorities - Regulators under the IT Act -The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability– Powers of Police under the IT Act – Impact of the IT Act on other Laws .
Authentication of electronic records (Section-3, IT ACT), legal recognition of electronic records and digital signature (Section-4 and 5, IT Act), Certifying Authorities and Controller, Offences as per IT Act (Section-65 to Section-78), Special provision in Indian Evidence Act regarding admissibility of electronic records (Section-65B of IEA, 1872).

UNIT III: Cr.P.C and Indian Evidence Act - Cyber crimes under the Information Technology Act,2000 - Cyber crimes under International Law - Hacking Child Pornography, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc - Cyber Terrorism Violation of Privacy on Internet - Data Protection and Privacy – Indian Court cases

UNIT IV: Intellectual Property Rights – Copyrights- Software – Copyrights vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Trademarks - Trademarks in Internet – Copyright and Trademark cases
Patents - Understanding Patents - European Law on Computer related Patents, Legal process on Computer related Patents - Indian process Patents – Case Law, Domain names -registration - Domain Name Disputes-Cyber Squatting-IPR cases

UNIT V: E-commerce and related laws: History, Overview of developments in Information Technology and Defining E-Commerce, Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance. UNCITRAL model law in electronic commerce.

REFERENCES:

1. The Information Technology Act, 2000 Bare Act with Short Notes, Universal Law Publishing Co., New Delhi
2. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi
3. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi
4. S.R.Myneni: Information Technology Law(Cyber Laws), Asia Law House, Hyderabad.
5. Chris Reed, Internet Law-Text and Materials, Cambridge University Press.
6. Pawan Duggal: Cyber Law- the Indian perspective Universal Law Publishing Co., NewDelhi
7. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.

Co-curricular Activities:

1. Court Visit
2. Cyber Cell Visit

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6A	Cyber Law	Hrs/Wk: 2

Cyber Law Practicals:

1. Do a case study at least 5 cyber terrorism cases.
2. Do a case study on e-commerce frauds.
3. Prepare a report for various laws of cyber crime.
4. Do a comparative analysis on Indian laws and international laws for cybercrime

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7A	Advanced Cyber Forensics	Hrs/Wk: 4

Learning Outcomes: Overview of Windows Forensics

1. File System Analysis
2. Overview of Cryptography
3. Encryption and Decryption
4. Overview of Memory Forensics
5. Anti-forensic Techniques
6. Hypervisor Files and Formats
7. Forensic Analysis of a Virtual Machine
8. Overview of Cloud Forensics
9. Analysis of Cloud Applications

UNIT I: Windows Forensics - Volatile data collection, Non-volatile data collection, Registry Analysis, Browser Usage, Hibernate File Analysis, Crash Dump Analysis, File System Analysis, File Metadata and Timestamp Analysis, Event Viewer Log Analysis, MFT analysis, Timeline Creation, Evidence Collection in Linux and Mac Operating system.

UNIT II: Cryptography - Cryptographic System, Classification of Cryptographic System, Secret Key, Cryptography, Cryptanalysis and Attacks, Encryption and their types, Encryption algorithms, brute force attack, Decryption and their types, HDD and Artifacts Encryption and Decryption Techniques.

UNIT III: Memory Forensics - History of Memory Forensics, x86/x64 architecture, Data structures, Volatility Framework & plugins Memory acquisition, File Formats – PE/ELF/Mach-O, Processes and process injection, Command execution and User activity, Networking, sockets, DNS and Internet history, shellbags, paged memory and advanced registry artifacts, Related tools-Bulk Extractor and YARA, Timelining memory, Recovering and tracking user activity, Recovering attacker activity from memory, Introduction to Anti-forensics, tools and techniques.

UNIT IV: Virtual Machine Forensics - Types of Hypervisors, Hypervisor Files and Formats, Use and Implementation of Virtual Machines in Forensic Analysis, Use of VMware to establish working version of suspect's machine, Networking and virtual networks within Virtual Machine, Forensic Analysis of a Virtual Machine (Imaging of a VM, Identification and Extraction of supporting VM files in the host system, VM Snapshots, Mounting Image, Searching for evidence)

UNIT V:Cloud Forensics - Introduction to Cloud Computing, Challenges faced by Law enforcement and government agencies, Cloud Storage Forensic Framework (Evidence Source Identification and preservation, Collection of Evidence, Examination and analysis of collected data) Cloud Storage Forensic Analysis.

Dropbox analysis: Data remnants on user machines, Evidence source identification and analysis, Collection of evidence from cloud storage services, Examination and analysis of collected data.

Google Drive: Forensic analysis of Cloud storage and data remnants, Evidence source identification and analysis - Collection of evidence from cloud storage services, Examination and analysis of collected data, Issues in cloud forensics.

Case Studies.

REFERENCE:

1. Window Forensic Analysis (DVD Toolkit) by Harlan Carver
2. File System Forensic Analysis by Brain Carrier
3. Windows Registry Forensics
4. Advanced Digital Forensic Analysis of the Windows Registry by Harlan Carvey
5. Cryptography and Network Security: United States Edition by William Stallings
6. Cryptography: An Introduction (3rd Edition) by Nigel Smart
7. An Introduction to Cryptography
8. Cryptography and Data Security by Dorothy Elizabeth Rob, ling Denning
9. The Art of Memory Forensics (Detecting Malware and Threats in Windows, Linux, and Mac Memory) Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters
10. Advances in Memory Forensics by Fabio Pagani
11. Virtualization and Forensics A Digital Forensic Investigator's Guide to Virtual Environments by Diane Barrett
12. http://atkison.cs.ua.edu/papers/ACMSE11_JF.pdf
13. https://stars.library.ucf.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2790&context=etd
14. https://odr.chalmers.se/bitstream/20.500.12380/300023/1/CSE%2019-10%20CPL%20Andersson.pdf
15. Cloud Forensics by Keyun Ruan, Joe Carthy, Tahar Kechadi, Mark Crosbie
16. Digital Forensics for Network, Internet, and Cloud Computing: A Forensic Evidence Guide for Moving Targets and Data Paperback by Terrence V. Lillard
17. Data Collection Techniques for Forensic Investigation in Cloud by Thankaraja Raja Sree and Somasundaram Mary Saira Bhanu
18. https://www.researchgate.net/publication/235712413_Cloud_Forensics_A_MetaStudy_of_Challenges_Approaches_and_OpenProblems
19. Cloud and Edge Computing-Based Computer Forensics: Challenges and Open Problems by Vijay Prakash, Alex Williams, Lalit Garg, Claudio Savaglio and Seema Bawa. (Research Paper)

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7A	Advanced Cyber Forensics	Hrs/Wk: 2

Advanced Cyber Forensics Practical:

1. Create a backup using icloud.
2. Create a backup using itunes.
3. Extractions of data from ibackup.
4. Recovery of data using bulk extractor.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6B	Machine Learning for Digital Forensics	Hrs/Wk: 4

Learning Outcomes:

- Understanding the important role of machine learning
- Analyzing large amounts of diverse datasets in order to reveal any criminal behavior
- Understanding various machine learning algorithms and techniques that can be useful in the process of extracting and analyzing digital evidence

UNIT I: Introduction to Machine Learning

Brief Introduction to Machine Learning Well Posed Learning Problems, Motivation to Machine Learning, Applications of Machine Learning, Designing a Learning System, Perspective and Issues in Machine Learning, Concept Learning; Types of Machine Learning - Supervised Learning, Unsupervised Learning, Reinforcement Learning.

Applications of Machine Learning in Natural Language Processing, Image & Video Processing and Analysis, Computer Vision, Financial Data Processing and Social Network Analysis

Data analysis using machine learning for forensic expert, social media and machine learning, malware analysis using ML, HIDS, NIPS based analysis

UNIT II: Dimensionality Reduction

Subset Selection, Shrinkage Methods, Principle Components Regression; Linear Classification, Logistic Regression, Linear Discriminant Analysis; Optimization, Classification-Separating Hyperplanes Classification.

UNIT III: Supervised and Unsupervised Learning

Naïve Bayes Classification: Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K-Nearest Neighbors, Decision Trees.

Support Vector Machines: Hard Margin and Soft Margin, Kernels and Kernel Trick, Evaluation Measures for Classification, Ensemble Models, k-means and Hierarchical Agglomerative Clustering, Evaluation Measures for Clustering

UNIT IV: Artificial Neural Network

Artificial Neural Networks (Early models, Back Propagation, Initialization, Training & Validation), Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation), Decision Trees, Evaluation Measures, Hypothesis Testing, Ensemble Methods,Graphical ModeL

UNIT V:Clustering

Clustering, Gaussian Mixture Models, Spectral Clustering; Ensemble Methods; Learning Theory, Reinforcement Learning

SUGGESTED READINGS:

1. Tom Mitchell, Machine Learning, TMH
2. C. Bishop, Pattern Recognition and Machine Learning, Springer
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, Wiley
4. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
5. Rajjan Shinghal, Pattern Recognition, Techniques and Applications, OXFORD
6. Athem Ealpaydin, Introduction to Machine Learning, PHI
7. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication
8. Prince , Computer Vision: Models, Learning, and Inference, Cambridge University Press, Theodoridis and Koutroumbas

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6B	Machine Learning for Digital Forensics	Hrs/Wk: 2

Machine Learning for Digital Forensics Practical:

1. Malware analysis using ML.
2. Using HIDS analysis the malware.
3. Analysis of malware using NIPS.
4. To perform image analysis using a tool.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7B	Multimedia Forensic & Speaker Identification	Hrs/Wk: 4

Learning Outcomes:

1. Overview of Multimedia Forensic
2. Image Enhancement Techniques
3. Video Frame Analysis
4. DVR Examination
5. Voice Production Process
6. Automatic Speaker Identification System

UNIT I: Foundation to Multimedia Forensics

Introduction to digital signals: audio, image and video, Digitization process: sampling and quantization, Image Enhancement Techniques: Spatial and frequency domain, Image Compression Techniques: Introduction and techniques, Image description and representation techniques, Pattern clustering and classification.

UNIT II: Introduction to Multimedia Forensics

Introduction and scope of Multimedia Forensics, Basics of Multimedia Devices for capturing image and video, audio, Standard and best practices in Multimedia Forensics, Admissibility of multimedia evidence to the court of law along with various acts.

UNIT III: Image and Video Forensics

Introduction and scope, Standards for video transmission, Active and passive image/video forensics, Blind and non-blind image/video forensics, Methods of source camera identification, Methods for tampering of digital image/video, Forensic authentication of digital image/video, Enhancement of digital image/video, Specific Frame Analysis, Scope & it's Forensic Application in the Field of Security, DVR Examination.

UNIT IV: Audio Forensics

Introduction and scope, Analog to Digital Conversion- Sampling and Quantization, Acoustic Parameters of Sound, Fourier Analysis, Frequency and Time Domain Representation of Speech Signal, Fast Fourier Transform, Methods of tampering for digital audio, Forensic authentication of digital audio, Microphone Forensics, Enhancement of digital audio.

UNIT V: Speaker Identification

Introduction and scope of speaker identification, Human vocal tract and production and description of speech sound, Voice Production Theory, Speech Signal Processing and Pattern Recognition, Forensic phonetics and phonetic transcription, Methods of speaker identification: auditory and spectrographic analysis, Spectrographic cues for Vowels and Consonants, Automatic Speaker Identification System, Collection of voice samples: methods and challenges.

REFERENCES

1. Handbook of Digital Forensics of Multimedia Data and Devices by Anthony T S Ho, Shujun Li
2. Multimedia Forensics and Security Foundations, Innovations, and Applications by Aboul Ella Hassanien, Mohamed Mostafa Fouad
3. Fundamentals of Speaker Recognition by Homayoon Beigi
4. Fundamentals of Speaker Recognition Law Enforcement and Counter- Terrorism by Amy Neistein, Hemant A. Patil
5. Forensic Comparison of Voice, Speech and Speakers by Jonas Lindh

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7B	Multimedia Forensic & Speaker Identification	Hrs/Wk: 2

Multimedia Forensic & Speaker Identification Practical:

1. Collection of multimedia samples
2. Segregation of voice using Audacity.
3. Image analysis.
4. Analysis of voice.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6C	Social Media Forensics	Hrs/Wk: 4

Learning Outcomes:

1. Overview of Social Media Forensics
2. Cyber Crimes related to social media
3. Open Street Map
4. Open-Source tools for social media analytics

UNIT I: What is Online Social Networks, data collection from social networks, challenges, opportunities, and drawbacks in online social network, Cybercrimes related to social media and its awareness, scrapping of data from social media API's.

UNIT II: Information privacy disclosure, revelation and its effects in OSM and online social networks, Privacy issues related to location-based services on OSM.

UNIT III: Tracking social footprint / identities across different social network, Identifying fraudulent entities in online social networks, Effective and usable privacy setting and policies on OSM, Policing & OSM.

UNIT IV: Detection and characterization of spam, phishing, frauds, hate crime, abuse and extremism via online social media, Data Collection & Analysis, Fake News & content on socialmedia.

UNIT V: Social Media Forensics: Case Studies Open-Source tools or social media analytics, Safety on social media. Legal Issues in world social media, Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021

REFERENCES:

1. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics
2. Social Network Analysis: Methods and Application by Katherine Faust and Stanley Wasserman.
3. Understanding Social Networks: Theories, Concepts by Charles Kadushin
4. Social Media Data Extraction and Content Analysis by Shalin Hai-Jew

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6C	Social Media Forensics	Hrs/Wk: 2

Social Media Forensics Practical

1. Analyse the Facebook app
2. Detection of spam.
3. Data extraction using Bulk Extractor.
4. Scrapping of data from social media APIs.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7C	Network Forensics	Hrs/Wk: 4

Learning Outcomes: Overview of networks

1. Overview of Wireless Network Forensics
2. Packet Analysis
3. Different Malware Analysis techniques and their behavior.
4. Ransom ware Analysis

UNIT I: BASICS OF NETWORK ARCHITECTURE & INTERNET - Part 1

Network Forensics: Overview, Securing a Network, Scope, Standard Operating Procedure of Network Data, Introduction to Networks: ARPANET Protocols, Network, Need of Networks.

Classification by Network Geography: Types of Topologies- RING, STAR, BUS, MESH (features, advantages, disadvantages). Classification by Component: Peer to Peer, Client/ Server

Types of Networks: LAN, MAN, WA (with applications). Wireless Network: Wireless LAN, MAN,WAN

UNIT II: BASICS OF NETWORK ARCHITECTURE & INTERNET Part 2

Network Communication: Introduction, Types of network communication

Network Components: Twisted Pair Cable, Shielded Twisted Pair, Unshielded Twisted Pair, Unshielded Twisted Pair, Coaxial cable, Fiber Optic Cables Standard categories of cables. Network Interface Card-HUB, Switch, Router. Router: Working of Router, Router Logs, Routing, Routing Table.

UNIT III: PACKET SWITCHING

Basic Terms: MAC Address, ARP, NAT, Gateway, Wireless Access Point, Lifi

ISO/OSI Model in Communication Networks: Features of OSI Model, Functions of layers- Physical, Data Link, Network, Transport, Session, Presentation, Application. Merits of OSI TCP/IP Reference Model: Overview, Different TCP/IP Protocols, Merits/ Demerits

Packet Routing: Packet in Internet, Processing packet at source machine, router

UNIT IV: NETWORK TRAFFIC- CAPTURING & ANALYSIS

Basics: NeSA (features, Creating a dump file, Preliminary Settings, Loading a dump file, Session Filtering) Wireshark: Overview, features, Running the application, FTP Analysis, SMTP Analysis, SSL Decryption. Extraction of Media Files from Network Traffic: NetworkMiner, Xplico.

UNIT V: MALWARE ANALYSIS AND RANSOMWARE ANALYSIS

Introductory Malware Analysis: Malware, viruses, and worms, Importance of Malware Analysis, Essential Skills and Tools for Malware Analysis, Dependency walker, PEview, W32dasm, OllyDbg, Wireshark, Convertshell Code. Trends in Malware Evolution: Botnets, Encryption and Obfuscation, Automatic Self Updates, Metamorphic network behaviour, Blending Network Activity. Ransomware Analysis: Patterns of Ransomeware, Cruptolocker, Moscellaneous Ransomeware, RSO Cryptosystem, AES Cryptosystem, Cryptographich Techniqyes as Hacking tools, Tor Network, Digital Cash and Bitcoin.

REFERENCES:

1. Ndatinya, V., Xiao, Z., Manepalli, V. R., Meng, K., & Xiao, Y. (2015). Network forensics analysis using Wireshark. *International Journal of Security and Networks*, *10*(2), 91-106.
2. Meghanathan, N., Allam, S. R., & Moore, L. A. (2010). Tools and techniques for network forensics. *arXiv preprint arXiv:1004.0570*.
3. Davidoff, S., & Ham, J. (2012). *Network forensics: tracking hackers through cyberspace* (Vol. 2014). Upper Saddle River: Prentice Hall.
4. Social Media & Network Forensics, CDAC
5. Monnappa, K. A. (2018). *Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware*. Packt Publishing Ltd.
6. Mohanta, A., Velmurugan, K., & Hahad, M. (2018). *Preventing Ransomware: Understand, prevent, and remediate ransomware attacks*. Packt Publishing Ltd.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7C	Network Forensics	Hrs/Wk: 2

Network Forensics Practical

1. Network capturing using Wireshark.
2. Malware detection using tools.
3. Extraction of media files from network miner.
4. Examine the working of router.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6D	Reverse Engineering and Malware Analysis	Hrs/Wk: 4

Aim and Objectives of Course: Understanding Reverse Engineering, Typical Malware Behaviour, Working with the Payload. Also covering the Low-Level Language, Binary Obfuscation Techniques, Anti-emulation tricks, and Anti-dumping tricks.

Learning Outcomes

1. Overview of Tools like Autoruns and The Process Explorer
2. Design a payload
3. Working with Assemblers
4. Binary Obfuscation Techniques
5. Passing code execution via SHE
6. Reversing Various File Types

UNIT I: Preparing to Reverse Engineer

What is Reverse engineering, Reverse engineering as a process, Tools, The operating system environment, Typical malware behaviour: Persistence, Malware delivery, Software piracy, Payload - the evil within, Tools: Autoruns, The Process explorer.

UNIT II: The Low-Level Language

Binary numbers, x86: Registers, Memory addressing: Endianness. Basic instructions, Bitwise algebra, Control flow, Stack manipulation, Tools – builder and debugger: Popular assemblers: MASM, NASM, FASM, x86: Debuggers, WinDbg, Ollydebug, x64dbg.

Hello World: Installation of FASM, Dealing with common errors when building, Dissecting the program. After Hello: Calling APIs, Common Windows API libraries, Short list of common, API functions, Debugging

UNIT III: Static and Dynamic Reversing

Assessment and static analysis: Static analysis, File types and header analysis: Extracting useful information from file, Other information: PE executables. Deadlisting: IDA (Interactive Disassembler), Decompilers: ILSpy – C# Decompiler. Dynamic analysis, Analysis environments, Information gathering tools, Disassemblers, Debuggers, Decompilers, Network tools, Editing tools, Attack tools, Automation tools, Software forensic tools, Automated dynamic analysis, Online service sites.

UNIT IV: Sandboxing and Binary Obfuscation Techniques

Emulation of Windows and Linux under an x86 host, Analysis in unfamiliar environments: Linux ARM guest in QEMU, MBR debugging with Bochs. Binary Obfuscation Techniques: Data assembly on the stack, Encrypted data identification, Assembly of data in other memory regions,Decrypting with x86dbg, Other obfuscation techniques, Packing and Encryption: A quick review on how native executables are loaded by the OS, Packers, crypters, obfuscators, protectors and SFX, Unpacking, Dumping processes from memory, How about an executable in its unpacked state? Other file-types.

UNIT V- Anti-analysis Tricks

Anti-debugging tricks, Debugger information from NtQueryInformationProcess, Timing tricks. Passing code execution via SHE, Anti-VM tricks, Anti-emulation tricks, Anti-dumping tricks. Practical Reverse Engineering of a Windows Executable, Initial static analysis, Debugging, Reversing Various File Types: Analysis of HTML scripts, MS Office macro analysis, PDF file analysis, SWF file analysis: SWFTools, FLASM, Flare, XXXSWF, JPEXS SWF decompiler.

SUGGESTED READING:

1. Mastering Reverse Engineering, Reginald Wong
2. Practical Reverse Engineering by Bruce Dang, Alexandre Gazet, Elias Bachaalany
3. Reversing: Secrets of Reverse Engineering by Eldad Eilam
4. Implementing Reverse Engineering: The Real Practice of X86 Internals by Jitender Narula
5. Ghidra Software Reverse Engineering for Beginners: Analyze, identify, and avoid malicious code and potential threats in your networks and systems by A. P. David

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6D	Reverse Engineering and Malware Analysis	Hrs/Wk: 2

Reverse Engineering and Malware Analysis Practical

1. Network capturing using Wireshark.
2. Analysis of HTML script.
3. Perform MS office macro analysis.
4. Do analyse the given PDF file samples.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7D	Vulnerability Assessment of Application Security	Hrs/Wk: 4

Aim and Objectives of Course: Understanding Vulnerability Assessment, Differences between a bug bounty and a client-initiated pentest, Detecting SQL Injection flaws. Also covering the Extracting data using Insecure Direct Object Reference (IDOR) Flaws, Discovering Authentication methods.

Learning Outcomes

1. Working with Proxies and non-proxy-aware clients
2. Setting up Vulnerable web applications
3. Identifying XSS, XML, SSTI, SSRF, and CSRF vulnerabilities
4. Executing an out-of-band command injection
5. Exploiting crypto vulnerabilities
6. Discovering Blind SQL injection

UNIT I: Configuring Burp Suite

Setting up proxy listeners, Working with non-proxy-aware clients, Creating target scopes in Burp Suite, Working with target, Additional browser add-ons that can be used to manage proxy Settings, Setting system-wide proxy for non-proxy-aware clients, Setting up Android and iOS to work with Burp Suite, Differences between a bug bounty and a client-initiated pentest, Why Burp Suite?: Types and features, Crawling. Why Burp Suite Scanner?: Auditor/Scanner, Understanding the insertion points. Detailed Stages of an application pentest, Features of Burp Suite.

UNIT II: Preparing for an Application Penetration Test and Identifying Vulnerabilities

Setup of vulnerable web applications, Reconnaissance, and file discovery: Using Burp for content and file discovery. Testing for authentication via Burp, Detecting SQL injection flaws, Detecting OS command injection, Detecting XSS vulnerabilities, Detecting XML-related issues such as XXE, Detecting SSTI, Detecting SSRF, Detecting CSRF, Detecting Insecure Direct Object References, Detecting security misconfigurations, Detecting insecure deserialization, Detecting OAuth-related issues, Detecting broken authentication.

UNIT III: Detecting and Exploiting Vulnerabilities - 1

Data exfiltration via a blind Boolean-based SQL injection, Executing OS commands using an SQL injection, Executing an out-of-band command injection, Stealing session credentials using XSS, Taking control of the user's browser using XSS, Extracting server files using XXE vulnerabilities, Performing out-of-data extraction using XXE and Burp Suite collaborator, Exploiting SSTI vulnerabilities to execute server commands.

UNIT IV: Exploiting Vulnerabilities Using Burp Suite - 2

Using SSRF/XSPA to perform internal port scans. Using SSRF/XSPA to extract data from internal machines, Extracting data using Insecure Direct Object Reference (IDOR) Flaws. Exploiting security misconfigurations, Directory listings, Default credentials, Untrusted HTTP methods. Using insecure deserialization to execute OS commands, Exploiting crypto vulnerabilities, Brute forcing HTTP basic authentication, Brute forcing forms, Bypassing file upload restrictions.

UNIT V: Writing Burp Suite Extensions and Breaking the Authentication

Setting up the development environment, Writing a Burp Suite extension: Burp Suite's API, Modifying the user-agent using an extension. Executing the extension, Performing information gathering, Port scanning, Discovering Authentication method. Exploiting and Exfiltrating Data from a Large Shipping Corporation: Discovering Blind SQL injection: Automatic scan, SQLMap detection, Intruder detection.

SUGGESTED READING:

1. Hands-on Penetration Testing for Web Applications: Run Web Security Testing on Modern Applications Using Nmap, Burp Suite and Wireshark by Richa Gupta
2. Practical Web Penetration Testing: Secure web applications using Burp Suite, Nmap, Metasploit, and more by Gus Khawaja
3. Hands-On Application Penetration Testing with Burp Suite: Use Burp Suite and its features by Carlos A. Lozano, Dhruv Shah, et al.

B.Sc.	Semester: V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7D	Vulnerability Assessment of Application Security	Hrs/Wk: 2

Vulnerability Assessment of Application Security Practical

1. Detecting STI
2. Setting up Android with Burp suit.
3. Setting up iOS with Burp suit.
4. Execute OS commands using an SQL injection.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6A	Synthetic Organic Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts indifferent types of pericyclic reactions.
4. Understand the importance of retro synthesis in organic chemistry.
5. Comprehend the applications of different reactions in synthetic organic chemistry.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Pericyclic reactions 12 hours

3. A brief introduction to synthetic organic chemistry
4. Features and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbitals in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.
5. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules.(Correlation diagrams are not required)
6. Cyclo addition reactions: Definition and examples, definitions of supra facial and antar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

Unit-2: Organic photochemistry 8hours

1. Jablonski diagram-singlet and triplet states
2. Photochemistry of Carbonyl compounds-□−□ and □−□* transitions, Norrish type-1and type-2 reactions
3. Paterno – Buchi reaction.

Unit-3: Retro synthesis 12 hours

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b. 4-Nitro toluene, c. Paracetamol.

Unit-4: Synthetic Reactions 8hours

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using1, 3-Dithiane.

Unit-5: Reagents in Organic Chemistry 10 hours

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.

Reducing agents: $LiAlH_4$ (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.

References

1. Pericyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Pericyclic Reactions-A Text book: Reactions, Applications and Theory by S. Sankararaman, WILEY-VCH.
3. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-A Mechanistic study by S.M. Mukherji, Macmillan India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6A	Synthetic Organic Chemistry Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
2. Learn the procedure for the separation of mixture famine acids using paper Chromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
4. Separation of mixture of methyl range and methyl enable by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities

a) Mandatory:*(Lab/field training of students by teacher:(lab: 10+field:05)*:

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of N, Sand halogens using the green procedure, preparation of TLC plates, detection of organic compounds using R_f values in TLC/ paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dye mixture using chromatographic techniques.
2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

4. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7A	Analysis of Organic Compounds	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. Acquire the knowledge eon structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation and identification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Mass Spectrometry **10 hours**

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, Butaldehyde, Propionic acid.

Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data- **8hours**

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data- **8 hours**

Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline.

Unit-4: Separation techniques-1 **12 hours**

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base &neutral.
2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, $R_f$values and factors affecting $R_f$values.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques-2 **12 hours**

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

References

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lamp man, Kriz and Vyvyan, Fifth edition, Cen gage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
4. Spector's copy of Organic Compounds by P.S. Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cen gage.
7. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
8. Quantitative analysis by R.A. Day Jr. and A.L. Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7A	Analysis of Organic Compounds Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of anazodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylating of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solvent extraction.

Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, Universitypress.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):*

5. **For Teacher**: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
6. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.
7. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6B	Analytical Methods in Chemistry-1	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods.

Syllabus:

(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Quantitative analysis-1 **8 hours**

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.
3. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Unit-2: Quantitative analysis-2 **12hours**

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit-3: Treatment of analytical data **8hours**

Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval.

Unit-4: separation techniques **12 hours**

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).
2. Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water **10hours**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.

References

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug,Seventh edition, Wiley.
3. Quantitative analysis by R.A.DayJr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6B	Analytical methods in Chemistry-1 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Estimate Iron(II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

c) Practical (Laboratory)Syllabus:(30hrs) (Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr's method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

d) Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

e) Co-Curricular Activities:

***a)* Mandatory:** *(Lab/field training of students by teacher:(lab:10+field:05):*

8. **For Teacher**: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs strong base titration using pH meter, determination of chloride ion, estimation of water quality parameters and estimation of Iron(II).
9. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methods used for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
10. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7B	Analytical Methods in Chemistry-2	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification of compounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectro chemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Chromatography-Introduction and classification **10 hours**

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, $R_f$values, factors affecting $R_f$values.

Unit-2: TLC and paper chromatography **12 hours**

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.
2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

Unit -3: Column chromatography **12 hours**

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

Unit -4: Spectrophotometry **8hours**

Principle, Instrumentation: Single beam and double beam spectrometer, Beer-Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer-Lambert's law-Quantitative determination ofFe^{+2}, $Mn^{+2}$and Pb^{+2}.

Unit -5: Atomic spectroscopy **8hours**

Types, atomizer, atomic absorption and emission and applications.

References

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/ Pearson.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7B	Analytical Methods in Chemistry-2 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
2. Separation of mixture of methyl orange and methylene blue by column chromatography.
3. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
4. Separation of food dyes using Column Chromatography
5. Separation of triglycerides using TLC
6. Verification of Beer lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer.

Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
3. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
4. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
5. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher (lab:10+field:05):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6C	Industrial Chemistry-1	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of different surface coatings.
2. Acquire a critical knowledge on manufacture of ceramics and cement.
3. Understand various steps in the manufacture of cane sugar.
4. Explain the manufacture of pulp and paper.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Fertilizers **10 hours**

A brief introduction to industrial chemistry

Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

Unit-2: Silicates **10hours**

1. **Ceramics:** Important clays and Felds par. Ceramics-types, uses and manufacture. High technology ceramics and their applications.

2. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit-3: Surface Coatings **12 hours**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

Unit-4: Sugar Chemistry **08hours**

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrose from beat root, testing and estimation of sucrose.

Unit-5: Paper Industry **10hours**

Pulp and Paper-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

References:

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis HorwoodLtd.UK
2. J.A.Kent: Riegel's *Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, NewDelhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6C	Industrial Chemistry - 1 Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Determine free acidity in ammonium sulphate fertilizer.
2. Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
4. Acquire skills in using colorimetry for the estimation of sucrose.

Practical(Laboratory)Syllabus:(30hrs) (Max.50 Marks)

5. Determination of free acidity in ammonium sulphate fertilizer.
6. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
7. Estimation of phosphoric acid in superphosphate fertilizer.
8. Estimation of sucrose by colorimetry.

Lab References

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: Engineering Chemistry, Vikas Publications.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on field related skills in determination of free acidity, estimation of calcium and phosphoric acid in a fertilizer, use of colorimeter to estimate sucrose.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the surface coatings of surfaces used to prevent the corrosion. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co - Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7C	Industrial Chemistry-2	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of industrial waste management.
2. Acquire a critical knowledge on the preparation and applications of organic polymers.
3. Demonstrate the analysis of water quality parameters.
4. Explain the sources of air pollution.

II.* Syllabus :(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Organic Polymers-1 **10 hours**

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and In organic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross-Linked polymers.

Unit-2: Organic Polymers-2 **10 hours**

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate, Poly methyl-methacrylate.

Unit-3: Air Pollution **8 hours**

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NOx, SOx, SPM, CO, hydrocarbons, controlling methods of air pollution.

Unit-4: Analysis of water **10hours**

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

Unit-5: Industrial Waste Management **12hours**

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste treatment and disposal, microbiology involved in solid waste disposal, methods of solid waste disposal-composting, sanitary landfilling- economic, aesthetic and environmental problems.

References:

1. E.Stocchi: *IndustrialChemistry*,Vol-I,EllisHorwoodLtd.UK
2. J.A.Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* DhanpatRai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand &CoLtd.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7C	Industrial Chemistry-2 Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Learn the procedures for the determination of BOD and COD.
2. Demonstrate skills in the determination of chloride in the given water sample.
3. Acquire skills in determining the hardness of water.

Practical (Laboratory) Syllabus:(30hrs)

Determination of Hardness of water by EDTA titration.

1. Determination of Chemical Oxygen Demand (COD)
2. Determination of Biological Oxygen Demand (BOD)
3. Determination of chloride using Mohr's method.
4. Determination of pH, turbidity and total solids in water sample.
5. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
6. Determination of Ph in soil samples using pH-metry.

Lab References:

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Textbook on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.

Co-Curricular Activities

***a)* Mandatory:** *(Student training by teacher in field related skills: inlab:15, infield: 05 hours):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15hours on the field related skills in determination of hardness of water, estimation of COD and BOD in water sample, determination chloride ion in water sample.

2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the measurement of water quality parameters. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6D	Environmental Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the environment functions and how it is affected by human activities.
2. Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.
4. Engage in simple and advanced analytical tools used to measure the different types of pollution.
5. Explain the energy crisis and different aspects of sustainability.
6. Analyze key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life.

Syllabus :*(Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-I Introduction **10h**

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydro logical cycle.

Unit -II

Air Pollution **10h**

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Instrumental techniques to monitor pollution – Controlling methods of air pollution.

Unit -III

Water pollution **10h**

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity– Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects –Industrial waste water treatment.

Unit -IV

Chemical Toxicology **10h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid waste management.

Unit -V

Ecosystem and biodiversity **10h**

Ecosystem

Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels–Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

List of Reference books:

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
6. Environmental analysis, SM Khopkar (IIT Bombay)
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener
10. Web related references suggested by teacher.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6D	Environmental Chemistry Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

11. List out, identify and handle various equipment in Chemistry lab.
12. Learn the procedures of preparation of standard solutions.
13. Demonstrate skills in operating instruments.
14. Acquire skills in handling spectrophotometer.
15. Analyse water and soil samples.

Practical (Laboratory) Syllabus: (30hrs) (Max.50 Marks).

16. Identification of various equipment in the laboratory.
17. Determination of carbonate and bicarbonate in water samples by double titration method.
18. Determination of hardness of water using EDTA
    a) Permanent hardness b) Temporary hardness
19. Determination of Chlorides in water samples by Mohr's method.
20. Determination of pH, turbidity and total solids in water sample.
21. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
22. Determination of PH in soil samples using pH metry.

List of Reference books:

23. A Text Book of Quantitative Inorganic Analysis (3rd Edition)–A.I.Vogel
24. Water pollution, Lalude, MC Graw Hill
25. Environmental analysis, SM Khopkar (IIT Bombay)
26. Web related references suggested by teacher.

Co-Curricular Activities:

a) **Mandatory:** (Training of students by teacher on field related skills: 15hrs)

1. For Teacher: Skills training of students by the teacher in classroom, lab and field for not less than15 hours on field related quantitative techniques for the water quality parameters, soil pollution and air pollution.

2. For Student: Individual visit to any one of the local field agencies/research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of spectrophotometry.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7D	Green Chemistry and Nanotechnology	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the importance of Green chemistry and Green synthesis.
2. Engage in Microwave assisted organic synthesis.
3. Demonstrate skills using the alternative green solvents in synthesis.
4. Demonstrate and explain enzymatic catalysis.
5. Analyse alternative sources of energy and carry out green synthesis.
6. Carry out the chemical method of nanomaterial synthesis.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Training, Unit tests etc.)*

Unit-I Green Chemistry: Part- I **10 hrs**

Introduction-Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hunds dicker and Wittig reactions).

Unit- II Green Chemistry: Part- II **10 hrs**

A) Selection of solvent:

i) Aqueous phase reactions

ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation.

Iii) Solid supported synthesis

B) Supercritical CO2: Preparation, properties and applications, (decaffeination, drycleaning)

C) Green energy and sustainability.

Unit-III Microwave and Ultrasound assisted green synthesis: **10 hrs**

Apparatus required, examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldol condensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

Unit-IV Green catalysis and Green synthesis **10 hrs.**

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - bio catalysis: Enzymes, microbes Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menudo acetate (alternative Strecker's synthesis)

2. Microwave assisted reaction in water –Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction.

3. Ultrasound assisted reactions–sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

Unit – V Nanotechnology in Green chemistry **10 hrs**

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top-down approaches with examples – Synthesis of Nano materials – Classification of Nanomaterial – Properties and Application of Nanomaterial. Chemical and Physical properties of Nanoparticles – Physical synthesis of nanoparticles – Inert gas condensation - aerosol method - Chemical Synthesis of nanoparticles – precipitation and co-precipitation method, sol-gel method.

Lab work - Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in the laboratory.
2. Learn the procedures of green synthesis.
3. Demonstrate skills in the preparation of Nanomaterials.
4. Acquire skills in Microwave assisted organic synthesis.
5. Perform some applications of Nanomaterials.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7D	Green Chemistry and Nanotechnology Lab	Hrs/Wk:2

Practical (Laboratory) Syllabus: (30 hrs.) (Max.50 Marks).

1. Identification of various equipment in the laboratory.
2. Acetylation of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipicacid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Preparation and characterization of Nanoparticles of gold using tea leaves.
8. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
9. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.

Reference books:

1. Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Principles and practice of heterogeneous catalysis, Thomas J.M.,Thomas M.J., John Wiley
6. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications
7. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press (2008).
8. Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)
9. Web related references suggested by teacher.

Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1.For Teacher: Training of students by the teacher in the classroom or in the laboratory for not less than 15 hours on field related quantitative techniques for Enzymatic catalysis, Microwave assisted organic synthesis, Biodiesel preparation etc.

2.For Student: Individual visit to any one of the local field agencies, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for fieldwork/project work Report: 05.

4. Suggested Format for fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of Green chemistry and Nano synthesis.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6E	Analytical Methods in Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the various methods involved in Quantitative analysis.
2. Acquire a critical knowledge on separation techniques.
3. Demonstrate skills related to Chromatographic techniques through hands on experience.
4. Able to engage in safe and accurate laboratory practices by handling laboratory glassware, Equipment and chemical reagents appropriately.
5. Comprehend the applications of Chromatographic techniques in different fields.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Quantitative analysis **(10hrs)**

Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis: Theories of acid-base, redox, complex metric, iodometric and precipitation titrations Detection of end point in redox titration, choice of indicators for the saturations. Principles of gravimetric analysis: precipitation, coagulation, peptization, co-precipitation, post-precipitation, digestion, filtration and washing of precipitate, drying and ignition.

Unit-2: Treatment of analytical data: **(10hrs)**

Types of errors, significant figures and its importance, accuracy-methods of expressing accuracy, absolute and relative errors, error analysis and minimization of errors.

Precision - methods of expressing precision, standard deviation and confidence limit. The correlation coefficient.

Unit-3: Separation techniques in Chemical analysis: **(10hrs)**

Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).

Ion Exchange: Introduction, action of ionex change resins, separation of inorganic mixtures, applications.

Unit– 4: Chromatography: Part - I **(10hrs)**

Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors effecting R_f values.

Paper Chromatography: Principles, R_f values, experimental procedures, choice of paper and solvent systems, developments of chromatogram-ascending, descending and radial. Two dimensional chromatography, applications.

Unit– 5: Chromatography: Part - II **(10hrs)**

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting R_f values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation techniques, Applications. HPLC: Basic principles and applications.

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Analytical Chemistry lab.
2. Learn the procedures of preparation of primary and secondary standard solutions.
3. Demonstrate skills in the preparation of Paper, Thin layer and column Chromatography.
4. Acquire skills in observing the Chromatogram.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6E	Analytical Methods in Chemistry Lab	Hrs/Wk:2

5. Perform some separation techniques of Organic compounds.

Practical (Laboratory) Syllabus :(30hrs) (Max.50Marks).

1. Identification and handling of various laboratory equipment.
2. Determination of Zn(II)/ Mg(II) using EDTA
3. Determination of Fe (II) present in an Iron tablet using $KMnO_4$ .Redox titration.
4. Determination of Saponification value of oil and Iodine value of oil.
5. Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}.
6. Separation and identification of the monosaccharaides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
7. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC.
8. Separation by Column Chromatography – Mixture of Ortho and Para Nitro anilines.

List of Reference Books

1. Analytical Chemistry by Skoog and Miller
2. A text book of qualitative in organic analysis by A.I.Vogel
3. Nano chemistry by Geoffrey Ozin and Andre Arsenault
4. Stereo chemistry by D.Nasipuri
5. Organic Chemistry by Clayden
6. Analytical Chemistry by Gary D. Christian, 6th edition
7. Chemistry experiments for instrumental methods, Donald T Sawyer William
8. Instrumental methods of analysis, Willard, Merit, Dean, 6th edition.
9. Web related references suggested by teacher.

Co-Curricular Activities:

a) Mandatory: (training of students by teacher on field related skills: 15 hrs.)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on field related Quantitative techniques like Separation techniques, preparation by Column, preparation of TLC and determination of the purity of the sample.

2. For Student: Individual visit to any one of the Field agency, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visitor research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of chromatography.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATIONS

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM

B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7E	Cosmetics and Pharmaceutical Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Explain the principles of formulation and application of Cosmetics & perfumes.
2. Acquire a critical knowledge on synthetic techniques of drugs.
3. Demonstrate the skills in various aspects of the fermentation technology and apply for production.
4. Comprehend the applications offer mentation.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit- I Chemistry of Cosmetics **(8hrs)**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

Unit- II Chemistry of Perfumes **(8hrs)**

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geranial, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmine, Civet one, Mascon.

Unit–III Drugs & Pharmaceuticals – I **(10hrs)**

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti- inflammatory agents (Aspirin, paracetamol, ibuprofen)

Unit–IV Drugs & Pharmaceuticals - II **(12hrs)**

Synthesis of the representative drugs of the following classes: Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glycerol triturate), antilaprosy (Daps one), HIV-AIDS related drugs (AZT-Zidovudine).

Unit – V Fermentation **(12hrs)**

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B_2, Vitamin B_{12} and Vitamin C.

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. The ability to develop comprehensive product development programs to meet new product criteria and timing.
2. Acquire skills in the preparation of Cosmeceuticals.
3. Demonstrate proficiency in the experimental techniques for fermentation and microbial production of enzymes.
4. Carry out perfume testing with the knowledge of perfumes.
5. Learn the procedure of synthesis of drugs.
6. Critically develop, apply, report, interpret and reflect on strategies for collecting data in the lab and field.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7E	Cosmetics and Pharmaceutical Chemistry Lab	Hrs/Wk:2

Practical (Laboratory) Syllabus :(**30hrs**)

Identification of various equipment in the laboratory

1. Preparation of talcum powder.
2. Preparation of shampoo.
3. Preparation of hair remover.
4. Preparation of face cream.
5. Preparation of nail polish and nail polish remover.
6. Preparation of Aspirin and it's analysis.
7. Preparation of Magnesium bisilicate (Antacid).
8. Fermentation process.

Reference Books:

1. A handbook of Industrial Organic Chemistry by Samuel P Sadtler, JB Lippincott company.
2. Handbook Industrial Chemistry by Mohammad Farhat Ali Khan, First edition
3. Related online methods available.
4. Industrial Chemistry, E. Stocchi: Vol -I, Ellis Horwood Ltd. UK.
5. Engineering Chemistry P.C. Jain, M. Jain:,Dhanpat Rai & Sons, Delhi.
6. Industrial Chemistry, Sharma, B.K. & Gaur, , Goel Publishing House, Meerut(1996)
7. Introduction to Medicinal Chemistry, G.L. Patrick: Oxford University Press, UK.
8. Medicinal and Pharmaceutical Chemistry, Hakishan, V.K. Kapoor:, Vallabh Prakashan, Pitampura, New Delhi.
9. Principles of Medicinal Chemistry, William O. Foye, Thomas L., Lemke, David A. William: B.I. Waverly Pvt. Ltd. New Delhi.
10. Industrial Microbiology, 3rd Edition, JR Casida L.E. (2015New Age International (P) Limited Publishers, New Delhi, India.
11. Industrial Microbiology: An Introduction. 1st Edition, Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001) Blackwell Science, London, UK.
12. Microbiology. 5th Edition, Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Tata McGraw-Hill Publishing Company Limited, New Delhi.

Co-Curricular Activities:

a) **Mandatory** :*(Training of students by teacher on field related skills: 15hrs)*

1. For Teacher: Training of students by the teacher in laboratory and field fornotlessthan15hoursonfield skills/techniques like purification of the crude, Separation techniques, synthesis of simple drugs etc.

2. For Student: Individual visit to any one of the related local agencies, cosmetic industry, pharmaceutical laboratories in universities / research organizations / private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) <u>Suggested Co-Curricular Activities</u>

1. Training of students by related industrial experts.
2. Assignments(including technical assignments like identifying tools in plant biotechnology and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant biotechnology.
5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
6. Visits to plant tissue culture/biotechnology facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

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